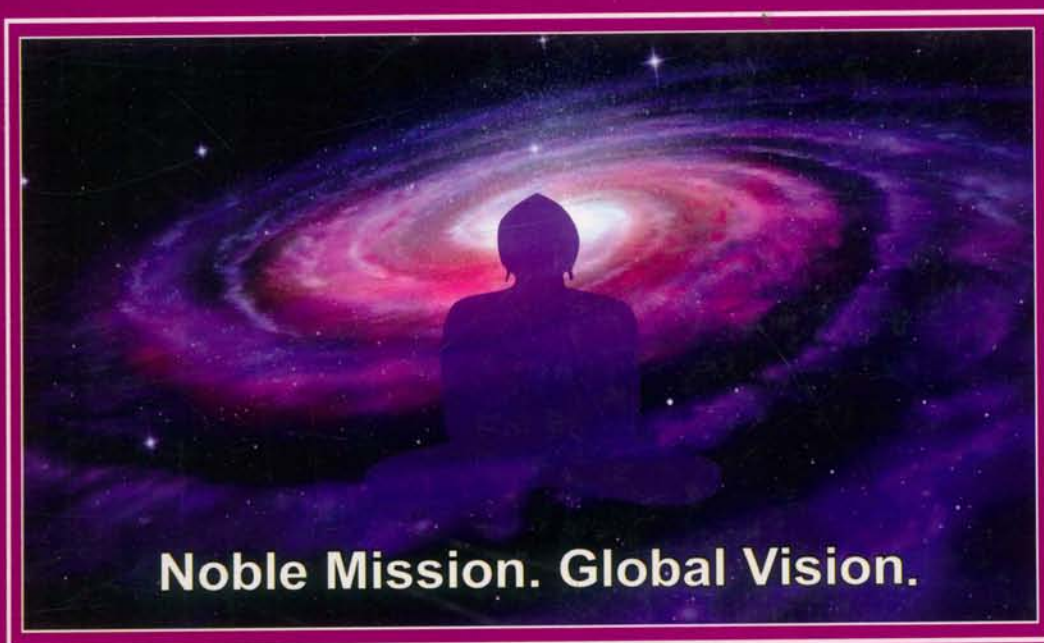


# Jain Philosophy: A Scientific Approach to Reality

Proceedings of the International Conference  
on  
Science and Jain Philosophy  
held at Indian Institute of Technology Bombay, Mumbai, 2016



## **Editors**

Samani Chaitanya Prajna  
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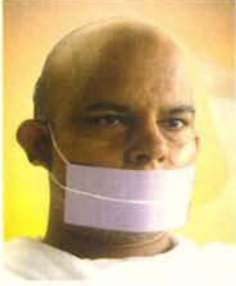
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# BLESSINGS



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## अहम्

दुनिया को अध्यात्म और विज्ञान दोनों की आवश्यकता है। दोनों में समानता है तो असमानताएं भी हैं। मेरा मंतव्य है कि 'सत्य की खोज' के क्षेत्र में दोनों में कुछ समानता है। अंतर यह है कि अध्यात्म आत्मा की खोज का लक्ष्य रखता है और विज्ञान संभवतया मुख्यतः भौतिक जगत की खोज का उद्देश्य रखता है। अध्यात्म का लक्ष्य है मोक्ष, सभी प्रकार के दुखों से मुक्ति। विज्ञान का मुख्य लक्ष्य संभवतः पदार्थ से जुड़े सत्य की खोज करना है, मानव को अधिक से अधिक सुविधा उपलब्ध कराना है। मेरा विचार है कि अध्यात्म और विज्ञान दोनों का समन्वय मानव के समुचित विकास में सहायक बन सकता है।

जैन धर्म के कई सिद्धान्तों में विज्ञान की सहमति दृष्टिगोचर होती है तो कई सिद्धान्त अब तक विज्ञान से परे भी हैं। आधुनिक युग में विज्ञान के माध्यम से जैन सिद्धान्तों को समझने और समझाने में कुछ सुगमता भी हो सकती है।

भगवान महावीर अंतर्राष्ट्रीय अनुसंधान केन्द्र, जैन विश्व भारती संस्थान द्वारा समायोजित 'विज्ञान और जैन दर्शन' विषयक अंतर्राष्ट्रीय सम्मेलन के संदर्भ में प्रकाशित होने वाला यह ग्रन्थ पाठकों को सम्यक् अवगति के साथ सत्प्रेरणा प्रदान करने वाला सिद्ध हो, शुभाशंसा।

राजरहाट, कोलकाता

आचार्य महाश्रमण

# FOREWORD

In spite of the unprecedented advancements in the fields of science and technology, some eminent scientists are of the view that science and technology alone cannot find solutions to the diverse problems prevailing in the human society, and mysteries of nature. There are many reasons for this apprehension, and many scientists are in search of ways and means to overcome this limitation. On the other hand, the branch of knowledge, popularly known as Oriental Wisdom, which has its origin in the hoary past and which prevailed throughout the East, has been studied by some scientists and philosophers with great interest. They have found that the Oriental texts contain scientific ideas and concepts that not only have striking resemblances with the recent scientific ideas and concepts, but also may give hints to pave the way for further researches in the field of microcosmology as well as macrocosmology. If the scientists are convinced about the value of knowledge contained in the ancient wisdom, especially manifested in spiritual scriptures and philosophical treatises, such as in Jainism, then a breakthrough can be made opening some new avenues to overcome the limitations referred to above.

The organization of the International Conference on Science and Jain Philosophy (ICSJP) 2016 has proved to be a landmark and has attracted the attention of many scientists who have done some preliminary study of the ancient texts. It is hoped that this welcome trend shall usher a new era of integrating ancient wisdom and modern science.

The proceedings of ICSJP 2016 are expected to provide a blueprint for the future researchers. The reader will find that the papers are spanning diverse disciplines of science, mathematics and philosophy. The contributors have shown that there is ample scope for undertaking innovative research in the fields of consciousness, relativism, microcosmology, macrocosmology, environment and ecology, societal ethics, spirituality and science, various aspects of culture, literature and society, and different branches of mathematics.

Dr. Yoshinori Ohsumi, a Japanese cell biologist, studied the cell processes of autophagy in great detail. He successfully proved that similar amazing biochemical and physiological changes also occur in the body on fasting. This is a strong evidence of scientific base of well settled traditions

of ancient times. He has been awarded the Nobel Prize in Physiology and Medicine 2016.

## **Need of Futuristic Research**

The Bhagawan Mahavira International Research Centre (BMIRC) has been set up in Jain Vishva Bharati Institute with the aim of conducting scientific research in the ancient Jain wisdom so as to benefit the entire mankind. The Centre has plans to collaborate with universities and institutes for realizing the goal of integrating science with principles and practices of Jain philosophy.

We look forward to cooperation and active participation of scientists, scholars, educationists, government authorities as well as the enthusiastic leaders of social and religious organizations in general, and those of Jain tradition in particular, for help in promoting researches in the field of spiritual practices, metaphysical and ethical doctrines etc., with the prime objective of finding out solutions to the burning problems of human society. It is desired that efforts should be made not only to discover the eternal truths of nature but also to reveal the mysteries of human consciousness, psychology and behaviour and develop techniques which can successfully bring about the required transformation of human consciousness that reduces violence, greediness, utter selfishness and the effect of animal instincts in the human mind, and thus, pave the way for rebuilding a global society infused with non-violence, altruism, peacefulness and mutual cooperation.

**Muni Mahendra Kumar**  
Emeritus Professor  
Jain Vishva Bharati Institute, Ladnun

## **From the Desk of Conference Chairman**

The principal objective of the **International Conference on Science and Jain Philosophy (ICSJP)** organized by Jain Vishva Bharati Institute (JVBI) in close collaboration with the Indian Institute of Technology (IITB), Mumbai and the Mumbai University was to explore and establish convergence between modern science and ancient Jain Philosophy. ICSJP held at IITB campus in Mumbai from Jan. 8 to 10, 2016 was an epoch-making and landmark event in the annals of modern history of Jainism. The conference brought together nearly 900 participants including 50 from abroad comprising of renowned scientists, famous doctors, eminent philosophers, reputed spiritual leaders, learned scholars and dedicated practitioners on one platform and to have in-depth deliberations both in plenary and technical sessions along with workshops, round table and panel sessions to explore close connectivity between Jain religion and science. Separate sessions were held for younger generation to assess their approach on the subject and acquaint them with the basic theme and outcome of the conference.

Through complex and multilayered engagement in thought provoking sessions and amiable parleys close linkage between science and Jainism philosophy was amply explored and established. It enlightened lineage between seraphic wisdom as enshrined in the ancient Jain scriptures and dynamic and revolutionary developments espoused by modern scientific researches. ICSJP stressed that Jainism founded by Bhagawan Mahavira, before the emergence of Christianity, was established on sound and scientific foundations and dispelled misinformed beliefs especially in the western world about Jainism as an old, out-dated and a religion which cannot be adapted.

ICSJP 2016 was successful in achieving its objectives with the blessings of HH Acharya Mahashraman, the present Anushasta of JVBI. The credit for planning and executing this historical event goes to the wisdom and untiring efforts of venerated Prof. Muni Mahendra Kumar, his companion monks Dr. Muni Amrit Kumar and Dr. Muni Abhijit Kumar, Prof. Samani Chaitanya Prajna, the Director of BMIRC, Dr. Narayan Lal Kachhara, Dr. Narendra Bhandari and Dr. Kaushala Prasad Mishra, the Executive Directors, along with the local organizing team of Mumbai and all the secretarial staff.



ICSJP strongly recommended that in future JVBI should take lead and organize subject-wise conferences, conclaves and coalitions for integrating science and Jain spirituality and draw a road map for propagating the cardinal principles of Jainism namely *Ahiṃsā* (non-violence), *Aparigraha* (non-possessiveness) and *Anekāntavāda* (theory of multiplicity of truth) throughout the globe. To achieve this active cooperation and involvement of scientists and scientific institutions both in India and abroad must be sought in studies and research projects for validating scientific basis of Jain precepts and practices.

The conference suggested strengthening of JVBI research activities through Bhagawan Mahavira International Research Centre (BMIRC) for organizing periodical seminars and for generating awareness in general public about relevance of Jainism in modern times and its scientific approach in areas of environment related programs etc.

**Basant Raj Bhandari**  
Chairman of ICSJP & Former Chancellor, JVBI

# MESSAGE

The International Conference on Science and Jain Philosophy held at Mumbai during January 8-10, 2016 was a landmark in the history of Jains and Jainism when Indian Institute of Technology (IITB), a leading Science Institution, hosted discourses on Jainism in the context of science. The event offered JVBI and IIT a common platform, brought together Scientists, Philosophers and Spiritual leaders and provided them an opportunity to have a fresh look at Jainism beyond its dogmatic and conservative image and rigid ascetic traditions.

The conference underlined the immediate need to project Jainism in a scientific perspective and to dispel unfounded views, especially in the West, about Jainism as an ascetic, quasi-scientific and superstitious religion.

This was a historic development for Jainism which was never witnessed in the past, despite our worldwide contacts and missionary work. While JVBI deserves credit and appreciation for undertaking the responsibility of keeping alive the interest among scientists and science institutions worldwide about Jainism as a scientific religion, it calls upon the JVBI to retain the leadership it displayed in organizing this event integrating science and spirituality. JVBI has to build upon the renewed interest in Jainism generated from the conference and it should chalk out a program and execute the road map which has emerged by deliberations at this conference which *inter alia* included:

- (a) Worldwide projection of Jainism, which is lesser known compared to Buddhism, with focus on its scientific foundations, and concept of non-violence.
- (b) Mechanism for active involvement of scientists and science institutions like TIFR, IITs, BARC, NEERI, ICMR etc. in taking up study and research projects for validating scientific basis of Jain practices.
- (c) Organizing periodically seminars and conferences for generating awareness in masses about relevance of Jainism in modern times and its scientific foundation.
- (d) Strengthening Bhagawan Mahavira International Research Centre (BMIRC) by growing regional centers, and associating with it scientists and science institutions to carry out projects and conduct discourses.

It calls upon JVBI to assume leadership, strengthen BMIRC, and

initiate steps to integrate science and spirituality. I strongly believe that BMIRC will succeed in these tasks and with the blessings of its spiritual mentors and great visionaries- Acharya Tulsi, Acharya Mahaprajna and the present Acharya Mahashraman- BMIRC will be able to take Jainism to new heights. The spiritual guidance and blessings of Sadhvi-Pramukha Kanakprabhaji provides us strength to undertake such initiatives.

I am very much thankful to versatile thinker Prof. Muni Mahendrakumarji Swami for giving a new message to the world of science and spirituality through ICSJP-2016, mainly showing that happy blending of the two can lead the world to a new light of peace, prosperity and sustainable development- how humanity and our planet Earth can be saved by this happy blending. I also pay my deep sense of respect to Dr. Muni Shree Amrit Kumarji Swami who has very strong knowledge of management. His inexplicable contribution converted an impossible-to-realise event into a reality. Dr. Muni Abhijit Kumarji Swami is a very energetic and dynamic monk and he put all his energy to make this event a grand success. I congratulate Prof. Samani Chaitanya Prajna, Head of Department of Jainology who put her brain to give momentum to scientific and social innovative research through BMIRC. She has worked hard and done astonishing work in a very short period. As the Founder Director of BMIRC and the Director General of ICSJP, she has shown her strong will power and confidence in taking adventurous steps and timely initiatives to organise the conference. My special thanks to Prof. Narayan Lal Kachhara, Prof. Narendra Bhandari and Prof. Kaushala Prasad Mishra, the Executive Directors of ICSJP, for organising the conference very meticulously and high academic quality. With the support of Dr. Bipin Doshi, University of Mumbai and the Director, Prof. Parthasarathi and Prof. Bhatt of the host institute IITB, the conference was prominently covered by the media of Mumbai, in India and all over the world. All of these spiritual leaders and academicians have succeeded in achieving the objective of the conference and have provided a road map for the future.

It was my good luck to see JVBI faculty taking it to new heights during its Silver Jubilee Celebration Year. Once again I thank all the esteemed members of BMIRC, donors, collaborators, organisers and delegates who directly or indirectly contributed in organising the conference with grand success.

**Samani Charitra Prajna**  
Former Vice Chancellor, JVBI

## **From the Vice Chancellor's Desk**

I am delighted to present this academic venture of this young University, which has emerged as a significant milestone in the history and development of a comprehensive approach towards science, philosophy and religion, as envisioned for the first time by the great saints like Ganadhipati Tulsi, Acharyashree Mahaprajna and Acharyashree Mahashraman. This publication aims at providing an opportunity to reflect on our rich past and look forward to an exciting future, as we continue to develop as one of the world's great universities dedicated to make knowledge work for serving mankind by way of making a difference to the world with emphasis on finding a convergence of science and religion.

Jainism is a rational and a scientific religion as acceptability of its principles is not based on any divine revelation; rather, the principles are considered as true as they are borne out by the nature of reality. Although Jain system of thought is often referred to as revealed by Omniscient Teachers, the Jain thinkers attach more importance to absence of contradiction rather than to revelation. Accordingly, a doctrine must not contradict the accepted standards of truth and logic. Those who have read ancient texts would have noticed that Jain authors took pains to examine the various opposing views, which were rejected only when they were found to be self-contradictory or inconsistent with accepted standards of truth and logic. In ancient Jain philosophy, the elements of scientific traditions were already established. The study of Astronomy (Stars, Planets, Universe etc.), Physics (Matter, Atoms, Space, Motion and Time), Biology (Living beings, Microbes etc.), Mathematics, etc have been extensively mentioned in ancient Jains Texts.

The principal objective of the International Conference on Science and Jain Philosophy (ICSJP) organized by Jain Vishva Bharati Institute (JVBI) in close collaboration with the Indian Institute of Technology (IITB), Mumbai and the Mumbai University was intended to explore and establish convergence between modern science and ancient Jain Philosophy at IITB campus in Mumbai from Jan. 8 to 10, 2016. This experiment was an epoch-making and landmark event in the annals of modern history of Jainism. The conference brought together nearly 900 participants including 50 from abroad; comprising of renowned scientists, famous doctors, eminent philosophers, reputed spiritual leaders, learned scholars and dedicated practitioners on one platform and to have in-depth



deliberations both in plenary and technical sessions along with workshops, round table and panel sessions to explore close connectivity between Jain religion and science. Separate sessions were held for younger generation to assess their approach on the subject and acquaint them with the basic theme and outcome of the conference. It enlightened lineage between seraphic wisdom as enshrined in the ancient Jain scriptures and dynamic and revolutionary developments espoused by modern scientific researches.

I appreciate the efforts of the organizers of the conference and very specially pay my deep respect to Prof. Muni Mahendra Kumar Ji, who was the spiritual guide of this academic venture. I congratulate Prof. Samani Chaitanya Prajna, the Director General of the conference, Prof. Narayan Lal Kachhara, Prof. Narendra Bhandari and Prof. Kaushal Parasad Mishra, the Executive Directors of the conference, who steered the concept very well and made the discussions fruitful. Needless to say, the message of the conference to give a momentum to such academic exercises would be further encouraged over the period of time. The scientific aspects of Jain philosophy need to be researched and presented to the world in the larger interest of humanity.

**B. R. Dugar**  
Vice Chancellor, JVBI

# PREFACE

Jain philosophy, having discarded *ad hocism*, miracles and God the Creator, firmly believes that all phenomena in the Universe, involving both, the living and the non-living, operate on the basis of certain laws, which are inviolable. In this sense it is very similar to the current scientific approach. The great edifice of Jain philosophy has been built upon certain laws, principles and observations, with much emphasis on knowledge and logic. The only, and the most significant difference between Jain philosophy and scientific theories is that these principles, laws and observations were enunciated by enlightened Tīrthaṅkaras, who attained omniscience by meditational and spiritual practices by super sensuous techniques, transcending the imperfect sense organs and mind, whereas scientific theories are based on direct observations by sense organs, empowered by technology and supplemented by sound theoretical, mathematical logic. The approach thus is distinctly different but the goal is the same – to understand the laws behind operation of the Universe.

Claims of Jainism to be scientific in its content and approach may be justified based on certain arguments but the real test that it is on the same scientific footing as the modern science is whether these laws, which encompass much wider scope not only of life but also of afterlife, are similar, in many ways, to those postulated by modern physics, chemistry and biology. Thus Jain philosophy must be subjected to scientific tests to prove its scientific nature. In support of scientific nature of Jain philosophy we can cite at least 50 important scientific discoveries made by renowned scientists during the past couple of centuries, which are mentioned in some form in Jain Agamas, enunciated by Tīrthaṅkara Mahāvīra, about 2600 years ago and compiled one to two millennia ago.

Such conclusions cannot be derived in isolation, and for this purpose meeting of scientists and Jain scholars was considered desirable. The International Conference on Science and Jain Philosophy offered just such an opportunity. Hundreds of scholars, both of science and Jainism met during the three day conference in the academic settings and environment of the Indian Institute of Technology, Mumbai. True, this is the first such attempt and many more meetings will be required to settle the matters which are in disagreement, but we must emphasize that some

common ground has been found as is evident from the series of articles presented in these proceedings.

This Proceeding of the International Conference on Science and Jain philosophy contains selected papers presented in the Plenary and Invited talks. The three day conference had eight sessions dealing with Relativism and Jain Logic; Soul and consciousness; Relevance of Jainism in Modern Times, Science, Society and Ethics; Laws of Nature and Karma Theory; Environment and Ecology; Macrocosmology, Universe, cosmography and cosmogony; Mathematics; Microcosmology, *Paramāṇu* and Atom; besides Round Table discussions, Experimental Workshops on Impact of Lifestyle intervention, *Prekṣā* meditation, Yoga in achieving holistic health, Young Researchers' sessions, Workshop on meditation, Panel discussions on International and National collaboration for Integrating Jainism and Science etc. The selected papers presented in these Proceedings are grouped under seven sections: Nature of Reality; Jain Metaphysics and Science; Consciousness and Life; Meditation and Health; Matter, Universe and Cosmology; Environment; and Mathematics.

In the section on Nature of Reality, we begin with the seminal paper on the views of *Ācārya* Mahāprajna on Theory of Creation (*Śṛṣṭivāda*) in Jain canonical literature, presented by Samani Chaitanya Prajna. In contrast to Vedāntic view, wherein all the creation is due to *Brahmn*, a universal super soul, or the materialistic view wherein everything, living and non-living in the Universe arises from matter, Jain philosophy propounds that the creation is a consequence of karma and is due to efforts of the living beings and the innate nature of matter. The second paper by Narendra Bhandari addresses to the fundamental question "What the Truth of our origin, existence and ultimate goal is and do humans have the capability of knowing it?", and he concludes that The Truth can never be completely known. He advances arguments based on modern science i.e. Special Theory of Relativity, Schrödinger's Wave Equation, wave particle duality and non locality and Gödel's Incompleteness Theorems and similar arguments based on Jain principles of *Anekāntavāda*, *Nayavāda*, *Syādvāda*, and *Saptabhaṅgī* (Seven-fold Predication), to bring out the inherent uncertainty in knowing the complete Truth of our origin and existence. M.K. Jain in his article on Logic of Reality is concerned with Reality as *it is*, and *its existence* independent of the observer. He discards Omniscience as a self-referential

*ad hoc* construct, inconsistent and contradictory to the real world behavior. Addressing the basic questions like 'can an object be observed, can it be described or does it make a difference', he discusses senses and its fallibility and logic and its limitations in determining *Sat* (existence) vs. *Satya* (truth). After describing the limitation of binary logic, he brings out the distinguishing features and merits of *Saptabhāṅgī*, summarizing contributions of the 24 Tirthankaras to the development of logic, and proposes a way forward by using this approach in constructing intelligent machines. Dr. Sudhir Jain takes this discussion further by discussing Determinism and Statistics and finds similarities and harmony between *Syādvāda* and *Anekāntavāda* and Quantum Physics. He then comes to a very fundamental question regarding nature of time – Whether it is linear, as believed by some western faiths like Christianity and Judaism, or is circular as believed by Oriental faiths like Jainism, Buddhism and Hinduism? Considering the possibility of recurrence, he argues for circularity of time, although it is inconsistent with the increase of entropy (second Law of Thermodynamics) with time. The quantum mechanical concepts of entanglement, non-separability and teleportation are presented by Sisir Roy and he raises the basic question of reality of relationship and compares various concepts of Western and Indian thoughts. Whereas idealists like Buddhists claim that relationships are not real, realists like Jains consider it to be real.

The second section is devoted to Jain Metaphysics and Science. Origin of life has been an enigmatic problem of prime importance. Whether it is exogenic, brought from outer space (*panspermia*) or endogenic, generated here on Earth, have been key issues. Then again, life was created by abiogenesis i.e. produced from chemical synthesis of basic elements like hydrogen, carbon, nitrogen, sulfur, and oxygen etc. via formation of proteins and other complex molecules or has a biogenic origin, has been much debated. In any scenario, proteins are required for formation of living cells and they, in turn, copiously produce proteins. Which came first- proteins so that living cells could evolve from them - or living cells capable of producing proteins? This question is addressed by Kazuyuki Akasaka in his article on atoms and life. The paper, however, deals with the physical process of biology at molecular level and attempts to explain the cause of diversity, and also commonality, of life. It assumes materialistic view of origin of life which is however, at variance with the fundamental tenet of Jain philosophy that life and matter are two distinct



entities and one cannot emerge from the other. The article points out that *Anekāntavāda* can help in understanding multifacetedness and diversity of life.

Several articles bring out the importance of *Anekāntavāda*. Asking the question: Many, One and None, Ranjit Nair reflects on the scientific and philosophical aspects of Jainism and looks for parallels with Quantum theory. In a critical essay on Western science and its limitations in the sense that it deals with only the outer material world, ignoring the self, and holistic Oriental approach to understanding both the objective world and the subjective self, Krishnaswamy Natesan brings out the importance of a holistic approach, and a synthesis of the two, calling post-humanism as the greatest danger to humanity. In the absence of any proofs of similarities between Jaina hypotheses and modern science, different authors try to interpret or speculate various Jain hypotheses in different ways. Robert Zydenbos, in his critical essay on the western view of Jainism and other Indian religions, points out that the scientists in the west are deeply suspicious of scientific basis of various faiths and philosophies. Some of these arguments are superficial and overstretched, although he emphasizes that psychology, linguistics, logic and mathematics have the real strength and superiority of ancient Indian thought compared to the western philosophy of those days. Well, Science and Jain philosophy is the main objective of this conference and various view points are presented here which will enable scholars and readers to judge the strengths and weaknesses of Jain philosophy from scientific, philosophical, ethical and ecological points of views.

Section III deals with consciousness, life, voluntary death, and rebirth. Consciousness is the core principle of Jainism. In the paper Origin of Life in Jain Perspective, Samani Chaitanya Prajna and Samani Him Prajna mention that Jain philosophy regards the existence of living beings i.e. soul as eternal. Events of birth and death are only change of modes of the soul, which are determined by karma. The karma is the governing principle for birth and death and rebirth in various realms. They also describe in detail the various modes of soul, rebirth and classification of life forms in Jaina context. Dharm Chand Jain presents the Jaina view of consciousness and its manifestation in various modes at various levels in mind and body. Rudi Jansma integrates his views on Truth and Consciousness with modern scientific views of quantum mechanics, specifically entanglement and wave particle duality and attempts to build a

simplistic, self consistent theory. Pointing out how little we know about various components of the universe, in this attempt, he endows the *paramāṇu* with qualities of mind and soul, which is neither consistent with the Jaina view, nor has a scientific basis. Much work will be required to prove such hypotheses. This is followed by the visionary talk of Gary Zukav, who talks of the current evolving phase of consciousness to a new level in which one can develop inner power, and links it to the karma theory of cause and effect, which forms the basis of Jainism. This new realization will usher the world into love, peace, and harmony with enormous power and energy. Paras Mal Agrawal discusses the reasons why science of soul has not found favour as a subject of research. He combines it with karmic Laws, quoting many renowned scientists and makes a case for further research on this topic. Sriramamurti describes the activities related to consciousness at the Dayalbagh Institute, Agra, believing that development of consciousness may resolve all conflicts and bring in harmony and peace. He mainly concentrates on the views of Radhasoami sect and compares them with some aspects of Jaina and Baudhha philosophies. Jeffery Long, in his essay on reincarnation, gives some perspective based on recent para-psychological research and discusses pros and cons of this hypothesis. He quotes some reliable events of rebirth but whether it stands scientific scrutiny or not is a matter of debate. Certainly, it cannot be taken as a matter of faith by believers and non believers in rebirth and more work is required. The two articles on *Sallekhanā* i.e. voluntary death by Luitgard Soni and Raksha Shah give a good overview of the practice and importance of *Sallekhanā* to die with dignity and achieve salvation. The subject has become topically important because of the recent judgment by Indian courts and deserves debate and documentation to secure legal sanctity. Soni gives an authentic and technical description of various types of *sallekhanā*, under different situations, quoting from various scriptures and laying emphasis on complete confidence and trust in the scriptures and *samyagdarśana*. In the last moment, one can attain purity of the soul by observing *sallekhanā*. Raksha Shah gives arguments to distinguish suicide, voluntary death and *sallekhanā* etc. Clearly the conditions under which one can opt for *sallekhanā* have to be clearly defined, taking into account the legal, philosophical and faith related issues.

Meditation and Health is the subject matter of section IV, which begins with an article by Drs. Sanchetee and Sanchetee. They describe the human nervous system and brain functions. Some recent work using

modern techniques on physiological and psychological as well as philosophical effects of meditation on humans are described by Sanchetees as well as by Vimla Vyas in the following article on theory and practice. Vimla Vyas dwells upon various types of meditations and their effects on the brain. Much of this work is statistical and limited to small groups. It is a good beginning but an in-depth and statistically significant study is required to obtain firm and reproducible conclusions. 'Universal Forgiveness' is an important concept in Jain practices. In the next paper, Viney Jain describes various types of forgiveness people practice: conditional forgiveness, unconditional forgiveness, forgiveness after one apologizes etc., and their psycho-physical benefits. He argues that the Jain form of Supreme Forgiveness (*Uttama Kṣamā*), which is not only spontaneous and non-conditional but also unilateral and universal, independent of the offender and the offence, arising without a trace of any emotion, i.e. from a state of *Vītarāgatā* in which the offence is totally forgotten, is the highest form of forgiveness that gives extraordinary benefits, spiritual, mental and physical to the forgiver. Shailesh Mehta takes the discussion on *Vītarāgatā* further and states that it includes the whole spectrum of inner science and outer science. He emphasizes that when it comes to sciences of living beings and consciousness, the theories of material science are not adequate but *Vītarāga Vijñāna* can help in this effort. Fasting is practiced in many religious traditions. Pratap Sanchetee et al. in their article on Scientific View of Fasting mention that controlled studies on animals have confirmed that fasting protects against diabetes, cancer, heart diseases, and neuro-degeneration. Some studies on humans have found that fasting helps reduce obesity, hypertension, asthma, and rheumatoid arthritis. Jain fasts are done as a penance and to purify the body, mind and soul. Fasting can be linked to autophagy for which Yoshinori Ohsumi was awarded Nobel Prize in 2016. Living in synchronisation with circadian rhythm has many health benefits. M. P. Lele stresses that in order to enjoy perfect holistic health, one needs to invoke the innate forces of soul and mind along with physical treatment. He quotes many famous yogis and makes the point that holistic health is related to human values and is connected with social health, and requires constant interaction between inner spiritual impulses and the social environment around. Arvind Gelra presents the results of a case study with the conclusion that *Prekṣā Dhyāna*, especially, *Prāṇāyāma* and *Swāsaprekṣā*, can help patients of bronchial asthma by improving subjectivity and by reducing the requirement of inhalers. He thinks that this is due to changes in sympathetic tone and improved psychology. Bipin Doshi refers extensively to the ancient Jain texts on health practices and emphasizes that the Jaina approach, involving their nonviolent methods,

gives much importance to physical and mental well being along with the objective of salvation. He mentions that integrating health care systems with practices described in Jain scriptures have great potential to meet the growing demands of simple and economical health care system.

In the beginning of Section V, Narayan Lal Kachhara deliberates on the concept of matter in Jain philosophy propounding that the fundamental constituent of the material world is energy and *paramāṇu* is its smallest unit. Besides large aggregates, Jain philosophy describes some subtler forms of matter, which have not been discovered by scientific investigations so far. Jain philosophy also offers some plausible explanation to the puzzling question like nature of hitherto undiscovered other types of matter (*catursparsī*) besides the ordinary (*aṣṭasparśī*) matter, so far studied scientifically. Devakumar thinks that the Jaina statement that *paramāṇus* may combine in 200 different ways may correspond to the elementary particles of modern physics, from Quarks, Leptons and carrier particles of various forces, 61 of which have been discovered so far whereas more remain to be discovered. Although the particles responsible for dark matter still remain to be discovered, such forced speculations or superficial resemblances to find similes between modern science and Jain philosophy, in fact, may create a negative image and, instead of showing that Jainism is a scientific religion, may actually harm it in the minds of western scientists and philosophers.

Cosmology was discussed at length in the conference with the invited Skype talk by Roger Penrose in which he presented his theory of Conformal Cyclical Universe (this paper is not included in the proceedings). Whether the universe is eternal, as Jainism propounds or has originated in the Big Bang, for which overwhelming observational evidence exists, was a point of intense discussion at the conference. According to the Conformal Cyclic Cosmological model of Penrose, the universe undergoes repeated cycles of expansion, each starting from its own Big Bang, and finally coming to a stage of accelerated expansion which continues indefinitely and there is no contraction or Big Crunch. Thus, the universe iterates through infinite cycles, with the future time-like infinity of each previous iteration identified with the Big Bang singularity of the next. This seems to be consistent with the eternal Universe propounded by Jainism. Pankaj Joshi dwells upon cosmology in Indian traditions. He mentions that while both the modern scientific methods and the ancient traditions have their own strengths, amalgamation of both streams of knowledge in a unified approach, can



free people from dogma and blind faith. J. J. Rawal compares the nature of the universe in modern science and Jain philosophy from the point of view of space, time and reality. He proposes mass as the fifth dimension, which still remains to be established, and recommends that scientists should study Jain philosophy in detail.

Jain principles and practices are fundamentally eco-friendly. In Section VI on environment, Kim Skoog examines Jain views on environmental responsibility. He compares several ecofriendly life style models, like Sentialism, Vitalism and Deep ecology, with Jaina ecological ethics which incorporates many of the positive elements of other current approaches, while at the same time minimizes the problems facing them. Although he argues that Deep ecology is the most eco-friendly- but what could be more concerned with ecology compared to Jain way of living where *aparigrah* is a basic vow and even water, air, earth etc. are respected as living entities, giving them equal status as human beings. He concludes that the Jain principle of *ahimsā* (nonviolence) coupled with their overall metaphysical system can lead one towards a very robust environmentally responsible and practical life style. Ashok Jain highlights the relationship between the Jain way of life, *Śrāvakācāra*, and ecological and environmental ethics. The eco-friendly life as mentioned in *Śrāvakācāra* is much concerned with conservation of nature. Kokila Shah talks about man–nature relationship in the context of Jain science. She stresses that our spiritual self should give us strength not to exploit nature for ourselves or for some chosen ends.

Jain *Ācāryas* have been using mathematics since ancient times for supporting and explaining the Jaina principles and doctrines of karma, rebirth, cosmology etc. Mathematics is an integral and fundamental part of Jain literature and philosophy. In the last Section on Mathematics, Ratnakumar Shah provides historical proofs that concepts of calculus, infinities, laws of indices, logarithms, partition of numbers, binomial theorem, continued fractions, infinitesimals, permutations and combinations, etc., were developed by Jaina *Ācāryas*. This shows that some of the ideas of modern mathematics were conceived some 1000 to 1500 years back by Jain saint-scholars and rediscovered much later by European mathematicians. Samani Vinay Prajna explores the mathematical contents of scripture *Paṇṇavaṇā* (2<sup>nd</sup> century CE). This text uses decimal place value system, large numbers, concept of zero, dyadic scale, rules of indices, numerables, innumerables and infinite,

combinatorics, fractions, maxima and minima, exponentials, infinitesimals, geometrical figures etc. *Kāla-cakra* or repetitive system of time cycles forms an important part of Jain cosmology. G.C. Jain argues that the cyclic concept of time, *Kāla-cakra*, conceived by Jain philosophers, mentioned by *Āryabhaṭa* in his book *Āryabhaṭīya* probably indicates his Jain background and should be a matter of further historical research. Subhash Jain presents a mathematical model of the karma doctrine. He proposes that it is feasible to use mathematical techniques to unearth the 'treasure' of knowledge buried in the Jain scriptures. Anupam Jain surveys the mathematical contents in Jain literature and divides it in two parts: worldly (*Laukika*) mathematics and para-worldly (*Alaukika*) mathematics. This paper includes a literature survey and gives information about various attempts made by recent researchers in reviewing the ancient Jain mathematical texts.

Section VIII gives the highlights of the Panel Sessions, Round Table, Poster Presentations, etc. Panel-1 discussed possibility of International and National Collaboration for Integrating Jainism and Science. Panel-2 was devoted to Research Problems and Academic Curriculum in Science and Jain Philosophy. Round Table discussions deliberated Development of Scientific and Spiritual Methods for inculcation of Moral values and Development of Emotional Quotient in Global Education. In Experimental Workshops, recent results of experimental work on effects of various meditational and other spiritual practices were presented, some of which have been included as articles in these Proceedings. Information on papers presented in Young Researchers Sessions and Poster Sessions, and the highlights of the Inaugural and Concluding Sessions are also given at the end of this section.

The real argument that Jainism is a scientific religion lies in its approach, of 'discovering the truth by studying the universe' which is real, and not an 'illusion' as some other oriental philosophies claim. The universe runs on laws and not on the will of God. This can be a subject of much debate, but here we only refer to some of the papers mentioned above, as also to the papers presented at the Ladnun seminar on 'Engaging Jainism with Modern Issues' and the monograph on 'Scientific Perspectives of Jainism' (edited by Samani Chaitanya Prajna, Narendra Bhandari and Narayan Lal Kachhara, 2017, published by JVBI) where scientific aspects of Jainism have been described and leave it to the readers to judge the extent to which they are correct.

The proceeding covers a wide spectrum of topics and thus gives an overall view of Jain philosophy and its scientific and logical approach. Some articles presents different views, some of which seem to be contradictory, and are also at variance with the accepted principles of Jain philosophy. We refrain here from offering our comments on such *controversial papers*. *Keeping in with the principles of Anekānta*, we have included them to present the diversity of views. Some articles are in form of Short Notes (marked SN). We hope the presentations will provide some basic views on Jainism, stimulate the thinking and imagination of the readers, inspire them to search the Truth and know the Reality and encourage further research.

**Samani Chaitanya Prajna  
Narayan Lal Kachhara  
Narendra Bhandari  
Kaushala Prasad Mishra**

**EDITORS**

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# Section I: Nature of Reality

## 1. Ācārya Mahāprajña's Views on Theory of Creation (*Sṛṣṭivāda*) in Jain Canonical Literature\*

*Samani Chaitanya Prajna*<sup>1</sup>

### Abstract

Creationism is one of the earliest concepts to explain the existence of different species on Earth and is in stark contrast to the Evolutionary theory of Charles Darwin, proposed about 150 years ago. Creationism is founded on two basic postulates. The first is that all the living beings were created directly by God and are not a consequence of long and gradual evolutionary process of interaction with the environment as proposed by Darwin [1]. The second assumption is that God creates a soul for each human being whenever required, in contrast to the pre-existence of souls in the Universe and to traducianism (that souls generate souls as and when bodies generate bodies). The theory of creation has become a matter of serious discussion in all the philosophical schools. Jain thinkers all along have been presenting their arguments, rejecting the idea of God as Creator, but have not felt the necessity to present the Jain view in a systematic

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\* Original article '*Āgama Sāhitya Mein Sṛṣṭivāda*' (in Hindi) by Ācārya Mahāprajña.  
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manner. Ācārya Mahāprajña, a great thinker and philosopher, has presented a consistent Jain theory of creation for the first time.

The basic points of *Sṛṣṭivāda*, based on various Jain scriptures, are presented in this article. Basically, creation takes place in three ways: by effort of the self; by innate nature of matter, which may include interaction with environment and by combination of these two processes. The transformation occurs by bonding. Various types of bonds required for formation of different species and subtle bodies are discussed in some detail.

## **1. Introduction**

Ācārya Mahāprajña has divided Jain literature into three categories: canon, post-canon philosophy and medieval philosophy. The inner corpus *Ācārāṅga* etc. and its supportive texts come under the first category. The texts pertaining to philosophy such as *Sanmati Tarka*, *Tattvārtha Sūtra*, *Samayasāra*, *Pañcāstikāya*, *Āptamīmāṃsā*, *Viśeṣāvaśyakabhāṣya*, *Ṣaṭkhaṇḍāgama*, *Kaṣāyapāhuḍa* etc. come under the second category. The texts such as *Laghīyastraya*, *Śāstravārtā-samuccaya*, *ṣaḍdarsanasamuccaya*, *Pramāṇa-Naya-Tattvāloka*, *Nyāya-Kumada-Candra*, *Pramāṇa-Mīmāṃsā* etc. come under the third category of medieval philosophy.

The post-canon philosophical texts present canonical doctrines in philosophical language whereas the medieval philosophical texts do not primarily focus on the canons. Their style is more argumentative and their subject matter is also determined in relation to other philosophies. These Jain texts are seen more engaged in examining critically, rehabilitating or reconciling with other philosophical doctrines from non-absolutistic point of view rather than establishing their own original concepts. The idea that Jain philosophy is a bundle of theories propounded by other philosophical systems and does not have any independent existence is absolutely baseless. This kind of misconception appeared due to several reasons resulting in the non-acquaintance of the scholars with the original canonical and post-canonical texts of Jainism.

Although, the Jain logicians were successful in the development of the theory of *Anekāntavāda*, theory of multiplicity of truth, they could not



sufficiently expose the doctrines which are documented in Jain canons. Had it been so, as we will see in this article, the originality of the Jain philosophy would have been a subject of serious study by other schools of thought.

## 2. Creationism

One of the important subjects of philosophy is creationism. Jain philosophy accepts the theory of existence-cum-nonexistence. According to it, the five extended realities (soul (*Ātmā*), matter (*pudgal*), space (*Ākāśa*), medium of motion (*dharmāstikāya*) and medium of rest (*adharmaastikāya*) termed as *Astikāyas*) are real and existent. Substantially, they are permanent, devoid of phenomena of origination and cessation. Only the modes of substances originate and cease and therefore, everything becomes real in the present and becomes unreal in the past and future. Out of the five, the three extended realities, the medium of motion, the medium of rest and space are non-material and motionless and therefore they are not the main cause of creation. Their existence is confined to the subtle world. Soul is non-physical. Matter is physical. These both entities are dynamic. These both are the main cause of the gross world. Soul is non-physical and subtle too. *Paramāṇu*, the smallest unit of matter, is subtle but physical. The fundamental or main cause of the gross or visible world is *paramāṇu*. Soul is only supportive to it. The explicit mode or gross change occurs in both soul and matter. The explicit mode is the direct cause of the manifested world or creation. The implicit mode or subtle change is unmanifested, while the explicit mode is manifested. In Illuminator of Jain Tenets, Acarya Tulsi writes that "It is because of the various combinations of soul and matter, the world is multifaceted. The multiplicity of the world is called creation [2]".

### 2.1 Modification

There are three types of modifications or changes: *Prayoga* i.e. by effort or force, *Visrasā* i.e. natural and *Miśra* i.e. mixed. On the basis of the three types of modifications creation is also of three types ([3], 8.2):

#### 1. Creation by effort or inner force of soul.

2. **Creation** due to innate nature of an entity (intrinsic, with self power).
3. **Creation** based on combination of the above two. processes, termed as mixed creation.

Siddhasena Gaṇi, the commentator of *Tattvārtha Sūtra*, has mentioned three types of causes, viz. *pariṇāmī* i.e. material, *nimitta* i.e. formal and *nirvartaka* i.e. auxiliary ([4]; 5.16, p 338). In the Vaiśeṣika philosophy also there are three types of causes, viz. *samavāyī* (material cause), *asamavāyī* (auxiliary) and *nimitta* (formal). According to the Jain canons, the natural creation is free from the law of cause and effect; it occurs spontaneously. The forced creation is free from the law of formal cause. It is caused by the free will. In the mixed creation, there is need of both the causes auxiliary and formal. Thus, in Jain philosophy, the law of cause and effect is relative. There is no necessity of looking for the cause for every effect since change is the natural property of every substance.

Ācārya Umāswāti (ca. 2-4 century) has classified the functions (*kārya*) of matter. One of them is bonding. The material aggregates come into existence because of the integration or disintegration of *paramāṇus*. There are three reasons of the formation of the material aggregates:

1. **Prayoga** i.e. by effort or force
2. **Viśrasā** i.e. Natural
3. **Miśra** i.e. Mixed

The formation of body is possible only by the effort of soul of the living being. Hence, body is the example of the creation by force ([5]; Patra 32). According to Siddhasena Gaṇi, 'force' means by the effort of soul ([6]; 5.24, p.363) and according to Ācārya Akalaṅka (ca. 8<sup>th</sup> century), 'force' means relation with body, speech and mind of the living being ([7]; 124, p. 487).

The modification that takes place by both: force (external means) and nature (internal means), is called mixed. According to Siddhasana Gaṇi, mixed implies the creation of a material object by the effort of living being, such as, pillar and pitcher ([6]; 5.24, p 360). Akalaṅka has mentioned only two types of creations. He has not mentioned the mixed

separately. He mentioned the third one by introducing two types of the forced creation, viz. the forced creation related to non-living entity or matter, and the forced creation related to both the living and the non-living entities. He has given the example of *Jatukāṣṭha*, a kind of glue used to join two wooden pieces, to explain the forced creation related to non-living entities ([7]; 5.24, *Vṛtti*, p.468). Siddhasena Gaṇi has also given the same example ([6]; *Vṛtti*, p.360). The forced creation related to living and non-living are of two kinds:

1. **Bondage of Karma**, e.g., the bondage of knowledge obscuring karma etc.
2. **Bondage of Matter Other than Karma**, e.g., the formation of the gross body etc. ([7]; 5.24, *Vṛtti*, p. 486).

Abhayadeva Sūri, the commentator of *Bhagavaī*, has given two examples in his commentary to explain mixed creation:

1. The body left by the liberated soul (*Mukta*).
2. The conversion of the *Audārika Vargaṇās* into the gross body etc.

The body is formed by soul so it is creation by force but after formation it changes by nature so it is mixed creation.

The *Audārika, vaikriya etc. vargaṇās* are natural but they convert into the form of body by the effort of soul so the conversion of *vargaṇās* into the form of body is also a mixed creation.

Abhayadeva raised question regarding the difference between the creation by force and the creation by mixed process. He himself answered it stating that in the creation by force nature also plays a role ([5], *vṛtti* of *sūtra* 1). Siddhasena Gaṇi has also mentioned that in the mixed creation both force and nature play primary role ([14], 5.24, *Vṛtti*, p.360).

According to Ācārya Mahāprajña, both the interpretations can be justified only in the context of the theory of cause and effect. Pillar and pitcher are the examples of the mixed creation. In making the pitcher there is effort of man and to convert into the form of a pitcher is in nature of the soil. Hence, pitcher is the outcome of the mixed process. It can be

compared with the material cause (*samavāyikāraṇa*) which is accepted in the Vaiśeṣika philosophy [8].

In the forced creation, there is no need of any external cause. It is done by the inner effort of soul itself. In the mixed creation, there is role of the external cause along with the internal effort. Natural creation is independent of both the internal and external causes ([6], 5.24, *Vṛtti*, p. 360).

## **2.2 Formation of Body**

In the canon *Bhagavaī*, there is a detailed discussion in regard to the material entities created by force or effort ([3], 8.2-39). It implies that a living being makes body, senses, and their colour and shape by its own inner efforts.

The creation by force implies the theory of self-exertion (*Puruṣārthavāda*) and the creation by nature, the theory of nature (*Svabhāvavāda*). Jain philosophy is non-absolutistic in its approach; hence it regards both, the theory of self-exertion and the theory of nature, in relative sense.

The first example of the creation by force is – the bodies of one-sensed living beings ([3], 8.2). Similarly, the example of the mixed creation is also the bodies of one-sensed living beings. But both the examples are not of the same nature. The one-sensed living beings create body out of matter of the *Audārika Vargaṇā* and only that matter is created by force.

The bodies of the one-sensed living beings change by nature. Such bodies come under the mixed creation. In these bodies there are both, the inner effort and natural change.

Pitcher is made of soil. Soil is the body of the one-sensed earth-bodied living beings. It becomes dead when the one-sensed living beings pass away. In this state the soil is the dead body of the living beings. Soil has innate quality to convert into pitcher. Soil is converted and it takes shape of a pitcher.

The visible world is a material world. What we see around is either a living body or the body left by the living beings. The living body is the example of the creation by force. There are five main types of the living bodies:

1. The living body of one-sensed beings
2. The living body of two-sensed beings
3. The living body of three-sensed beings
4. The living body of four-sensed beings
5. The living body of five-sensed beings

The sub-types of these bodies are innumerable.

The body left by the living being is also of five types. Their sub-types are also innumerable.

Modifications or changes by force (effort), by nature and by both are the fundamental causes of creation. The first two are the creation by the living beings. The natural change is the creation by the non-living. Since the change in colour etc. is due to the nature of matter itself. The soul has no role in it.

In *Bhagavatī*, there is mention of nine types of material entities created by force or effort ([5], p.331-332; *Bhagavatī Joḍa, Śataka* 8, *dhāla*130, *gāthā* 49-131; [11], 36.68-247: [9], 1.10-88).

1. The creation of all the physical entities by the effort of the living being.
2. The creation of the bodies pertaining to fully developed (*paryāpta*) and undeveloped (*aparyāpta*) living beings.
3. The creation of body by effort.
4. The creation of sense-organs by effort.
5. The creation of both body and senses by effort.
6. The creation of colour, smell, taste, touch and shape of material body.

7. The creation of body and colour etc.
8. The creation of sense-organs and colour etc.
9. The creation of body, sense-organs and colour etc.

In brief, there are two kinds of creation according to Jain Philosophy:

**1. Self-induced Creation**

**2. Non-self-induced creation**

The living being creates body, senses and their colour, smell, taste, touch and the shape by its own inner power. It is creation by soul or the living being. The cause of the diversity of the self-induced creation i.e. by the effort of the living being, is the difference in the development of their body, senses and colour etc. ([11], 36.83, 105, 116, 125, 135, 154, 168, 178, 187, 203, 247). *Bhagavaī* gives an elaborate treatment of the diversity of self-induced creation on the basis of the difference of body, senses and colour etc. ([3], 8.2-39).

Body and senses are material. Colour, smell, taste and touch are the material qualities. Shape is the defining characteristic of material entities. The diversity of self-induced creation is due to its relation with matter. This is the reason why there is discussion of body, sense and their colour, smell, taste, touch and shape in the context of the diversity of self-induced creation. As the living being creates its own body and senses so it creates colour, smell, taste, touch and shape also.

The power of self is of two types, viz. voluntary (*ābhiyogika*) and involuntary (*anābhiyogika*). To perform something motivated by desire, the soul uses its voluntary power. The involuntary power is autonomous. Body, senses and their color etc. are created with the help of the involuntary power ([6], 8.3 *Vṛtti*, p.128).

There are five types of bodies, five types of colours, two types of smells, five types of tastes, eight types of touches and five types of shapes ([3], 8.42). The colour, smell, taste and touch have further innumerable grades. Various combinations of these parameters give rise to the diversity of life we see around.

### 3. Bonding

Bonding or creation is of two types, viz; natural (intrinsic) and forced (unnatural/by effort, extrinsic).

#### 3.1 Natural Bonding

The natural bonding is of two types, viz. with and without beginning. The smallest unit of the three eternal substances: the medium of motion, the medium of rest and space, is technically known as *pradeśa*. Both the medium of motion and the medium of rest have innumerable units (*pradeśas*). Space has infinite units and is divided into two, viz; cosmic (*lokākāśa*) and trans-cosmic (*alokākāśa*) space. The cosmic space has innumerable units and the trans-cosmic space consists of infinite units. The bond among the units of each of these extended realities is natural and eternal (beginningless). Their units are static i.e. have constant dimensions; there is no extension and contraction in them. They are static; do not move from their place.

There are two types of bondings: partial and complete. In partial bonds there is partial contact between two adjoining members such as between two units of a chain. In complete bond, there is full contact between the members as it happens in the mixture of milk and water. In such a mixture, the two constituents can not be seen individually.

So far as the bonding between two units of the medium of motion, and also that of the medium of rest and space is concerned, it is of touching only. The two neighbouring units only touch each other at some point. If their units merge into one another, they will not have independent location ([5], Patra, 395). The bond of the units of all these entities is beginningless and endless.

The natural bonding having a beginning is of three types:

- **Bond Caused by Integration**
- **Bond Caused by Container**
- **Bond Caused by Transformation**

### 3.1.1 Bond Caused by Integration

Clusters are formed by integration of *paramāṇus*. Two *paramāṇus* combine together to make a *dvī-paramāṇu* cluster. Similarly, three *paramāṇus* combine together to make a *tri-paramāṇu* cluster, and so on up to infinite number of *paramāṇus* combine to make cluster of infinite-*paramāṇus*. The bonding between *paramāṇus* takes place due to:

1. Difference in viscosity
2. Difference in dryness

In the context of modern science the properties *viscosity* and *dryness* have been recognized as positive electric charge and negative electric charge respectively. This is an electrical or ionic bonding.

A *paramāṇu* possessing some degree of positive charge does not integrate with the *paramāṇu* having the same degree of positive charge. Similarly, a *paramāṇu* possessing some degree of negative charge does not integrate with another *paramāṇu* having the same degree of negative charge. The *paramāṇus* integrate with each other only when either their charges are of different kinds or, if the charges are similar, then the charges should differ in degrees ([5], Patra, p.395). In the scripture *Prajñāpanā*, there is mention of bonding between *paramāṇus* having similar and dissimilar charges ([8], Pada 13.21-22). There is no mention in *Bhagavat* about the bonding between *paramāṇus* having dissimilar charges.

**3.1.1.1 Laws of Combination of Similar *Paramāṇus*:** The combination of *paramāṇus* not only depends on whether they are *snigdha* or *rūkṣa* but also on the degree of *snigdhatā* and *rūkṣatā*. According to *Prajñāpanā*, the positive *paramāṇus* combine with other positive *paramāṇus* and the negative *paramāṇus* combine with other negative *paramāṇus* if their charges differ by two or more degrees. The *paramāṇus* do not combine if they have the same charge or the charges differ by one degree ([8], 13.21-22; *Paṇṇavaṇāvṛtti*, Patra 228). *Cūrṇi* of *Uttarādhyayana* gives some examples of bonding between similar *paramāṇus*. The *paramāṇu* of one degree *snigdhatā* can combine with the *paramāṇu* of three-degree *snigdhatā*. Similarly, the *paramāṇu* having three-degree *snigdhatā* combines with the *paramāṇu* of five-degree *snigdhatā*. The *paramāṇu* of the five-degree *snigdhatā* combines with the *paramāṇu* of seven-degree *snigdhatā*. This text does not mention any restriction for the *paramāṇu*



having minimum degree i.e. one-degree *snigdhatā* to combine with another *paramāṇu* of the same quality. The same rule applies to the *paramāṇus* having dissimilar i.e. *snigdha* and *rūkṣa* qualities ([11], *Cūrṇi*, 2.17).

**3.1.1.2 Laws of Bonding of Dissimilar *Paramāṇus*:** Dissimilar *paramāṇus* having minimum *snigdha* and *rūkṣa* properties do not combine. It means that the *paramāṇu* having one degree *snigdhatā* does not combine with the *paramāṇu* having one degree *rūkṣatā*. The *paramāṇu* of two-degree *snigdhatā* can combine with the *paramāṇu* having two-degree *rūkṣatā*. This is the combination of same degree *paramāṇu*. The *paramāṇu* having two degree *snigdhatā* can combine with the *paramāṇu* possessing three- or four-degree *rūkṣatā* etc. This is the combination of different degree *paramāṇus*. In the combination of the dissimilar *paramāṇus*, both the rules of same and different degrees are applicable.

The Digambara canon *Śaṭkhaṇḍāgama* gives a systematic scheme of forced and natural bonds.

Tables (1, 2, 3, 4 and 5) present the laws accepted in different Jain texts ([11], Book 14, Division 5, Parts 4-5, 6, 26-27).

**Table 1: Rules for combinations of *paramāṇus* according to *Prajñāpanā*, *Uttarādhyayana Cūrṇi* and *Bhagavati***

Sr. no.	Degree of two <i>paramāṇus</i>	Similar quality or charge (S&R)	Dissimilar quality or charge (S&R)
1.	1+1	No	No
2.	1+2	No	No
3.	1+3	Yes	No
4.	1+4	Yes	No
5.	2+2	Yes	Yes
6.	2+3	Yes	Yes
7.	2+4	Yes	Yes
8.	2+5 to infinite	Yes	Yes

**Table 2: Rules for combination of paramāṇus according to Tattvārthabhāṣyānusāriṇī**

Sr. no.	Degree of two paramāṇus	Similar quality or charge (S&R)	Dissimilar quality or charge (S&R)
1.	1+1	No	No
2.	1+2	No	Yes
3.	1+3	Yes	Yes
4.	1+4	Yes	Yes
5.	2+2	No	No
6.	2+3	No	Yes
7.	2+4	Yes	Yes
8.	2+5 to infinite	Yes	Yes

**Table 3: Rules for combination of paramāṇus according to Sarvārthasiddhi**

Sr. no.	Degree of two paramāṇus	Similar quality or charge (S&R)	Dissimilar quality or charge (S&R)
1.	1+1	No	No
2.	1+2	No	No
3.	1+3	No	No
4.	1+4	No	No
5.	2+2	No	No
6.	2+3	No	No
7.	2+4	Yes	Yes
8.	2+5 to infinite	No	No

**Table 4: Rules for combination of paramāṇus according to Śaṭkhaṇḍāgama**

Sr. no.	Degree of two paramāṇus	Similar quality or charge (S&S)	Dissimilar quality or charge (S&R)
1.	1+1	No	No
2.	1+2	No	No
3.	2+2	No	Yes
4.	2+3	No	Yes
5.	2+4	Yes	Yes
6.	2+5 to infinite	No	Yes

**Table 5: Rules for combination of paramāṇus according to Tattvārthasūtra**

Sr. no.	Degree of two paramāṇus	Similar quality or charge (S&S)	Dissimilar quality or charge (S&R)
1.	1+1	No	No
2.	1+2	No	No
3.	2+2	No	No
4.	2+3	No	No
5.	2+4	Yes	Yes
6.	2+5 to infinite	No	No

### 3.1.2 Bond Caused by Container

Things kept in a container for a long time get automatically changed. For example, the old wine becomes solid (*gādhī*), the old jaggery and rice convert into a lump after long time ([3], *Tikā* p.395).

### 3.1.3 Bond Caused by Transformation

The clusters of *paramāṇus* convert into various forms such as cloud etc. due to some factors other than the two i.e. integration and effort is called creation by modification.

## 3.2 Forced Bonding

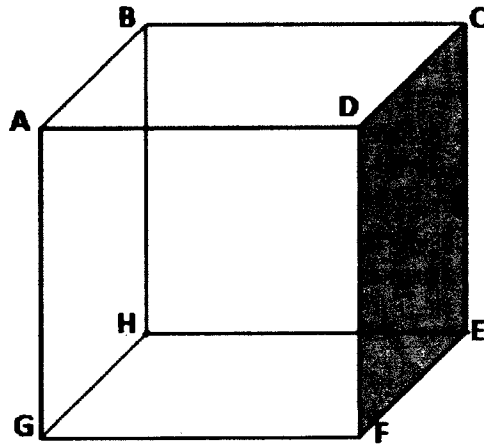
As indicated before that *pradeśa* is a dimensionless smallest unit of an entity. It is considered as a point. How an extended structure of soul is constructed starting from a point? For this purpose a small elemental form was conceived. This elemental form becomes the building block in constructing the extended structures. This is like a brick used in constructing a house.

The units (*pradeśas*) of an embodied soul are dynamic and not static like that of medium of motion, medium of rest and space. They can contract and expand. If the body is big, the units of soul expand and if the body is small, they contract. In the state of *Samudghāta*, the units of soul expand to occupy the whole *loka* and contract again to the original size

([6], 5.16). This is the reason why there is separate mention of the bonding of the units of soul from the eternal natural bonding which is found in the units of medium of motion, medium of rest and space.

The units of soul expand and contract and therefore their bonding is by force. *Bhagavaī* mentions eight middle units of the four extended realities ([6], 5.16). The bonding of the eight middle units of soul is beginningless and endless and therefore their bonding must be natural; yet their bond is considered as by force because of their relation with other unstable units of the soul. According to Abhayadeva, the meaning of the forced bonding is the bonding of the units which takes place by the effort of soul. The alternative meaning of the forced bonding is the bonding of the units of soul with the matter of *audārika* etc. *vargaṇās*.

In figure 1, the eight middle units are shown marked by A-H. Among the eight units, there is eternal bonding or connection of one-one unit with three-three adjacent units located in three directions. Similarly, among the four-four units situated up and down, there is eternal connection of one-one unit with two-two adjacent units located in two directions. These units, in turn, are connected with other units and so all units of soul are connected with each other. This implies that all units of an extended reality are connected with each other and they together form one body.



**Fig. 1: An eight unit element of *pradeśas*, having a structure like one cube, formed by bonding proposed for the four extended realities: *ātmā* (soul), *ākāśa* (space), *dharmāstikāya* (medium of motion), and *adharmaśtikāya* (medium of rest).**

Abhayadeva Sūri mentioned four alternative types of the forced bonds in the soul ([5], Patra 32):

1. The bond of the eight units of soul is beginningless and endless, while the bond of the rest of the units of soul has beginning in the sense of having power of contraction and expansion.
2. The bond without beginning and without an end is impossible.
3. The bond with beginning and without end: The bond of the units of a liberated soul (*Mukta*) is with beginning but without end, i.e. it continues for ever.

*Ṣaṭkhaṇḍāgama* mentions that the bond of the eight central units of soul as beginningless psychical bond ([11], Book 14-5, 6, 63). Siddhasena Gaṇi has also discussed eight middle units in his commentary of *Tattvārtha Sūtra* ([6], 2.9 *Bhāṣya* p.151, 154). In the *Tattvārthavārtika* of Akalaṅka, the location of the eight middle units is shown constant. They are located up and down, four units up and four down. They always remain associated with each other so their bond is beginningless. The other units of soul contract and expand because of karma. They are, therefore, with beginning ([11], Patra 398).

4. The bond with a beginning and an end are of four types:
  - *Ālāpana Bandha* i.e. Bond by rope etc.
  - *Ātīnakaraṇa Bandha* i.e. Bond by glue etc.
  - *Śarīra Bandha* i.e. Bond by contraction of units of *Kārmic* and *Taijasa* bodies.
  - *Śarīra-prayoga Bandha* i.e. Bond by physical effort ([5], Patra 395).

### 3.2.1. *Ālāpana* Bond

Bonding by the rope like things is called *Ālāpana* bond. *Bhagavatī* mentions the following means to understand this bonding:

1. *Vetralatā* i.e. like a piece of bamboo grown in water.

2. **Varatra** i.e. like a rope of leather.
3. **Vallī** i.e. like a creeper.
4. **Darbha** i.e. like a small soft grass blade used on auspicious occasions.
5. **Valka** i.e. like the bark of a tree.
6. **Rajju** i.e. as the rope made up of Sana plant.
7. **Kuśa** i.e. as the grass with hard and edged leaves.

The commentator has mentioned *Kuśa* as grass without root and *Darbha* as grass with root. Cloth etc. are also means of *Ālāpana* bond ([5], Patra 398). *Ṣaṭkhaṇḍāgama* ([11], Book 14, 5.6.41, p. 38) and *Tattvārthavārtika* ([11], 5.24, *Vṛtti*, p.486-488) also mention iron in the list of this type of bond.

### 3.2.2. *Ālīnakaraṇa* Bond

Joining of one object with another by some glue is called *Ālīna* bond. It is of four types:

- **Śleṣa Bond**: The bond is made by some adhesive element, for example, bonding of walls and pillars etc. ([5] Patra 388; [10], Book 14, 5.6.48, p.41). Some bonding agents are lime, mud, glue, *lākha*, wax etc.
- **Uccaya Bond**: Piling up of objects to make a heap or a bundle. For example, the heap of grains or grass.
- **Samuccaya Bond**: In *Samuccaya* bond, there is piling as well as cementing of the objects like bricks or stones on one another in construction work.
- **Samghanana Bond**: It is bond obtained by joining different parts of an object. It is of two types:
  - a. **Partial Samghanana Bond**: Joint of some parts without any blending material, e.g., the construction of a bullock cart.
  - b. **Complete Samghanana Bond**: the bond formed by unification, e.g., mixture of milk and water.

### 3.2.3. Śarīra Bandha

Soul consists of innumerable units. The units are always associated with each other so they are inseparable. Due to their association with karmic body their structure gets changed. They contract and expand. In the process of *Samudghāta* the units of soul expand and contract. In this event the units of *kārmic* (*kārmaṇa*) and electric (*taijasa*) bodies, which are associated with embodied soul, also expand and contract. The expansion and contraction of the two bodies is called *Śarīra Bandha*. The main cause of this is *Samudghāta* i.e. astral projection. In *Samudghāta*, soul expands out of body and gets back to it. The expansion and contraction of the units of soul is called *Śarīri* i.e. psychical bond.

Abhayadeva Sūri has given some details of the psychical Bond. In the case of physical bonding (*Śarīra bandha*) the units of *kārmic* and electric bodies are mainly involved and the units of soul (*Ātma-pradeśas*) are marginalized. In the case of psychical bonds, the units of soul are primarily involved and the units of *kārmic* and electric bodies are marginalized ([5], Patra 399). The psychical bond and the physical bond are also considered separately in *Ṣaṭkhaṇḍāgama* ([11], Book 14, 5.6.44, 625 p.41–45) and *Tattvārthavārtika* ([11], 5.24, *Vṛtti*, p.488). The physical bond is of two types:

- **Pūrva-Prayoga Pratyayika** i.e. bond caused by past effort
- **Pratyutpanna Prayoga Pratyayika** i.e. bond caused by present effort

**Bond Caused by Past Efforts:** The meaning of physical bond here is the contraction of *kārmic* and electric bodies during *Samudghāta*. The main cause of this contraction is due to the effort of soul itself, since *Vedanā Samudghāta*, *Kaṣāya Samudghāta* etc. take place due to effort of the soul. Living beings undergo *Samudghāta* because of different reasons. During the time of *Samudghāta* the units of soul expand and contract while remaining bonded. In this process of expansion and contraction, the effort of soul along with the units of the two bodies is related to the past. This is the reason why the bond is said to be caused by past effort ([5], Patra 399).

**Bond Caused by Present Effort:** The total time of *Kevalī Samudghāta* is eight moments (*samaya*). In the first four moments the soul

expands and in the last four moments it contracts. The fifth moment is the first moment of contraction known as "*Mantha*". In this state, the units of soul along with the units of the two bodies start contracting. The bond (contraction) during *Mantha* is by present effort.

This bond has never taken place at any point of time in the past and therefore, the bond is unique. This bond is found in sixth, seventh and eighth moments also but starts from fifth moment and therefore, the fifth moment only is regarded appropriate time for the bond caused by present effort.

### **3.2.4 Physical Bond by Application of Force**

The soul develops its own body. The subtle electric body and *kārmic* body are always associated with the embodied soul. The gross body technically known as *Audārika śarīra* is built at the time of new birth and separates from the soul at the time of death of the living being. *Vaikriya* i.e. protean body and *Āhāraka* i.e. communication body are also comparatively gross. The gross body is built by human and sub-human beings, the protean body is developed by the celestial and hellish beings and the communication body is developed by human beings with the help of mystical or meditational powers.

There are three causes for the bonding or creation of the gross body ([3], 5.110, *Bhāṣya*)

- 1. Power of Soul, Action of Body and Matter:** Power of soul is obtained by destruction-cum-subsidence of *Vīryāntarāya* karma. The word 'action' implies mental, physical and vocal activities of the living beings. Matter here means the material aggregates pertaining to the gross body. All these three entities jointly determine formation of the body structure.
- 2. Non-attentiveness towards Soul:** It also plays some role in the bond caused by physical effort.
- 3. Role of Karma:** The rising (*udaya*) karma, the actions of the body etc., psyche and the present life-span are the deciding factors in the formation of the gross body. The main cause of this formation is the rising of body-making karma and the power of soul, actions of body etc., and matter are its auxiliary



causes ([5], Patra 400). In *Ṣaṭkhaṇḍāgama*, the bond of gross body is counted as *nokarma*, matter different from the *kārmic* matter ([11], Book 14, 5.6.40, p.37).

The *Audārika* body bond may be in two states:

1. **Partial Bond**
2. **Complete Bond**

Soul giving up the previous body creates a new one. In the first moment of the formation of the new body, the living being absorbs only external matter and therefore, it is called complete bond. It means in the first moment he only develops his physical powers which are necessary for new life. These powers are known as *pariyāpti* i.e. bio-potential. Completion of *pariyāpti* means full construction of all physical systems which are necessary for new body ([3], 8.376). In the second, third etc. moments, the rejection of waste matter starts along with intake of new matter. In this situation, there is not only intake and assimilation of new matter but also separation of the unwanted matter aggregates and, therefore, it is a partial bonding.

Abhayadeva Sūri has explained the process by the example of *Apūpa*, an eatable item made up of wheat. *Apūpa* when put in the frying pan absorbs oil during the first moment but in subsequent moments, both the processes i.e. absorption and desorption of oil ([5], Patra 400) occur.

### 3.3 Source of Material World

*Vaiśeṣika* philosophy has considered *paramāṇus* of earth, water, fire, and air as the source of origin of the universe. According to it, the *paramāṇus* are eternal, absolutely unchangeable. In Jain philosophy, there is mention of matter comprising eight groups of *paramāṇus* technically known as *Vargaṇās*. They are:

- 1) *Audārika Vargaṇā*: *paramāṇus* appropriate for gross body
- 2) *Vaikriya Vargaṇā*: *paramāṇus* appropriate for protean body
- 3) *Āhāraka Vargaṇā*: *paramāṇus* appropriate for migratory body

- 4) *Taijasa Vargaṇā*: *paramāṇus* appropriate for electric body
- 5) *Kārmaṇa Vargaṇā*: *paramāṇus* appropriate for kārmic body
- 6) *Śvasocchvāsa Vargaṇā*: *paramāṇus* appropriate for breathing
- 7) *Bhāṣā Vargaṇā*: *paramāṇus* appropriate for speech
- 8) *Mano Vargaṇā*: *paramāṇus* appropriate for formation of mind

All these *vargaṇās* are variable-constant (*pariṇāmī-nitya*). They are inter-convertible; one can convert into another. For example, the *paramāṇus* of *Audārika vargaṇā* can convert into *Taijasa vargaṇā* and vice versa. The concept of creation can be explained on the basis of the theory of variable-constant (*pariṇāmī-nityavāda*) only. From the concept of *vargaṇās* it is clear that the fundamental elements of the creation are—matter and embodied soul only. The following are eight types of creation by force. They are five types of bodies and three types of physical apparatus.

1. *Audārika śarīra* i.e. Gross body
2. *Vaikriya śarīra* i.e. Protean body
3. *Āhāraka śarīra* i.e. Communication or Migratory body
4. *Taijasa śarīra* i.e. Electric body
5. *Kārmaṇa śarīra* i.e. Kārmic body
6. *Bhāṣā* i.e. Vocal system
7. *Śvāsocchavāsa* i.e. Breathing system
8. *Manas* i.e. Mind

#### **4. Concluding Remarks**

The Jain canonical literature gives a unique concept of creation which is governed by natural laws and processes and not by any supreme power called God. The concept of creation in Jainism is explained through the formation process of different types of subtle and gross material bodies.

There is an elaborate discussion about the three types of creation i.e. creation by force, natural and mixed, involving both. In the medieval philosophical period, the canonical concepts have not been properly highlighted and therefore the world of scholars could not come to know

the original and unique concept of creation found in Jainism. There is a need of bringing out the ancient wisdom, particularly in the modern context.

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- [1] Oxford Dictionary of World Religions.
- [2] Illuminator of Jaina Tenets 1.17— *Jīvapudgalayorvividhasaṃyogaiḥ sa vividharūpaḥ. Iyam vividharūpatā eva sṛṣṭiriti kathyate.*
- [3] *Bhagavaī* 8.2.
- [4] *Tattvārthādhigamasūtram* 5.16, p.338.  
*Nirvartako nimittam parināmī ca tridheṣyate hetuḥ/  
Kumbhasya kumbhakāro, kartā mṛcceti samasaṅkhyakaḥ//*
- [5] *Bhagavatīvr̥tti*, *patra* 32: *jīvavyāpāreṇa śarīrāditayā parinātāḥ*
- [6] *Tattvārthādhigamasūtram* 5.24, p.363.
- [7] *Tattvārtharājavārtika* 124, p. 487.
- [8] *Śaśvata*: Felicitation of Dayanand Bhargava, p.215.
- [9] *Pañṇavaṇā* 1.10-88.
- [10] *Uttarajjhayaṇāṇi* 36.83, 105, 116, 125, 135, 154, 168, 178, 187, 203, 247.
- [11] *Uttarādhyayana Cūrṇi* 2.17.
- [12] *Śaṭkhaṇḍāgama*, Book 14, Division -5, Parts 4-5, 6, 26-27.

## 2. Enigma of The Truth

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### **Abstract**

What is the Truth of our existence and do humans have the capability of knowing it? These are the two questions which science, philosophy and religions have been trying to answer since ages without much success and, in the process, produced many hypotheses. Jainism too has pondered over these questions. We discuss these aspects in this article and compare them with the modern scientific concepts.

In the present context by 'Truth' we mean the origin of Universe, origin of life, their ultimate fate and the laws governing the living and the non-living. The origin and nature of 'self' and consciousness, the question of life after death (rebirth) etc. constitute important aspects of life. Scientifically, the origin of the Universe and the laws governing the material Universe have been studied based on various laws and principles of physics, specifically General Theory of Relativity, Quantum physics, and more recently Quantum Gravity has been invoked, but the questions

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related to consciousness have remained elusive. There is a dilemma whether every event in the life of a being is predetermined or is governed by the law of Karma. These questions can be discussed within the framework of some Jain doctrines viz. *Anekāntavāda* (multiplicity of modes), *Syādvāda* (uncertainty), *Nayavāda* (contextuality) and *Saptabhaṅgī*; *Saptabhaṅgī* describes the possibility of seven modes of existence and arises from combinations of *Anekāntavāda* and limitations of sensory knowledge and mental deductions. In this article, it is emphasized that only some aspects of an object can be known at any time and the only true and definitive statement one can make about an object (living or non-living) is that nothing can be described completely and with certainty, which would hold true at all times, in all contexts and is termed as *Ajñeyavāda* which defines limitation of all knowledge.

The concepts of *Syādvāda* and *Anekāntavāda* have profound scientific implications, specifically in the context of quantum mechanics, wave-particle duality, complementarity, logic, probability and statistics. We first discuss these Jain doctrines in relation to some concepts of modern physics (Uncertainty principle and wave-particle duality). Heisenberg's Uncertainty principle, non-locality of wave nature of particles and Gödel's Incompleteness theorems put severe constraints on the accurate and complete description of certain phenomena. As we approach the point of origin of the Universe (or consciousness?), we encounter some degree of uncertainty, both according to current scientific theories and the ancient Jain principles and it appears that it may not be possible to know their origins with certainty.

Even so, Jainism claims that humans can realize the truth, not by sensory organs, mind or scientific observations, but by direct experience through consciousness (by the Omniscient), without the mediation of sensory organs. Truth can only be experienced, it cannot be described completely.

Before we address the question of the origins and compare the Jain concepts with scientific understanding, it is desirable to see if indeed there is any scientific basis for such a comparison i.e. are the Jain philosophic concepts, enunciated many millennia ago, scientific enough to be debated in modern context. This depends on both, the content and approach of Jainism. The question has been discussed in a separate paper (Bhandari, 1917) in which it has been concluded that there exists mention of a few

principles, laws and facts in the Jain *Āgamas*, documented millennia ago, which have been discovered by scientific techniques as recently as during the last one or two centuries. These are listed in Appendix-1. No doubt there are some serious disagreements between some Jain findings and scientific observations (listed in Appendix-2), but the information given in Appendix-1 justifies the scientific basis and logic on which the edifice of Jain philosophy has been constructed.

## **1. Defining the Problem**

The Truth or the enigma of our existence, involves several questions for which accurate, verifiable or universally acceptable answers have been difficult to obtain. These questions are related to the origins, existence and future of the Universe in which we live, and of our being, sometimes referred to as self or soul. How the Universe originated and how it will end; Is the Universe real, eternal or only *Māyā* (illusion), a product of Quantum Vacuum or it is just a holographic, virtual world. How the self came into existence and what happens to it after the body dies. Is there an eternal soul (*Ātmā*) or it is just a myth or a hypothesis? Is there a *Brahmn*, universal soul (*Paramātmā*) or God the creator? Is there a universal or individual, personal purpose of life and if so what is it? What is consciousness? Does it have an independent existence or it just appears when the neural network in the brain develops a critical level of complexity. There are also many other questions related to consciousness e.g. how the information is integrated in the brain and how it is converted into experience (Qualia). Answers to these questions are believed to be related to the 'Ultimate Truth' of our existence.

The Truth, in essence, involves three factors: The object (or the subject) to be known (in this case the Universe and all its components, including the self), the knower (sometimes called the *Ātmā*, *cetanā* or consciousness) and the knowledge (scientific, logical and intuitional). Of all the living beings, humans have the most developed brain but even their faculty of observation and comprehension has severe limitations, depending on the state of development of sensory organs and brain (and mind), which can understand a thing only within a limited perspective. It should be realized that humans are not the ultimate, perfect, final products of nature and much scope remains in store in the future for further evolution, progress and perfection. The nature is multifaceted implying

that everything in the Universe, living and non-living, have an infinite number of modes which, though potentially coexist in it all the time, are latent and only manifest under different conditions at different times. Furthermore, contrary to the scientific view, which classifies knowledge into two parts, Known and Unknown, Jainism postulates that there are three categories of knowledge: Known, Unknown and Unknowable by sensory organs. Whereas 'unknown' can be converted into 'known' by study of an object, unknowable can never be known by sensory organs or mental deductions. Combinations of these three aspects, i.e. nature of the Universe, which is changing every moment, limitations and imperfections of senses and mind, and unknowability (*Avaktavya*: Indeterminable or indescribable) of the objects, make it difficult to define anything perfectly, correctly and completely, in all its aspects.

The above questions have been debated by various philosophies, religions and science ever since the humans appeared on the Earth and form the core questions in *Vedas*, *Sāṅkhya*, *Mīmāṃsā*, *Upaniṣads*, Buddhism, Jainism, Hinduism, Christianity, Islam and Judaism, essentially in all the philosophies of the world. Each religion has discussed these questions with all seriousness and proposed models which can be broadly classified as Biocentrism and Materialism, each being a form of *Advaitavāda* (Monism) and *Dvaitavāda* (Duality), which includes both. Jainism is different from these concepts, basically subscribing to *Dvaitavāda* of *Jīva* and *Ajīva*, but further goes on to propound that the *Ajīva* consists of five, independent, eternal *dravyas* (*Ākāśa*, *Pudgala*, *Kāla*, *Dharmāstikāya* and *Adharmāstikāya*); thus the Universe (*Loka*) is made up of six *dravyas* in all (Hexa-D model; Bhandari, 2017). The various models can be briefly described as follows:

**(a) Materialistic View:** Matter (elementary particles) formed first, as in Big Bang creation of the Universe and as the Universe cooled and aggregated to form various structures, simple life forms (algae) appeared by abiotic synthesis of long chain carbon compounds (proteins, nucleotides, amino acids, sugars etc.). As complex species evolved further by Darwinian evolution to form brain, i.e. neural network, mind and consciousness arose spontaneously and suddenly.

**(b) Biocentric or Vedāntic View (*Advaitavāda*: Monism):** Consciousness (*Brahmn*) is the only motive force, existed first (there is none other which is existent, i.e. there is no second) and is eternal and

independent. Consciousness is energy and energy (E) can be converted into matter (mass, M) and vice versa according to the Einstein's relation  $E=Mc^2$ , c being the velocity of light. This led to formation of matter. This argument can also be used to support the reverse process i.e. life formed out of matter as in (a) above. Essentially, there is only one eternal element that is omnipotent *Brahmn*. Everything we see around (matter, energy, space, time, motion, rest etc.) miraculously and spontaneously arose from it.

**(C) *Dvaitavāda* (Duality):** Life comes from life. It is an everyday observation that life arises only from living beings and cannot be created from non-living entities like matter [*omni vivum ex vivo*]. Thus the two, life and matter are independent and one cannot be produced from the other. These are sometimes termed as *Puruṣa* and *Prakṛti*: Consciousness (*Puruṣa*) and Matter (*Māyā* or *Prakṛti*) are eternal or they arose at the same time, independently and simultaneously. It is *causa sui*, cause of itself. The whole Universe is the interplay of the two: *puruṣa* and *prakṛti*.

**(D) Jain View:** *Pudgala* (*paramāṇu*) and *Ātmā* are eternal and ever existent: *Paramāṇus* aggregated and gave rise to the material Universe and *Ātmā* combines with matter (*karmāṇu*) and gives rise to different living species. In a way, consisting of *jīva* and *ajīva*, this view is a kind of '*Dvaitavāda*' but differs in essential details, as these two are not the only *dravyas* but there are additional four eternal *dravyas*, which facilitate soul-matter interactions (Bhandari, 2017), making them six altogether (Hexa-D model) constituting the *Lokākāśa* (Universe).

Answers to any or all of the questions, posed above, reveal different aspects of the Truth of our existence. After pondering over these questions at depth, some philosophies came to the conclusion that the cause of origins cannot be determined with certainty or precision as is very aptly stated in the *Nāsadīya Sūkta* (see p.34). As a last resort, the almighty God, with miraculous powers for creating the Universe was invoked. Jainism and Buddhism do not subscribe to this concept and have given logical models invoking soul or mind as the ultimate source of sentience. Other oriental as well as western philosophies have also given considerable thought to these questions and provided several powerful concepts, but none can be established because their proofs lie in experience and is beyond logic. Scientific studies involving new tools of observations, modeling and theoretical basis have provided dependable,



testable, reproducible and compelling evidence of various processes operating in the Universe, but science itself is an extension of sensory organs and inherits the same limitations of imperfection. The question of origins thus remains beyond the grasp of sciences. The ancient wisdom of *Vedānta*, Jain and Buddhist thoughts still provide some appealing options.

There is also the question of whether the humans have the capability to know the truth. Other animals, we know, cannot even ask this question, let alone understand it. There is nothing special about humans and it is only one link in the long chain of evolving species which will continue in the future. May be some future species, which evolve to a higher state of mind or consciousness compared to humans will develop this capability.

In this article we compare some of the underlying Jain concepts with some modern scientific principles, specifically regarding the origin of the Universe, origin of self and the laws governing the Universe and see whether they can be reconciled with each other.

## 2. Scientific Concepts

In a previous study (Bhandari, 2015), I was able to establish that there are some principles which are similar in Jain philosophy and modern science, even though there are many areas where severe inconsistencies persist. In fact these Jain principles were propounded much before they were discovered by scientific observations and theories. These are listed in Table 1 and some points are elaborated in Appendix-1.

**Table 1: Some basic principles common to Science and Jainism**

Science (physical world)	Jainism (living and non-living)
Causality	<i>Karmavāda</i>
Determinism	<i>Kramabaddhaparyāya</i>
Entanglement	<i>Parasparopagraho Jīvānām</i> Interdependence of all life
Laws of conservation	Eternal nature of all <i>Dravyas</i>

It may be noted that the scientific principles or laws are applicable to physical, material world whereas Jainism has a much wider scope, and

includes both the living and the non-living. This table establishes the scientific credentials of Jainism and encourages us to pursue the Jain concepts scientifically.

### 2.1 Origin of the Universe

There are many theories of the origin of the Universe. It is clear from consideration of various principles of physics that a static Universe is unstable. The Big Bang theory is the most successful, supported by observations of receding galaxies, microwave background and many other features. Alternative models such as the Steady State Universe (Narlikar, 2002), which is closer to the Jain and Hindu Universe, have not found observational support or physical evidence though it may be conceptually appealing. Cyclic Universe, which may accommodate the expanding Big Bang Universe as one of the cycles, is another possibility (Penrose, 2006). Another model proposes the origin of the Universe from Quantum Vacuum (QV), akin to *Śūnyatā* (nothingness) of Buddhism, which may act as the substrate from which the Universe arose (see Abraham and Roy, 2010).

### 2.2 Heisenberg's Uncertainty Principle

In the QV model, there are energy fluctuations in vacuum and virtual particles can materialize from these fluctuations, some of which get isolated, leading, ultimately to the formation of the Universe. On the other hand, there is overwhelming evidence, observational as well as theoretical, for the Big Bang event, 13.7 billion years ago, when all there was, was energy, which exploded and matter, time (t) and space were created. This model is not so aesthetically pleasing because there is lot of *ad hocism* in the state at  $t=0$ , which is considered to be a singularity, and the physics does not allow us to extrapolate back in time to  $t=0$  or  $t<0$ , i.e. smaller than Planck time ( $= \sqrt{\{hG/(2\pi c^5)\}} = 10^{-43}$  seconds)<sup>2</sup> or to space dimensions smaller than Planck length ( $= \sqrt{\{hG/(2\pi c^3)\}} = 10^{-35}$  meters). Below these levels, Uncertainty takes over and the deterministic laws of physics are not valid. In this model, the question as to what was there before the Big Bang event does not arise, because time itself was created

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2. Here  $h$  = Planck constant;  $c$  = velocity of light,  $G$  = Gravitational constant.

then. Thus we see that the laws of physics do not allow us to understand the state of the Universe at  $t=0$ , so we can never understand the origin of the Universe with precision.

In this article we consider four glaring constraints or limitations of modern science, which do not allow us to come face to face with Reality (origin of the Universe). Besides, the Heisenberg's principle of Uncertainty, which does not allow us to extrapolate to  $t \leq 0$  as discussed above, there are constraints imposed by the Special theory of Relativity and the Schrödinger's description of wave nature of matter. The argument based on Gödel's Incompleteness theorems will be discussed later.

### 2.3 The Schrödinger's Wave Equation

The Schrödinger's Wave Equation describes the nature of matter from minute particles to large structures i.e. the Universe and is central to Quantum physics. It can be mathematically expressed in terms of the wave function  $\psi$ :

$$\psi = a \psi_1 + b \psi_2$$

This describes the existence of matter in form of a wave, with many possible states of existence. The general impression is that mathematical formulation leads to precision but, in effect, any formulation describes only one aspect precisely but leads to loss of information on other aspects, because the indescribable, unmanifested, aspects cannot be formulated and the moment we express it in mathematical form, the other possibilities cease to exist. This implies that we do not know what an electron really is: a particle or a wave or something else (a wavicle?) which sometimes manifests as particle and at other times as waves. When electron is observed by a particle detector, it materializes and the other aspect (wave nature), which was coexisting with it before it was observed, is lost forever. It also happens the other way round, i.e. when it is observed as a wave. Thus observation also leads to loss of information and completeness. Thus the true and complete nature of a substance can never be formulated; only one of its aspects can be.

### 2.4 Special Theory of Relativity

There is yet another limitation of science and that arises from the

Special Theory of Relativity (STR). The fundamental postulate of STR is that nothing, at least no information or matter, can physically travel with velocity greater than light ( $c \sim 3 \times 10^8$  meters per second), so that we can see only a limited part of the Universe, defined by the product of the velocity of light and the age of the Universe (13.7 billion years). That is as far as we can see i.e. from where the light can come to us over the age of the Universe. This calculates to a sphere with a radius of  $10^{23}$  km and we can never tell what lies beyond this space. What lies beyond can only be conjectured by some hypothetical models.

### **2.5 Gödel's Incompleteness Theorems**

As mentioned above, while considering Schrödinger's wave mechanical formulation, we generally have the impression that mathematical representation, e.g. formulae describing various scientific facts makes our knowledge more precise and accurate. This may be true, but precision and accuracy is obtained at the cost of completeness. Formulation of any observation makes knowledge incomplete as its aspects which cannot be formulated are lost. Kurt Gödel (1931) has shown that mathematical representation of any physical reality limits and actually reduces our knowledge of that reality. Complete knowledge must necessarily have its foundation in an unexpressed, unmanifested field of intelligence. Gödel's two incompleteness theorems put such constraints on complete knowledge and can be stated as follows:

1. The first Incompleteness theorem states that "If the system is consistent, it cannot be complete, and the truth of a formalism (which describes any phenomenon) cannot be proved".
2. The second Incompleteness theorem states that "The consistency of the axioms cannot be proven within the system, i.e. the definition of truth for a theory must be of a higher order than the theory itself".

Thus we come to the conclusion that at least four core principles of modern physics, listed above, limit our knowledge and do not allow us to determine the origin of the Universe with precision or completeness. Several other arguments can also be developed e.g. our model of the Universe is based on the visible matter (stars, galaxies, dust and planets etc.) which is only about 4% of the constituents of the Universe. We know

little about the invisible or Dark matter, which cannot be seen but whose existence is established by its gravitational pull and constitutes 5 times as much (21%). The Weakly Interacting Massive Particles (WIMP etc.) proposed for this gravitational effect have not yet been discovered, in spite of serious experimental efforts for the past 30 years. Neither there is much knowledge about the dark energy, which produced a huge repulsive force and expanded the Universe in the beginning, soon after Big Bang, called inflation of the Universe. This is estimated to be the overwhelming constituent (75%) of the Universe, some 19 times more than the visible matter. In the absence of complete knowledge of all the constituents of the Universe, it is futile to model its origin and evolution.

Moreover, humans are not the 'know all' species. Homosapiens are only a link in the evolutionary chain of species and in future more knowledgeable species may develop, which may have less limitations of sensory organs compared to humans. This puts additional constraint on our modern day knowledge. Whether in future species with perfect sensory organs will evolve remains a big question, but, in any case, Jainism does not consider sensory perception as reliable and advocates supersensory perception to be perfect. Now we discuss this problem of origin of the Universe from the Jain perspective.

### 3. Jain Constraints on Knowledge

Jainism is a non-absolutist philosophy and to illustrate the limitations of knowledge, we consider its four aspects here: *Anekāntavāda* (Multiplicity of modes); *Syādvāda* implying that no proposition is complete or fully correct; *Nayavāda*: stand point or contextuality; and *Saptabhaṅgī*: seven modes of predication, which includes indescribability, and limit our perception of the reality.

#### 3.1. *Anekāntavāda*

*Anekāntavāda* describes the true nature of reality. Everything in nature, living and non-living has infinite modes (*paryāya*) of existence. It is variously defined as Multi-foldedness, Multi-facetedness, Non-Absolutism, Relativism, Multi-Perspective view, Perspectivism, Pluralism, co-existentialism and in physics it is called complementarity. Everything (living and non-living) in the Universe is made of two or more components. When an object is an aggregate (*skandha*), all the properties

of the constituents coexist in the material entity and the aggregate behaves in different ways, under different conditions.

### 3.1.1 Multiplicity of Manifestations

We see that as one goes to finer and finer constituents of matter (from gross objects, i.e. large celestial structures, to molecules to atoms to protons to quarks and so on), it exhibits more and more attributes, like electric charge, spin, magnetic properties etc. It is difficult to perceive all of these subtle properties at once in the gross substance, although they inherently exist all the time. This is not a limitation of instruments or techniques of measurement, nor it is a limitation of consciousness with which we perceive these properties, but it is due to the innate nature of things. At any instant, we can only know the modes (*paryāya*) which exist at that instant. In view of *Anekāntavāda*, at the present instant, we cannot know its modes which existed in the past or those which will be manifested in the future. Thus our knowledge will remain incomplete.

### 3.2 *Syādvāda* : Principle of Contextual Uncertainty

Every statement is only partly true and none is completely true. To emphasise this underlying principle, Mahāvīra introduced *Syādvāda* when he urged his disciples thus: "since you have taken a vow to always tell the truth, you must qualify every statement by *syāt*, because otherwise it will be falsehood". Thus the only statement one can make with certainty is that "*No proposition can be made with certainty*". It does not mean ambiguity, confusion or doubt but makes our understanding as correct and complete as it can be, because this is how the nature is. *Syādvāda* can thus be termed as the Jain principle of Uncertainty<sup>2</sup> and it implies that:

- No proposition is absolute or complete truth, or there is NO ONE Truth.
- No proposition is complete because deeper one goes, more properties are revealed. Nature exists at multiple layers and some part of truth (property) always remains hidden or undescrivable (*avyaktavya*).

### 3.3 Perspectivism

Perspectivism, at any point of time, or under a given condition, is

essentially a consequence of *Nayavāda* or mental frame of mind. It can best be illustrated by the parable of the six blind men and an elephant, in which each blind man feels different parts of the elephant's body i.e. its leg, tail, trunk, tusk, belly, and ear and describes it, based on their individual experience, as a pillar, rope, branch of a tree, solid pipe, wall and a hand held fan respectively. Each one of them is partly correct but all are far from the complete truth. A practical consequence of perspectivism is that everything has seven modes of existence, termed as *saptabhāṅgī*.

### 3.4 *Saptabhāṅgī*

Every “thing” can have seven states of existence or manifestation: It is, it is not; it is both, it is and also it is not; it is neither; it is and is indescribable, it is not and is indescribable; it is both and is indescribable. This can be illustrated by any elementary particle such as an electron which exhibits wave-particle duality.

- In some respect, Electron is a wave.
- In some respect, Electron is not a wave (but a particle).
- In some respect, Electron is both a wave and a particle.
- In some respect, Electron is neither and is indeterminate.
- In some respect, Electron is a wave and is indeterminate.
- In some respect, Electron is not a wave and is indeterminate.
- In some respect, Electron is both, a wave and a particle and is indeterminate.

The legend has it that Mahāvīra, after He attained enlightenment, saw in his dream a strange bird having seven types of feathers representing the true nature of reality. Such birds do not occur in nature but this is how the nature is.

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<sup>2</sup>This principle is quite different from the Heisenberg's Principle of Uncertainty in quantum physics, which states that both the conjugate parameters like Energy and Time or Position and Momentum of a particle cannot be simultaneously determined with absolute precision, and the uncertainty in their measurement is determined by the Planck constant.

Thus we see that the four fundamental Jain concepts (described above) do not allow us to know the truth completely or correctly and put severe constraints on knowledge. Thus science and Jainism, both, do not allow us to know the whole or complete truth with precision. We end up with the conclusion that there is no light at the end of the dark tunnel of uncertainty, either based on our scientific understanding of the laws of physics or observations using powerful instruments or the basic tenets of Jain philosophy. The famous *Nāsadīya Sūkta* (Ṛgveda ~3000 BCE)<sup>3</sup> reflects this uncertainty very eloquently.

Yet, there is a ray of hope, according to Jainism: the soul, in pure state, becomes omniscient and can see, know and experience everything completely, not by using sense organs but in supersensuous way. Just as it happens in dreams, the eyes are closed but we can see. Similarly in a pure state, the soul can see things without using eyes, hear every sound without ears, taste everything without tongue, smell everything without nose, feel everything without touch and know everything without mind. In Jainism, self or *ātmā* is identified by its two perennial activities: *Jñāna* and *cetanā* (consciousness). Therefore, we now look into the concepts associated with the soul, both scientifically and according to Jain philosophy.

### 4. Consciousness

We are all conscious, and we know we are conscious, but it has been difficult to define consciousness. Consciousness is generally considered as awareness (of external world and self) and experience. 'I know that I exist' and 'I know that I experience' is the result of this property or power of the self. It integrates information, experiences from observations, makes choice of action and thought, results in emotions and feelings and has the capacity to control them.

Modern scientific theories presuppose that consciousness originates from matter. Brain is made up of neurons, synapses, axons etc.

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<sup>3</sup>The *Nāsadīya Sūkta* ponders over the fundamental question "What was there in the beginning, before water, air, light and Earth, Universe and God came into existence?" and goes on to describe the primeval conditions "There was neither non-existence nor existence then; no death, no immortality; no day, no night; no above, no below etc."; "Who really knows?", it asks. "Perhaps it created itself, perhaps it did not. May be it was the *Hiranyagarbha*, the primal nucleus. Perhaps He who looks from the highest heavens knows or even he knows not" it says.



all of which are made up of matter. When the neural network attains a certain complexity, mind emerges spontaneously. Huxley likened mind to Aladdin's lamp which when rubbed, a Genie appears by itself. Penrose (1994) has proposed a quantum gravity model of consciousness involving nanometer sized microtubules inside brain neurons. According to Hameroff (2007) and Hameroff and Penrose (2014) consciousness is the result of a series of quantum computations in microtubules, orchestrated (Orch) by neuronal/synaptic inputs, leading to objective reduction (OR). Thus Orch OR is a conscious event, what we prefer to call, from Jain point of view, as conscious decision making process. In Jain view, conscious decision making is not consciousness but only a process. Whereas consciousness is an ever existing (*sat*), eternal activity of the soul, it is the doer, who takes decisions and acts. Consciousness uses brain as a tool and is not produced by it. Consciousness is all the same, perfect, complete and full, in all living beings, but is inhibited to different extents in different species by the capacity of their brains, mind and sense organs.

Although many aspects of brain functions have been understood by direct observation of different parts of the brain, there are serious problems, specifically of how awareness and experience are created from simple sensory observations. These two problems, related to Qualia, have been classified as the 'Hard problem' (conversion of observation into experience) and the 'Binding problem' (synthesis of different types of signals obtained by sensory observations into one integrated whole) and memory, as will be discussed later. Here the 'whole' (experience) is more than the sum of the observations (sensory inputs). This has been amply illustrated by excitement parameters of brain function. Consciousness acts through neural correlates. Observations of brain activity show that the ensuing action after impingement on our sense organs, for example, verbal reply to a questions or return of a tennis ball after the ball has been played by the opponent, is completed within about 100 milliseconds, whereas, neural correlates of conscious perception apparently occur ~150 to 500 milliseconds after the impingement on our sense organs. Therefore the brain reacts 50 milliseconds or more *before* all the information becomes available to it. Therefore it is hard to believe that there is causal connection between conscious perceptions and the ensuing action. The observation from different organs, i.e. visual, olfactory, auditory etc. are received by the brain through different organs, but their integrated or synthesized whole is 'experienced' by the brain, much before the time required for

them to be analyzed and synthesized. Therefore, one of the more serious problems is the temporal precedence (~ 2 milliseconds) of formation of the correlates of consciousness or what we can say the response or experience occurs *before* the occurrence of the event. This can be termed as anticipation and it is known to improve with practice. In extreme case it can be considered as clairvoyance or premonition. This means that the soul can anticipate the action on receipt of part of the information; reception of the total information is just a formality, it is extrapolated from the first part received.

### 4.1. Jain Concept of Consciousness

In many philosophies, especially in Jainism, consciousness is considered to be the attribute of *Ātmā* (Soul). Therefore consciousness is central to our discussion of Truth. In the Jain model *Ātmā* has permanent existence, is eternal, and is a basic, independent *dravya* or verity; It is the one who knows, who perceives and who acts. Various powers of *Ātmā* have been described in *Samayasāra* and have been briefly summarized in my book (Bhandari, 2015). It knows the past, present and future of all objects, their all *paryāyas*, all processes in the Universe, at once, within one *samaya* (the smallest interval of time, thought to be much, much smaller than Planck time). Essentially *Ātmā* is omniscient. *Jīva* (the living being) does undergo the processes of origination, sustenance with change, and destruction while the *ātmā* (or consciousness) continues as essence of existence through all these processes. The most important aspect of consciousness is that in pure state, it has the capacity to know everything, without sensory organs. Thus consciousness of all species is perfect, identical and omniscient (*Kevalajñānī*). In such a state, the object, the knower and the knowledge merge into each other and the person becomes "only knower" (*Kevalajñānī*). In practice, it is limited by the capacity of the 'brains' of various species and thus it appears at a different level or manifests to different degrees in different species.

Jainism prescribes certain procedures, mainly based on non-violence, self discipline and penance, for cleansing the self for removing these limitations so that the consciousness manifests fully. Study of the brain functions and transmission or control of emotional feelings through molecular-chemical or neural-electrical pathways support some of these Jainistic ideas.

## 4.2 Jain Model of Consciousness

The Jain model of consciousness, with its inherent power of omniscience, offers a ray of hope in learning about the ultimate Truth. It explains Qualia, precedence of reaction compared to perception (20 to 50 Millisecond; Libet, 2004), temporal Binding problem, anticipation, clairvoyance, telepathy etc. Briefly, according to many oriental philosophies, the mechanism by which everything in the Universe gets known (omniscience), is through *Bodhi* or consciousness field which pervades the whole Universe (See Abraham and Roy, 2010). All species are instantaneously connected and are in communication with each other through this field. That is, every soul (embodied or free) and therefore every living being is connected to it. The strength of this bond depends on the degree of purity of the soul. *Karmas* (and passions) tend to dampen this bond. The laws operating in this field are different from the laws of the physical Universe (e.g. STR, where only speeds below the velocity of light are permitted) and involve instantaneous connectivity throughout the Universe, instantaneous communication, instantaneous movement of the souls etc. This model can make clairvoyance, telepathy, omniscience, transmigration and many qualities of the soul, feasible. How does it happen? Some clues are available in Jain scriptures. Some more assumptions can be added to them in order to enable us to understand the dynamics of these phenomena and a working model can be constructed.

There is one important consequence of this assumption. Causality i.e. cause and effect relationship is not instantaneous. For the Law of Causality to operate, past, present and future, all the three, have to be involved. Causality collapses and cannot operate within one '*samaya*' which defines the present moment. One must therefore visualize the whole Universe within one *samaya* to be able to understand all the processes. One who can do it can be called the 'Universal Observer'. Of course, the model remains to be established, which can only be done by individuals who have directly (supersensuously) experienced the Universe. According to Jainism, purity of the soul, *cetanā*, *jñāna* and *karma* are all interdependent. As *karmas* dissolve, *ātmā* gets purified and *cetanā* and *jñāna* spontaneously improve. This model is quite unique to Jainism and, if substantiated, can be developed further.

Based on the above discussion we come to the conclusion that with

**Table 2: Comparison of Some Aspects of Scientific and Jain Concepts of Consciousness**

<b>Materialistic (scientific) view</b>	<b>Jain view</b>
Consciousness is an emergent property of the brain, produced by neural network when it attains a certain level of complexity. It arises during information processing.	Consciousness ( <i>cetanā</i> ) is an eternal, continuous activity of the soul. Consciousness cannot exist without the soul and the soul never remains without this activity ( <i>upayoga</i> ). It is therefore considered synonymous with the soul. Since soul is self luminous, all knowing entity, so is <i>Chaitanya</i> .
Consciousness manifests to various degrees depending on the complexity of the neural network of the brain. This is the reason why it is different in different living beings, animals and humans.	<i>Cetanā</i> is always 'perfect', full (100%) and complete, never partial; It uses brain as a tool and appear to manifest to different degrees in different species, depending on the capacity of the brain.
Consciousness is considered equivalent to conscious decision making. It is thus a process and not a quality.	Consciousness or <i>Cetanā</i> makes choices or decisions based on its power of Free Will. Thus <i>Chaitanya</i> is an entity, a quality of the soul and not a process.
In the brain decision is made by quantum mechanical superposition. In Orch OR model of Hameroff and Penrose, Quantum processes in inter-dendritic cytoskeletal, nano-meter size microtubules act as substrates of consciousness. The decisions are made based on available information.	Soul, through consciousness, can 'see' without eyes, know without mind, hear without ears etc....., i.e. through supersensuous powers and therefore does not need mind or brain or sense organs to know anything or everything.

sense organs and scientific techniques, it is not possible to know with precision how the self (*Ātmā*) or the Universe originated and what will happen in future. As we approach the initial epochs (zero time and point space) of their origins, we encounter an era of uncertainty. Quantum mechanics and Jainism, both propound that there will always be an uncertainty associated with the origin of the Universe. The Truth is thus a paradox in the sense that "One knows the Truth when one realizes that it cannot be known". According to Jainism, soul is pure consciousness and in pure state it can see everything supersensuously and becomes omniscient. Jainism gives procedures for purification of soul through non-violence, self discipline and penance.

## 5. Summary

From the stand point of science, as we know up to now, and Jain philosophy, we come to the stark conclusion that the Truth can never be understood completely because of inherent limitations of both these methodologies. This is the overpowering consequence of the principle of Uncertainty, non locality, finiteness of the velocity of light, and Gödel's Incompleteness theorems on the one end, and *Syādvāda*, *Anekāntavāda*, *Nayavāda*, *Ajñeyavāda*, i.e. indescribable nature of things, and imperfection of the sensory organs and mind, according to Jainism, on the other.

Science does not offer a clue but Jainism suggests that the consciousness is inherently all-knowing and omniscient can encompass the whole Universe, like the Einstein's Universal observer. All we need to do to know the Truth is to purify the consciousness (self) and observe the Universe *directly* without the sense organs and we will see the seven modes of its existence, all at once.

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## **Appendix -1**

Some scientific concepts documented in *Āgamas*, rediscovered by scientific studies recently:

### **1. Life in Plants**

The western civilization and scientists did not believe that plants have life. Influenced by thinkers like Des Carte, the western thought did not even consider that the lower animals, below humans, have soul or are

living. *Āgamas* clearly emphasize that plants are living entities, have feelings and emotions and this forms a core component of Jain ethos and life style. The fact that plants have life and emotions was experimentally demonstrated by a set of experiments by J.C. Bose and published in his book 'Mechanism of plants' only in 1926, after which it became scientifically accepted.

## 2. Micro-organisms in Water, Air and Soil

Jainism postulated existence of microorganism, invisible to the eye, in earth, water, fire, air and soil, more than 2600 years ago. Scientific proof of such microorganisms came only after Zacharia Janssen and his father in 1590 CE invented a microscope with which microorganisms could be seen.

## 3. Concept of Unit Space and Unit Time

According to Jainism, space and time are quantized. Jainism mentions a *pradeśa* which is the smallest unit of space. This concept of quantum of space can be compared with Planck's length ( $\sqrt{hG/2\pi c^3}$ ) where G is the Gravitational constant, h is the Planck's constant and c is the velocity of light). It is calculated to be  $10^{-35}$  meters wherein, due to the Heisenberg's Uncertainty Principle, laws of physics are not valid. Similarly there is a mention of *samaya*, smallest unit of time in Jain philosophy and some scholars talk about *kālāṇu*, a quantum of time, which can be compared with Planck time ( $\sqrt{hG/2\pi c^5}$ ) which is calculated to be  $10^{-43}$  seconds.

## 4. Dimensionless *Paramāṇu* and its Motion

Jainism propounds that *paramāṇu* is the smallest material entity. It is dimensionless and indivisible, and although it undergoes several types of transformations, motion and vibrations, its behaviour is uncertain, depending on some conditions.

The *Bhagavatī Sūtra*, compiled during the early part of the current era, vividly describes types of motions of a *paramāṇu*. "Under certain conditions a *paramāṇu* undergoes simple vibrations, complex vibrations, motion, oscillations, collisions, penetration and excitation, that is, it

undergoes varied transformations; under other conditions, it does not undergo simple vibrations, complex vibrations, motions, oscillations, collisions, penetration and excitation, that is, it does not undergo varied transformations."

Although particles equivalent to *paramāṇu* described in Jain *Āgamas* have not yet been discovered, scientific understanding of such motions of elementary particles came only during the past century. Experimentally, after the high powered electron microscopes were invented, and theoretically, after quantum mechanics was developed during the last century, atoms and molecules have been found to have various types of vibrations, motions, oscillations, penetrations, collisions and excitation etc.

Furthermore, it has been mentioned in the *Bhagavatī Sūtra* that one to infinite *paramāṇus* can coexist in a unit space. This is similar to the Bose statistics, discovered by Satyendra Nath Bose, in 1924, who developed statistics dealing with particles, which are indistinguishable, but can coexist in the same space. These particles are called bosons with spin 1 (e.g. photons) and follow Bose-Einstein statistics.

## **5. Wave-Particle Duality**

The soul moves like a wave and also like a particle. This concept of Wave-Particle duality is clearly stated by Ācārya Abhayadevsūri (ca.1015 CE), while quoting *Bhagavatī Sūtra* (6/122) in connection with *samudghāta* (expansion) of the soul at the time of death. There are two types of *samudghāta*: *Deśa Māraṇānantika* and *Sarva Māraṇānantika*. In *Deśa Māraṇāntika Samudghāta* the soul, without taking all its *atmapradeshas* with it, expands to its destination of rebirth in the new realm elsewhere in the universe. The soul then returns to the dying body; not all the *atmapradeshas* of the soul had gone to the destination and some had remained within the dying body. This is called *Deśa Samudghāta* (spatial expansion) and the motion of the soul is described as *Illikā* (wave-like) *gati*. Then, upon death, the soul collects all its *ātma-pradeśas* in a ball like form and again goes to the destination like a *genda/genduka* (ball), when the new *jīva* is reborn. This is called *Sarvatmana-utpad-kshetra samudghat*.



## 6. Shells around Celestial Bodies

Mention of *Valaya* or shells around planetary bodies is mentioned in *Bhagavatī Sūtra*. In contrast, scientific discoveries of shells (e.g. Magnetosphere, Ionosphere, and Atmosphere around the Earth) and other planets were made in 1950's after the advent of space age when satellites were sent in space around Earth and other planets.

## 7. Climatic Cycles of 21000 Years and 42000 Years

*Kāla-cakra* or Cosmic wheel of time, described in Jain *Āgamas* clearly mentions six *Ārās* (eras) in *Avasarpiṇī* and *Utsarpiṇī* half cycles, the last of which (VI *Ārā*) has a period of 21000 years. Dr R.M. Jain (2011), N. Bhandari (2011) and Jain, Bhandari and Surana (2017) have argued that these are actually climatic cycles of Earth due to changes in tilt angle, ellipticity and eccentricity of Earth's orbit, as proposed by Milankovitch, known as Milankovitch cycles, and confirmed experimentally as temperature or climatic cycles preserved as oxygen isotopic ratios in the deep sea sediments and Antarctic ice cores. The quantitative agreement of the 21000 year cycle mentioned in *Āgamas* and determined by measuring oxygen isotopic composition is amazing.

## 8. Black Holes: *Kṛṣṇarājī* and *Tamaskāya*

*Sthāṇang Sūtra* mentions *Kṛṣṇarājī* (Black Giants) and *Tamaskāyā* (Dark bodies), which some scholars have translated as Black holes, which are massive invisible stars, discovered astronomically during the past century. They are so massive that space curves around them and even light cannot escape and hence they cannot be seen. Several *Āgamas* give details of their numbers, shapes and sizes. Ācārya Vijay Nandighosh Sūriji (2001) has summarized their description given in the *Āgamas* and have argued that their description does not agree with the properties of Black holes, yet these concepts were existing in Jain philosophy.

## 9. Law of Conservation

The law of conservation implies that certain entities are conserved in all processes and nothing can be created from nothing. This has been a basic concept of Jainism which led to the concept of eternal existence. According to Jainism, the universe consists of six substances (*Dravyas*):

living beings (*jīva*), Space (*ākāśa*), Matter (*pudgala*), Time (*kāla*), *dharma**māstikāya* (traditionally considered to be the medium of motion) and *adharmāstikāya* (medium of rest). This *ṣaṭdravya* model, what we call as Hexa-D model, is based on the laws of conservation. None of these *dravyas* and hence the Universe, can be created or destroyed and hence they have to be eternal, exist for ever, uncreated and without beginning and end.

Law of conservation is the underlying law of all physical and chemical phenomena, as formulated by modern science during the past few centuries. Energy, mass, velocity, angular momentum, linear momentum etc. cannot be produced from nothing; they are always conserved even as mass and energy are converted from one to another. Similarly particle properties and attributes are conserved in all transformations.

## **10. Causality**

According to Jainism cause and effect are related; one has no existence without the other, i.e. every cause has an effect and there is no effect without a cause. This is applicable to living as well as non-living-physical processes. This has led to the theory of *Karma*. In scientific theories, dealing with the physical universe, it is termed as Causality.

## **11. Concept of Indescribability**

One Jain concept which has found common ground with quantum mechanics is indescribability. *Saptabhaṅgī* or seven modes of predicament enunciated in Jainism has some modes which exists but are indescribable in any language or mathematically (i.e. *avaktavya*). The wave particle duality also predicts that some of their modes cannot be described (Bhandari and Pokharna, 2017).

## **12. Entanglement**

Entanglement is relatively new concept in physics. It states that two particles produced in the same interactions are entangled i.e. behaviour of one totally depends on the other, irrespective of separation between them. Their properties depend on each other. This is enshrined in Jain sutra '*Parasparopagraho Jīvānām*' which is the core principle of

Jainism. It states that all life forms are entangled, i.e. dependent on each other; none can exist as an independent entity.

### 13. Determinism

Determinism is the basic law dealing with the physical universe. If one knows the conditions or values of all parameters at any instant of time, involving any process and the laws governing the process, one can predict its state at any time in the future or past. This is the basis of all scientific calculations. In Jainism, this principle is called *Kramabadhha Paryāya* implying that everything happens according to predetermined sequence.

### 14. Newton's First Law of Motion

The law of inertia or Newton's first law of motion states that a body continues to move in a straight line (or remain in a state of rest), unless acted upon by a force. This is implied in many statements given in the *Āgamas*, motion of soul etc.

The laws, concepts and observations listed above are only illustrative and many more doctrines like *Syādvāda* (uncertainty), *Anekāntavāda* (complementarity) etc. can be added which emphasize similarity between Jain philosophy and modern science. Since these have been discussed in detail elsewhere (Bhandari, 2017; Bhandari and Pokharna, 2017) these will not be repeated here.

Apart from concepts and laws of physics, many a discoveries were made by Jain saint-mathematicians during the first millennia of the Current Era and they discovered many rules of calculations, conceived series and subseries and large numbers, as summarized by R.S. Shah (2017), Samani Vinay Prajna (2017) and Anupam Jain et al., (2017). The work of Sridhar (~799 C.E.) and Mahavirāchārya (814-877 CE) related to the Number theory, Fundamental Operations, Set theory, Fractions, Simple, Quadratic, Cubic and higher order equations, permutations and combinations deserve special mention. Nemichandra Siddhanta-chakravarti (10<sup>th</sup> Century CE) deals with 14 sequences, concept of infinity of various types, decimal system etc. in his work *Trilokasāra*. We will not go into details of these because they have been discussed in the papers quoted above. Some of these concepts and numbers are credited to

European mathematicians who discovered them much later, during the past 5 centuries. Possibility of many such concepts and laws described in the *Āgamas* remains unexplored.

Although due credit must be given to Jain thinkers for the above discoveries, there are several aspects of geography, planetary sciences, cosmology etc. where glaring disagreements with scientific concepts are found. Some of these are listed in Appendix 2.

## **Appendix- 2**

Topics of disagreement between Jain philosophy and modern science:

Most of the discrepancies between modern and Jain concepts relate to units of time (*Koḍākoḍī* etc., larger than the age of the universe) and space, body size of *Tīrthaṅkaras*, astronomy and geography. Existence of two Moons and two Suns, going round the Earth, shape of earth (Disc-shaped Earth) etc. are clearly erroneous because modern concepts are based on rigorous observations. As far as cosmology is concerned, the *Lokākāśa* or the Universe is described as static having a shape akin to a man standing with his elbows stretched out. Theories of modern cosmology and forces of physics indicate that such a structure would be unstable and cannot exist for a long time. The scientific theories and observations can be incomplete in some aspects and are subject to modifications but cannot be wrong since they are based on observations. Thus there is a need to reinterpret *Āgamas* in the light of modern scientific theories and observations.

### **3. Legacy of Jain *Tīrthaṅkaras*: Reality is Conserved during Change of States of Objects, Entities, and Events of Concern and Their Relationships**

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#### **Abstract**

The *Naya* legacy of the *Tīrthaṅkaras* is a tool chest for reasoning to address real world problems without *ad hoc* assumptions. These rules are based on the assumption that organisms interpret their sense experience to learn and respond by trial and error. Humans also create and use empirical knowledge for successful behaviour to make the future more predictable and minimize cognitive dissonance to shape their identities (*ātmā*). *Naya* seeks valid inferences (*anumāna*) from perceptions of sense experience that are also consistent with and do not contradict assertions and evidence. Only those affirmed by independent evidence are explored further to facilitate mind to mind transfer of ideas for scrutiny. Samantbhadra (ca. 200 CE) emphasized that inferences from a limited set of assertions necessarily remain tentative in search of additional evidence to minimize remaining liabilities and doubt. The only valid inference with no doubt and liabilities is also consistent with the sum total of the reality inherent in

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the sense experience and evidence. Such enterprises are nurtured in open and peaceful environment. They are distracted by wars, blind faith, unsupported claims, irrational beliefs, *ad hoc* assumptions, fear, secrecy, authority, premature judgment, temptations of reward, and threat of violence.

### 1. Introduction

Jains are the followers of the world view of the *Tīrthaṅkaras*. The 24 *Tīrthaṅkaras* developed the tradition of shared knowledge to uncover the reality behind complex world happenings. External reality is what it is - consistent and non-contradictory. *Naya* reasoning for an identified concern begins with real world analogies (*drāṣṭānt*). Constraints of real world behaviours in analogies are easily understood and thus avoid disputes about *your word against mine*. For example the inference of fire from the sight of smoke is strengthened by analogy of smoke from the fire in wood stove takes the discussion and debate to the next level of scrutiny of inputs and sense experience. Inferences from observed and measured inputs supported by independent evidence are likely to be rooted in reality. Consistency and non-contradiction criteria identify valid alternatives by trial and error. The role of secondary evidence to support reasoning (*upānaya*) and decision (*nir-naya*) is elaborated in Gautama's *Nyāya Sūtra* (ca. 550 BCE) [1-3]. In its current form it was compiled as *Gautama Sūtra* by Akṣapāda (ca.100 BCE) with minor changes introduced by others. The focus of this secular text is rules of debate with a minor thrust on logic. It does not mention *Nyāya*, nor go into the nature of evidence, proof, divine insight or God.

*Tīrthaṅkaras* are venerated for their philosophical insights (*darśana*) and world-views (*dṛṣṭi*) as milestones to resolve perceived concerns [4]. They encouraged decisions based on multiple inputs (*anekānta*) rather than a single (*ekānta*) *ad hoc* assertion. Mind is trained and programmed to interpret images of actualities captured from sense inputs and experiences. The five sense organs respond to specific inputs from external reality. There are scores of internal sense organs that detect and respond to gravity, pain, hunger, thirst, and other signals. Complexities and detours from faulty memory, unreliable recall, biased perceptions, and overlapping world happenings require continuing interpretation and evaluation of the ever changing sense experience.

## 2. Human as the Source of Prior Knowledge

If common sense aligns inputs with perceptions, it takes uncommon sense and reasoning to align perceptions with the reality of the phenomenal world. *Naya* methods build on the belief that organisms interpret sense experience to make choices to resolve concerns, and act to respond. Humans use abstract languages to reason and deliberate to minimize the gulf between belief and words, that is further minimized by practice. A secular, consistent, non-contradictory world view without *ad hoc* assumptions was empirically founded by the first *Tīrthaṅkara* Ṛṣabha from the insight that reality is conserved during the change of state of an object. Later *Tīrthaṅkaras* added creative elements to the conservation of reality during a change to address concerns of their time, identified constraints and liabilities of the *Naya* methods, and formulated criteria to reduce doubt in inferences (*anumāna*). Inferences based on multiple (*anekānta*) affirmed assertions may be tentative and imprecise for the lack of adequate information for complete scrutiny of a concern; limitations of binary deduction (*tarka*) with a single assertion (*ekānta*) are far more serious.

Prior knowledge and tested tools for reasoning encourage practices that are in harmony with realities of the world. By the time of twenty-third *Tīrthaṅkara* Pārśvanātha (ca. 850 BCE), the conservation principle was a part of reasoning to interpret valid inputs. These were supported by real-world analogies rather than *ad hoc* behaviours of imaginary constructs. Mahāvīra, the last *Tīrthaṅkara* (ca. 530 BCE), put the *Naya* reasoning on firmer footing by suggesting that a concern with identified content (*Dravyārthika*) and context (*Paryāyārthika*) can be reasoned to resolve its meaning and significance. Scrutiny of the content and context of assertions with identified assumptions encourages an open-ended search for certainty that proves and improves as *some uncertainty goes away with each day as inconsistencies and contradictions are weeded out with additional information*.

### 2.1. Independent evidence reduces doubt

Shared knowledge through discussions and debates to explore and scrutinize inputs, inferences, alternatives and evidence. Rule-bound

interpretations of sense experience enhance the quality of perceptions of the investigator. In response to a query from his discussion leader Indrabhuti Gautama (607–515 BCE), Mahāvīra emphasized that a belief is inferred not only from the content and context of what one knows and how it came to be known. To realize its full potential it is also necessary to know what one does not know, what else is needed, and how it may be affirmed, or falsified and refuted, or shown to be inconsistent or contradictory.

	<u>it is (A)</u>	<u>it is not (N)</u>	
T	affirmed (A+)	not affirmed (N-)	It is (consistent with A+)
D	affirmed (A+)	affirmed (N+)	It is (Inconsistent/ doubtful)
X	not-affirmed (A-)	not affirmed (N-)	No information/ Indeterminate
F	not-affirmed (A-)	affirmed (N+)	Inconsistent with 'it is'

## **2.2. Legacy of *Syād-Anekānta-Saptabhaṅgī-Naya* Steered with Evidence**

*Naya* strategies thus provide a basis for viable tools and conceptual framework for reality-based reasoning in terms of independent evidence for actions and actors. Analogies keep focus on the observed and measured reality. Each assertion is to be affirmed by independent evidence, so also its converse (falsification). Lack of evidence for presence is not necessarily the evidence for either absence or for non-existence. Two or more (n) independently affirmed assertions generate a set of  $2^n$  inference propositions. In the table above A and N assertions give 4 states: T (true), F (false), X (indeterminate) and D (doubtful).

In the Table 1, the three *Saptabhaṅgī* assertions (A,N,U) connected with AND give the proposition ANU (read as A AND N AND U) with eight ( $2^3$ ) states: four for AU (and N-) (*it does not exist*) and four more for A-U-(and N+): N- is not affirmed *it does not exist*, and U- is not affirmed *it is (in-, not-) undescrivable*. Affirmed *it is* or *it exists* (A+) is *descrivable* and its non-existence is not affirmed. If *it does not exist* (A- and N+) there is nothing to describe (U-), that is it is mirage indistinguishable from false, faked, or imagined.



**Table1. Propositions with N, A, U (assertions with logical connective AND) Assertions Affirmed (+) or Not-Affirmed (-) by Evidence [5]. Its 8 (23) propositions correspond to the eight corners of the 3D cubic space. Their truth values in bitmap are normalized.**

	N (does not exist)	A (exists)	U (un-describable)	bit map	(N-U-A+)
1	-	-	-	0 0 0	
2	-	+	-	0 0 1	NOR (ex)
3	-	-	+	0 1 0	
4	-	+	+	0 1 1	
5	+	-	-	1 0 0	
6	+	+	-	1 0 1	
7	+	-	+	1 1 0	NAND
8	+	+	+	1 1 1	NOR (incl)

Independent evidence may support *it is so* or *it exists* asserted by sense experience. If *it exists* it may be measured and described, with distinct consequences of its presence or absence. Umaswami (ca. 200 CE) in *Tattvārtha Sūtra* [6] summarized substantive (*Tattva*) terms, ideas, and possibly phrases from the *Tīrthaṅkara* period. It mentions the conservation principle and a few lines below is प्रमाणनयैरधिगमः (*evidence gives authority to an affirmed assertion for reasoning*). Real (*sat*) and substantive entities retain sharp boundaries. Reality is what it is. Its word label may be associated with words like always, forever, cause and consequence, one and only one of a kind, or *hetu* (purpose and relevance) with no relationship to the content and context of the concern. Bhadrabāhu-I (~380 BCE) emphasized that reasoning about a real object or concern does not depend on its name, however worded description of its attributes and behaviours introduce the concern for reality-based reasoning in debates [7]. Also one-time experiences and indescribable personal knowledge communicate little to be shared and meaningfully interpreted with others. Sāmantbhadra (ca 200 CE) was a *Naya* scholar and an influential debater (*Vādī*) who put here affirmed and negated orthogonal assertions to give seven propositions (*Saptabhāṅgī*) of demonstrably different truth values. Reasoning to rule out unreasonable

and meaningless is emphasized by Sāmantbhadra in *Yuktyānuśāsana*. Buddhists consider *Śūnyatā* (nothingness, blank medium) as the state of ultimate reality. Akalaṅka (ca 800 CE) in a famous debate in Kanchi invoked *Śūnyatā* as the eighth state with no affirmed assertions and therefore no truth value.

### **3. The Milestones from the *Tīrthaṅkaras***

The following summaries are extracted from *Swayambhu Stotra* of Samantbhadra. It is possibly the first work that mentions all the 24 *Tīrthaṅkaras* by name and their contributions to the development of *Naya*.

1. Ideas that cohered later into the Jain world view (*Darśana*) and practice (*Dharma*) are attributed to Ṛṣabha (ca >3000 BCE) [8-14]. He encouraged learning to create value by minimizing ignorance as the way to realize potential. He introduced methods for agriculture, emphasized reading and writing alphabets and use of numerals, encouraged crafts, fine and martial arts. He identified skills (*kalā*), 72 for men and 64 for women, to create value and improve quality of life. These include arts and crafts, agriculture, martial arts, gambling, painting, cookery, dancing, singing, art of making love, ethics, accounting, and identifying reasonable concerns for logical reasoning that others can understand. Family traditions and practices, incantation (*mantra*), contemplation, meditation and *yoga* are included, but worship is not. Such skills are a necessary part of upbringing of caring individuals in a settled and organized clan. Ṛṣabha as a clan leader (*kulakara*) prescribed punishment of increasing severity to match the crime: admonishment, public trial, and social exclusion. Those who did not change behaviours were asked to leave the tribe (banished). There was no provision for death penalty.

The most important legacy of Jain *Darśana* is the conservation principle of Ṛṣabha. It states that reality of the external world is conserved during change of form of tangible objects that are observable, measurable, and logically describable [6]:

उपानेई वा विगमेई वा धुवेई वा

Tangible reality (*sat*) of object or concern is neither created nor

destroyed. *Change of their form is net balance of inputs and outputs.* It holds for materials and abstract objects including energy and information. In agriculture *you harvest what you sow.* *Nothing real is created from nothing and real things do not disappear into nothing* is the foundation of laws of thermodynamics that hold for all sciences and technologies and for the action-consequence relations.

Rṣabha also surmised that humans strive with commitment to ideas and effort to improve quality of their lives and resolve identified concerns. Grasp of multifaceted world and happening requires looking at it from all sides. Empirical search through sense experience by trial and error with focus on substantive issues is likely to be successful if one builds on successes and learns from failures. All the later Tīrthaṅkaras built on suggestions of Rṣabha.

2. Ajita was a proponent of *anekānta* to search for unbiased valid inferences to resolve concern, and refuted arguments based on a single assertion. He emphasized development of knowledge in stages by trial and error, which continues to be an influential milestone.
3. Sambhava surmised that indulgences in worldly pleasures are maladies that bring unhappiness and interfere with commitment to complete tasks at hand to resolve concern. Overall reality is uncovered through multiple assertions (*anekānta*) to identify tangible reality. His prescriptions to minimize distractions and indulgences are like medical treatments for successful actions.
4. Abhinandana increased the scope of bookless transfer of knowledge by reach out laity. He emphasized meditation to understand the real nature of living being as self and the other that lies beyond momentary concerns. He encouraged compassion and forgiveness. Need to minimize external possessions and internal baggage permits focus on substantial concerns. It is not possible to surmise the moment of creation or the role of a creator in the affairs of the living. The cause and effect relationship is instinctive and intuitive guide for each and every organism to evaluate the consequences of its sense experiences for actions and indulgences.
5. Sumati emphasized the need to polarize dialectic to analytically

resolve descriptions. Scrutiny of converse assertions is carried out by considering consequences of *it exists* compared to those of *it does not exist*. It makes people aware of the role of multiple assertions to describe and understand reality reasoned from what is in front of eyes (*pratyakṣa*). As in the six blind men and elephant parable, multiple assertions describe the beast in its stable as well as changing forms.

6. Padmaprabh suggested a role for reasoning for personal growth and shape identity through discussions and discourse to modify behaviours with better inferences. Such understanding encourages individual decision-making for successful behaviours to improved quality of life.
7. Supārśva introduced participation of laity by objectively listening to sermons and discourses to focus on merit and substantive issues. Development of potential requires own effort and guidance without distractions. It is not possible to do so through self-indulgence, or short-cut through *mantra* (incantations) and rituals.
8. Candraprabh refuted arguments of his opponents for which he and other *Jin* monks are called *Arhat* or *Arihanta*. He emphasized that such discourses are necessary part of learning to make original substantive and rational arguments to provoke thought, encourage reasoning, and give extrasensory pleasure with novel ideas.
9. Suvidhi (*Puṣpadanta*) emphasized the importance of knowledge from well-reasoned and to affirm and negate well organized assertions supported independent evidence. This may be a key condition for valid inference, but such methods do not resolve conflicting awareness or the dialectic of one and many. Such inferences cannot be refuted and overcome by opponents.
10. Śīṭala's sermons console by addressing inner concerns with independent evidence by modifying tendencies of thought, words and actions for stepwise approach to resolve a concern.
11. Śreyāṃsa suggested that viable alternative states of an object or concern are identified and distinguished with clearly worded assertions and analogies (*drāṣṭānt*). Independent positive evidence is required not only to affirm and also to negate converse of each assertion. Unequivocal description of a concern facilitates

- irrefutable reasoning within bounds of its existence, and it may provide supporting evidence. For example *it is* is consistent with lack of evidence for *it is not*.
12. Vāsupūjya emphasized the need for equanimity and objectivity in reasoning. Elaboration of cause and effect relations makes arguments (in discourses and sermons) understandable to all.
  13. Vimala suggested that the same criteria be used to evaluate own opinion as of the others. This is indicated by use of *syād* (in some respect) with inferences. Knowledge is made accessible by elaborating its relevance (or lack thereof) to all sides. Often validity is relative: particular may be valid relative to the general, and vice versa. Valid sense inputs from particulars are describable and become part of the generalizations. Inconsistent and invalid objects and concerns are often indescribable.
  14. Ananta introduced need to discard prejudices and obsessions from reasoning for valid inferences (*kevalajñāna*). The *kevala* state has a broad appeal to all organisms.
  15. The Jain *Darśana* places emphasis on reasoning but not for a particular outcome. Knowledge for forming an opinion and making choices is likely to be rooted in the reality that is worthy of further inquiry.
  16. Śānti introduced the idea of body as the boundary of *what it is*. All well-defined objects and concerns have boundaries.
  17. Kunthu had extensive knowledge but still felt need to meditate about the significance of the sense experience. He introduced ideas about organized religion, microscopic beings and possessions.
  18. Ara emphasized need to focus *Anekānta* assertions on the common features of an object or concerns supported by evidence. It is not possible to provide full description without enough consideration of the main features of interest to all. He refuted many common fallacies by uncovering multifaceted nature of reality through multiple assertions.
  19. Malli suggested that negation of the presence of an entity may imply its absence or its non-existence. Such converse and opposite assertions require independent evidence.

20. Munisuvrata suggested that consistency of a description has broad appeal. Inputs, outputs and net balance (*Dhruvya*) may appear stable states but dynamic. He emphasized need for consistency and non-contradiction of assertions in propositions and descriptions.
21. Nami suggested use of sense experience for a better understanding of beliefs. He emphasized importance of nonviolence and need to discard external possessions for impassionate reasoning.
22. Nemi (Ariṣṭanemi) prescribed the role for logical reasoning to resolve internal doubt in rational conduct.
23. Pārśva showed that difficulties and failure need not be delusional and do not have to distract from the purpose. He emphasized forgiveness to achieve extrasensory knowledge.
24. Mahāvīra (Vīra, Vardhamāna) emphasized the importance of completing commitments. He also suggested that reasoning requires content and context of an identified concern. He reorganized the earlier work and suggested *Syād naya* syllogism for consistency with what is in front of eyes and also with the past experience. He suggested prescriptions and proscriptions for actions, behaviours and code of conduct without *ad hoc* assumption. He reiterated *Rṣabha*'s advice to his discussion leader: *Goyama, samayam mā pamāie* (Gautam, do not while away time by indulging in bantering).

#### **4. Gifts that Keep on Giving**

All the *Tīrthaṅkaras* were motivated by their own desire to develop tools for reasoning and decision-making to create knowledge to address concerns of human condition. Their activist approach emphasizes reliance successes of the prior knowledge with room for reinterpretation. Those who followed used creativity to restore and reinvent way out of stasis and used creativity to interpret their own sense experiences.

- (a) Continuous presence and influence in India for over the last 5000 years attests to the viability of Jain world-view and practices. It required creativity to reorganize, modify, and revitalize the tradition to keep it relevant. Viability and vitality of the Godless

and atheistic Jain *Darśana* comes from the fact that its prescriptions and prohibitions are suggested by humans on the basis of their own experience.

- (b) Humans and other organisms realize their inherited potential in the niches where they learn from feedback to change behaviours, adapt to available resources, and deal with threats. Shaping the future to realize individual potential requires balancing expectations, wishes, and desires with reality. It is like sculpting a rock that requires skills and vision.
- (c) Responsible activism steers group behaviours which calls for reasoned conversation to resolve conflicts to arrive at a rational basis for coexistence. Interest of one lies in the interest of all, and interest of all lies in the interest of each. It is the basis for *live, let live, and thrive*. The anti-theistic arguments of Mahāvīra are based on the concern that violence, fear, ignorance, indulgence, reflex response, and reptilian behaviour rob *ability of senses to see and of mind to think*.
- (d) Word reasoning is about objects that have boundaries of existence independent of the name word. Just as a story improves with each retelling, additional inputs also improve ideas, technologies, and organizations. Sharing concerns and scrutiny of the communicated content and context makes the world predictable, reliable, and less scary.
- (e) Reality dictates what is done cannot be undone because flow of time is in one direction. Restraints are called for actions with irreversible or binding consequences. Such choices encourage sense of self to sculpt identity with ethical behaviours congruent with thought, words and actions to achieve a rational balance of instincts, emotions, and expectation in behaviours.
- (f) Action-consequence relations. Mind is programmed and trained to interpret images of actualities captured from sense inputs and experiences. Logics track consistency and discard contradictions. It is insane to expect different outcomes from the same inputs or by repeating the action that was not successful before.

## 5. Conclusions

### 5.1. Reasoning with Real Objects and Evidence

Empirical strategies to interpret incomplete knowledge by trial and error are necessarily chaotic and confusing. It is often the case with decision-making and judgment to address our concerns about objects that we do not “see” and may not exist. Liabilities (doubt, uncertainty, or inconclusiveness) in the inference of '*it exists*' but absent may be resolved with multiple inputs (*anekānta*) and independent evidence. Material and abstract objects track reality that is conserved as consistency and non-contradiction in logical behaviours.

### 5.2 Sense experience that can be described, deliberated and reasoned

External reality is what it is and appears complex for a variety of reasons. *Saptabhaṅgī* propositions with three orthogonal assertions draw on three unique abilities of mind required to process reasoning about existence. Senses are windows for the observed and measured actualities. Communication and comprehension of an object or concern and their relations is facilitated by articulated sense experience to be interpreted to extract realities. Fragmented information coheres by trial and error into empirical knowledge in fits and starts while it seeks consistency. Object of concern exists without the observer. Boundaries of its existence are not the same as its name. Its perceptions from sense experience are largely constructs of the observer's mind. Individually and collectively humans share the same reality but each individual interprets world happenings in relation to own experiences. Thus discourse and dialogue can form a basis for understanding the world around us. Well-articulated opinions facilitate interpretation of the meaning and significance of inputs. Inconsistencies and contradictions corrupt if the sense experience is not relevant to the concern. All together quality of reasoning follows from the qualities of perceptions.

Mental images of sense experience expressed as word constructs facilitate search for reality through orthogonal assertions. If common sense aligns sense inputs with perceptions, it takes uncommon sense to align outputs with perceptions of inferred and shared realities. Such open-



ended search for certainty proves and improves as some uncertainty goes away with each day. Mahāvīra emphasized that a belief is inferred not only from the content and context of what one knows and how it came to be known, but for its fuller understanding, it is also necessary to know what one does not know, what else is needed, and what may falsify and contradict it.

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## 4. On the Nature of Determinism and Time

*Sudhir Ranjan Jain<sup>1</sup>*

### Abstract

The dialectics of *syādvāda* and *anekāntavāda* in relation to probability will be presented in the context of classical and quantum descriptions of nature. Determinism and its nature in the light of statistics-based enquiry will be brought out by invoking certain illustrative examples. Various concepts of quantum physics will be discussed in relation with *anekāntavāda*. It will be seen that the fundamental tenets of Jain philosophy are consistently in harmony with some of the basic ideas of Science. It will also emerge that the linear or circular nature of time can be made consistent even if that sounds contrary to the common sense.

### 1. Introduction

Science and philosophy share a reciprocal relational dependence. As noted by Einstein [1], Science can only be created by those who are thoroughly imbued with the aspiration towards truth and understanding. This feeling springs from faith, as in religion with an understanding of the philosophical tenets. This led Einstein to the famous remark – Science without religion is lame, religion without science is blind [1]. One of the

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important themes of science is to organize the observations and knowledge into one unifying fold. In this paper, we will concentrate on Physics and Mathematics more specifically than Science in general. In Physics, we have gone from absolute determinism from the times of Newton to relativism on one hand and statistical interpretation on the other. We will see how close we are to the two fundamental principles of Jain philosophy – *Syādvāda* and *Anekāntavāda* [2].

Our aim is to discuss these principles in the next Section, underlining the important aspects. In Section 2, we discuss specific physical situations, chosen to illustrate the general problem. Here we shall come across how basic ideas of quantum mechanics are related to *anekāntavāda*. Finally, in Section 3, we discuss the nature of time by considering a system of many particles and show that there is an intimate connection between recurrences, instability, and entropy. The question of time gets intimately linked with laws of thermodynamics.

## 2. Determinism and Statistics, *Syādvāda*, *Anekāntavāda*

The word *Syādvāda* has its origin from *Syāt* (in some respect) *vāda* (assertion). As expounded by the first Indian logician, Bhadrabahu Sr (433 BCE – 357 BCE), this is an assertion of possibilities – the so-called dialectic of seven-fold predication [3, 4]. The seven possibilities are: (i) in some respect, it is; (ii) in some respect, it is not; (iii) in some respect, it is and it is not; (iv) in some respect, it is indescribable; (v) in some respect, it is and yet is indescribable; (vi) in some respect, it is not and it is also indescribable; (vii) in some respect, it is and it is not and it is also indescribable. According to *syādvāda*, these seven categories are necessary and sufficient, thus they take care of all the possibilities. For example, if we roll a pair of dice, we may get 3 on the upper face. For now, this is the outcome. But at another trial, there might be another outcome. We cannot predict *a priori* exactly what might turn up on the face. One can see that there is no possibility which is not taken care of by the seven elements discussed above.

However, considering this experiment, let us see the nature of truth. The truth is that any of the six possibilities could show up, and no more. This then is the nature of an outcome of an experiment where many subsystems are interacting. We take recourse to statistical methods.

Another important tenet of Jain philosophy - *Anekānta* (meaning multi-form) - emphasizes the manifold nature of real things. To quote Mahalanobis [3], “no affirmation or judgment is absolute in nature, each is true in its own limited sense only, and for each one of them any of the seven alternatives hold good”. Jain philosophy emphasizes the multiple nature of reality. There is not only diversity of the real but each real is equally diversified. Change is continuous and the continuity never breaks down.

The other fundamental tenet of Jain philosophy is embodied in its relational aspect. It states that everything is related with every other thing. A real is only a part of a system knitted together by a network of relation, from which it cannot be divorced [3]. This relatedness finds a natural extension in causality.

To summarize, for our reference, all objects of the world are “multi-form” (*anekānta*) and endowed with infinite qualities and relations (*anantadharmaka*). The reality can be considered from different viewpoints or *nayas*. All judgments are relative and probable, none is absolute. This is *syādvāda*. According to Jain philosophy, world is self-existent and eternal [5].

### 3. Classical Determinism, Quantum Uncertainty, Statistical Results

Classical determinism begins with Kepler, Galileo, and Newton. The motion of a body is described in terms of ordinary differential equations. With prescribed initial conditions, the solutions are known for all times to come, and, for all the past that is gone. The so-called Newton's laws describe every day phenomena with a remarkable accuracy. For example, the planets follow expected elliptical orbits. However, in last one hundred years, it has been found that the dynamics described by the exact equations is such that the outcome is extremely sensitive to the initial conditions. Chaos is an integral part of the description of nature. The basic reason for this is the fact that the equations describing nature are nonlinear. In simple terms, this means that the equations are such that the effect is not proportional to the cause. Cause and effect are not linearly linked. As a result, although a definite outcome is expected from very well-known initial conditions, the accuracy with which the initial conditions could be known is limited.

Consider a real system like a gas which is made of identical molecules. Assuming that the molecules are like rigid hard spheres, they will go about colliding with each other and with the walls of the container. If we follow two molecules which were very close initially, we can see that after a short time their motion will bear no correlations at all. This is a demonstration of the phenomenon of chaos. But each of the trajectories is time-reversible. That is, if we begin with the end-point and reverse the direction of momentum, we will certainly reach the initial point. However, if we allow perfume to diffuse in a room, we experience that there is no time in future which we have observed when all the molecules of perfume return to their original positions, somewhere near the nozzle of the perfume bottle. Once they spread, they just remain that way. However, they keep moving and colliding with each other.

Questions relating kinematic reversibility and statistical irreversibility remain important in our mind even after we have evidence for both in our everyday experience. Historically, this has been a subject of debate in the works of many researchers who have influenced the course of theoretical physics. In the 1856 paper, A. Krönig wrote [6]: “The path of each molecule must be so irregular that it will defy all calculation. However, according to the laws of probability theory, one can assume a completely regular motion in place of this completely irregular one”. The first sentence in modern parlance amounts to the presence of chaotic behaviour in a single-particle motion which is known to be unpredictable simply because the initial conditions cannot be specified infinitely precisely. The second sentence calls for an application of probability theory to describe deterministic dynamics. It is this seemingly conflicting demand of the question where a stochastic process should be described in terms of some analytic functions, and, a deterministic process should find an explanation in probabilistic terms, that we find fascinating. The relation of this common situation in the description of the physical world with *Syādvāda* is obvious.

There is another class of phenomena which relates to the minutest of the bodies – at a scale which is about a millionth or a billionth of the scale we normally observe in day-to-day life. Here it turns out that for a description that is consistent with experiments; simultaneous measurement of certain quantities is not possible. Termed as the Uncertainty Principle, it implies, for example, that coordinate of position

and momentum along the same coordinate are not simultaneously measurable to an infinite precision. The uncertainty is understood in terms of the fact that a particle as treated in classical description must be modified. There is a wave-like character that each particle is endowed with. So the nature of an object is neither purely particle- nor wave-like, there is a duality of both. The Uncertainty Principle of Heisenberg and the duality of de Broglie were given a probabilistic interpretation by Born. We turn to this now and discuss its relation with aspects of Jain philosophy.

We must take a concrete situation to explain. Let us consider that a particle under the influence of certain external forces goes from a position A at  $r(t)$  and a time  $t$  to  $B(r+dr, t+dt)$ . A de Broglie wave associated with it will have an angular frequency  $\omega=E/\hbar$  (Einstein relation) where  $E$  is energy and  $\hbar$  is the Planck's constant divided by  $2\pi$ . The wave number associated with it is  $k=p/\hbar$  (de Broglie relation). In going from A to B, the change in phase is

$$d\phi = \mathbf{k} \cdot d\mathbf{r} - \omega dt = \frac{1}{\hbar} \left( \mathbf{p} \cdot \frac{d\mathbf{r}}{dt} - E \right) dt$$
$$\psi_p = (\text{amplitude}) e^{iS_p/\hbar}$$

The quantity in bracket is called the Lagrangian,  $L$  of the system in classical mechanics. The quantity  $Ldt$  is called the action,  $dS$ . Thus the change in phase is just  $dS/\hbar$ . Now there are many ways in going from A to B, and *all* are allowed. There is a certain probability associated with each path. The maximum probability is associated with a path if we were to follow Newton's equations. But other paths are also allowed. Thus there is a wave associated with each path and along a certain path,  $p$ , the wave can be written as

The net result is obtained after all the waves interfere. The paths with large ratio of action to the Planck's constant contribute insignificantly due to highly oscillatory character of the terms. The minimum action corresponds to the classical path. Thus, in going from A to B, there are an infinite paths, and each has a certain probability – this is just the *anekāntavāda*.

This discussion holds in general, not just for a simple situation we

just considered. Thus the infinitum of paths represent all the possibilities, each possibility is a “truth” and “the truth” (experimental result) goes through the myriad of all the “truths”.

## 1. Time

The nature of time is linear in Judeo-Christian-Chinese cultures. It is cyclic in the Hindu-Jain-Buddhist-Hellenic cultures. Jainism is an ancient non-*vedic* religion where it asserts that the universe is uncreated and eternal, consisting of infinite living entities (*jīva*) and nonliving elements (*ajīva*). It also states that there are four *ajiva* substances (*dravyas*): space (*ākāśa*), time (*kāla*), motion (*dharma*), rest (*adharma*) besides matter (*pudgala*).

In Science, time is a continuous parameter. In the Special Theory of Relativity, space and time make a continuum with a geometry that was expounded by Minkowski. We consider here a classical, non-relativistic world description. We observe in our daily life that events do not recur. There is irreversibility. This irreversibility itself gives an “arrow of time”. In thermodynamics, one can logically construct a quantity called “entropy” which increases with time. This is akin to linear time which should be understood more generally as monotonic. However, recently it has been shown that entropy is a periodic function of Poincaré recurrence time [8]. Nevertheless, this cyclic nature seems to be inconsistent with the Second law where entropy just increases.

We first introduce the idea of recurrence. We assume that the system has a finite volume of states. Poincaré [7] showed that almost every point in phase space (space of states) is recurrent. To prove it, consider a set of points,  $A$ , of finite volume. Let us imagine that there exists a subset  $B_0$  of  $A$  containing points that leave  $A$  in a time  $t$  and never return to  $A$ . It can be proved that the volume of  $B_0$  is zero.

The points  $B_0$  evolve (uniquely) in a time  $nt$  after  $n$  steps to make a set  $B_n$ . Now we argue that  $B_n$  and  $B_k$  have no points in common for  $k > n$ . If there was a common point  $x_n$  such that  $x_n$  belongs to  $B_n \cap B_k$ . This point would have evolved from  $x_{n-1}$  belonging to  $B_{n-1} \cap B_{k-1}$ . Thus,  $x_{n-k}$  must belong to  $B_0 \cap B_{k-n}$ . However, this implies that the point returned to the (assumed) non-recurrent set. To avoid the contradiction, we must conclude that all

$B_k$ 's are disjoint sets. They must also have the same volume, by Liouville's theorem. As time passes by, the total available space (which was assumed to be finite) will get exhausted. To ensure that the evolution may continue forever, the only possibility is the volume of the non-recurrent set must be zero. That is, recurrence is a must. Every cycle of recurrence time, the system re-visits the initial condition very closely, and this will happen infinitely often. There can be an exact recurrence. We study this special case when there is an exact recurrence. For this case, entropy must also recur. In a sense thus there is a cyclic character of time.

Let us present a nontrivial example – Kac's ring. The model consists of  $N$  sites placed evenly on a circle. On some of the randomly chosen sites, there are markers. Between each pair of adjacent sites, there is a ball. The colour of the ball is black (B) or white (W). The dynamics is discrete - at each time-step, the balls move to the adjacent place on their right (clockwise). If a ball passes a marked site, the colour changes. Thus, given a set of marked sites and a certain number of black and white balls, we want to find the time-rate of change of the difference between black and white balls,  $\Delta(t) = B(t) - W(t)$ . The difference at the next time-step  $\Delta(t+1)$  will depend on the number of white (black) balls that are in front of marked sites,  $w(t)$  ( $b(t)$ ). Thus,

$$B(t+1) = B(t) + w(t) - b(t),$$

$$W(t+1) = W(t) + b(t) - w(t),$$

$$\Delta(t+1) = \Delta(t) - 2(b(t) - w(t)).$$

This equation can be solved by following the dynamics on a computer, of course. However, following [6], vast simplification results by making stosszahlansatz where the probability that a ball changes its colour in the next instant is the same as the probability  $\mu$  of finding a marked site. Thus, just as in the deduction of the Boltzmann equation [7], we make an ensemble of rings that obtains us this probabilistic interpretation. We write

$$b(t)/B(t) = w(t)/W(t) = \mu.$$

It should be noted that this assumption is true for an ensemble of rings and not for a specific realization of the dynamics.



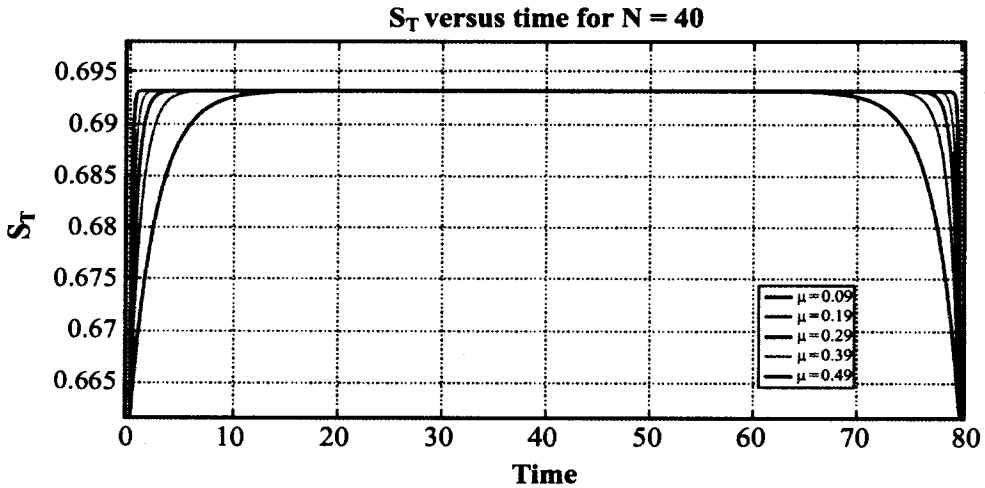


Fig. 1. Entropy ( $S_T$ ) for various values of  $\mu$  as a function of time for  $N=40$ .

In Fig. 1, we see that entropy is drawn for values of  $\mu$  from 0.09 (blue) to 0.49 (black). The Boltzmann equation can be solved and entropy can be calculated. We see in Fig. 1 that for all values of  $\mu$ , the entropy has a recurrent behaviour with a time of recurrence equal to  $2N$ . Fig. 1 shows the results for  $N = 40$ .

Entropy defined above is based on the difference of black and white balls. It is a gross quantity because it considers only the excess of black or white balls and hence lacks information about the exact number of black and white balls.

It can be noted that the entropy also reflects Poincaré recurrence which involves the entropy getting back the same way like on a time-reversed path. Also, for  $N = 10$ , there is a local decrease in entropy around  $t < N$  which disappears with increasing  $N$ . What is most remarkable is that it was pointed out that there is a “recurrence of statistical fluctuations”. This can be seen by studying the probability distribution function of  $\Delta$ ,  $P(\Delta)$ . This quantity, along with its Fourier transform recur at  $t=2N$ , with an exact symmetry about  $t=N$ .

## 1. Conclusion

The nature of determinism in Science has an essentially probabilistic element. In this sense, it falls under the purview of *Syādvāda*.

Classical mechanics, which is based on ordinary differential equations, is mired by the phenomenon of chaos and thus the final results become unpredictable. Climate is perhaps the best example in this regard. Quantum mechanics is a linear theory but its foundations require uncertainty and a probabilistic interpretation. It presents a fine example of *Anekāntavāda*.

The nature of time is linear or cyclic in different systems of philosophy. Physics presents an example where by invoking Poincaré recurrence and viewing time by entropy, we have seen that the cyclic character of time is consistent with the Second Law of thermodynamics.

The instances presented to illustrate our thoughts are generic in nature. The conclusions thus hold in general. There seems to be a fine underlying thread of Jain philosophy in the scientific enquiry. However, to make progress and predictions, we need to take the scientific approach – through experiments and mathematical interpretation of theoretical ideas.

The last remark concerns the connection of relational aspect of Jain philosophy and Quantum Physics. This relatedness is perhaps close to the concept of entanglement in quantum mechanics. More will be understood in this direction in the times to come.

## **Acknowledgements**

I thank my brother, Dr. Shaleen Jain for providing important references. Over the years, the books written and presented to me by my uncle, Dr. Pradyumna Kumar Jain, have played an important role in shaping my understanding, and in inspiring me.

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## 5. Quantum Entanglement and the Philosophy of Relations: Jaina Perspective

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### Abstract

Quantum entanglement is a property of a quantum state consisting of two or more microscopic objects like photons, electrons, neutrons etc. The objects producing the joint state i.e., entangled state is not separable but makes a non-local connection between the objects separated by arbitrary distance. The concept of non-locality is a metaphysical concept. This non-local connection or quantum correlation has been experimentally verified in laboratory experiment where the distance of separation between the two such objects is over a distance more than 12 km. This connection or so to say, the relation between the two microscopic entities contains the information about the relata (here, the microscopic objects) though the relata do not necessarily need to have intrinsic properties. The metaphysics of relation has been extensively discussed by various schools of Indian Philosophy. Buddhist scholar *Dharmakīrti* raised a lot of debate about the reality of the relations. Quantum entanglement as a relation has been critically analyzed and compared with

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the views of various schools of Indian philosophy with special emphasis on Jaina theory of reality. The present analysis from Jaina perspective sheds new insight on the reality of relations as envisaged in quantum theory.

## **1. Introduction**

The remarkable progress in modern physics in twentieth century raises lot of interest on the metaphysical aspects of quantum theory. Specifically, in dealing with the quantum theory in most general sense, the physical world is considered to be of nonlocal nature. It can also be stated as the space-like separated systems, which can occupy entangled states, are able to persist even when the systems separate further. The concept of quantum entanglement plays a crucial role in understanding quantum theory. This property i.e., quantum state consisting of two or more subatomic objects like photon, electron, neutron or proton act in such a manner so that whenever the state of one quantum object is altered, the other, instantaneously, change state to exactly the opposite of its partner, no matter how far these objects are being separated. It appears that the objects, making an entangled state, are connected non-locally and are non-separable. This phenomenon leads us to think the entanglement as a sort of holism. Holism is considered as a thesis which claims that the whole is more than the sum of the parts which, in present situation, means two or more quantum objects when entangled, can be stated as a joint state of a quantum whole.

Again, the joint state of a quantum whole contains information about the related objects. Technically speaking, the joint probability distribution associated to the joint state can give rise to the conditional probability of the related objects but not in the reverse way. So, one can conceive of an intrinsic property of the quantum whole which does not supervene on intrinsic properties of the parts. In other words, the intrinsic property of the quantum whole or the relation between the quantum objects making the whole contains the information about the relata (here, the two or more quantum objects) though the relata do not necessarily need to have intrinsic properties. Intrinsic properties are those qualitative properties which a thing possesses, irrespective of the presence of any other contingent things. All other qualitative properties are extrinsic or relational. So characterizing the entanglement in terms of non-separability

for quantum systems turns into a metaphysical proposal and a matter of philosophical arguments. In western philosophy, various theories of relations have been discussed, popularly known as medieval theories of relations. Aristotle in his treatise *the Categories* initiated a systematic investigation on the philosophy of relations. He suggested that whenever two or more objects or substances are related that is to be explained by the inherent or intrinsic properties of the relata. Aristotelian thoughts made a tremendous influence on the philosophers of middle ages on the nature and ontological status of relations. The ontological status of relations has been discussed by many western philosophers. Recently, Glenn critically analyzed the ontological status as discussed by Plato, Aristotle, Parmenides, Hume, Wittgenstein and others.

Esfeld studied in detail the metaphysics of relations between *subatomic* (quantum) systems from western perspective. According to his point of view, in the (quantum) entities (or the relata) between which the relation exists, there is no need to consider the intrinsic properties of the entities or things underlying the relations. This is in contrast to the metaphysics of individual things which have intrinsic properties. It is important to note that various schools of Indian philosophy, for example, different schools of ancient Hindu lineage including schools of Buddhist (Dreyfus) discuss the nature and the ontological status of relations in great details. Jaina scholars (Padmarajah) critically analyzed the views of Buddhist, *Vedānta* and *Nyāya* approach to the reality of relation. In this paper, we shall discuss the views of some of those schools on metaphysics of relations and ontological status with special emphasis on Jaina view.

At first, we define the concept of quantum entanglement and its characteristics in section 2. In section 3, the metaphysics of relations from western and eastern perspectives will be mentioned briefly. Then we discuss and develop the comparative views on reality and relational aspects from quantum theory as well as from perspectives existing in different Indian schools, especially, emphasizing on Jaina point of views in section 4. Finally in the Conclusion, the concept of non-local relation or quantum entanglement is shown to be more transparent within Jaina perspective.

## 2. Concept of Quantum Entanglement

Quantum entanglement, also known as quantum non-local connection is a property of quantum mechanical systems. This connection contains two or more objects which are linked in such a way that it is not possible to describe the quantum state of a constituent of that system without fully mentioning its counterparts, even if those individual parts are spatially separated. Erwin Schrödinger coined the term “entanglement” for this phenomenon and used it in his three part article published in Proceedings of Cambridge Philosophical Society. He proposed that entanglement arises due to the interactions of two particles (i.e., two quantum objects) through the evolution of wave equation (popularly known as Schrödinger equation) and called this phenomenon as the characteristic trait of quantum theory. Schrödinger also realized that this character, rather peculiar non-classical correlations to quantum systems, could be used to steer a distant particle into one of a set of systems having a certain probability (Lo et al., Nielson et al.). But, Einstein disliked this approach at first and called quantum entanglement “spooky action at a distance” in the famous EPR debate (Einstein et al.). Though his belief was that someday quantum entanglement would have been explained by future researchers in terms of certain error in calculations, further developments established this phenomenon in a concrete manner. Aspect et al. (1982), first showed that nonlocal interactions do occur (Aspect et al. [2]) even in the laboratory.

Two quantum objects, when *entangled* initially, will both have an undetermined state. When one object's state is determined, the other's state is instantaneously known to be the opposite, no matter how far apart they are. Quantum theory permits that the states of quantum systems are entangled. Instead of speaking of entangled states, one can also talk directly in terms of entangled systems. However, since entanglement is state-dependent, it seems more appropriate to use the notion of entangled states. Examples for this phenomenon are position and momentum and also spin angular momentum in any direction. Instead, there are only correlations between the state-dependent properties of the quantum systems in question encoded in a joint probability distribution determined by the joint state. Quantum theory does not include any property of a quantum system taken separately which is a supervenience basis for these correlated probability distributions. Furthermore, these correlations – and

thus entanglement – are independent of spatio-temporal distance. Because of this property, i.e., entanglement, quantum physics seems to exhibit some sort of a holism. Next, let us analyze the concept of non-separability.

## **2.1 Non-Separability**

Einstein based his criticism of quantum theory on the principle of separability. Taking Einstein's criticism into account, Don Howard formulates separability as the claim which states

- Spatially separated systems possess their own, distinct physical state each and that
- The joint state of two or more spatially separated systems is wholly determined by their separate states.

In view of employing the notion of separability for a systematic characterization of quantum entanglement, it seems reasonable to eliminate the condition of the systems being spatially separated; for entanglement is independent of whether or not the systems, whose states are entangled, are spatially separated. For instance, the spin state of the two electrons of a helium atom in the ground state is a case of entanglement too (singlet state), although the two electrons are not localized in such a way that they are spatially separated from one another. Furthermore, in quantum computation, one considers the entanglement of the states of many systems which are usually not localized in such a way that they are separated in space. Abandoning the condition of spatial separation, one can characterize separability in this way: physical systems have a state, each in the sense that

- This state completely determines the state-dependent properties of the system and
- The joint state of two or more systems supervenes on the states of each of these systems.

*The states of two or more systems are non-separable if and only if it is the joint state of the whole that completely determines the state-dependent properties of each system and the correlations among these systems to the extent that these are determined at all (Esfeld [10]).*

Following this characterization, any case of quantum



entanglement can be defined as a case of non-separability which, in turn, is the reason why quantum entanglement is a sort of holism. In any case of quantum entanglement, only the joint state of the whole completely determines the probability distributions of the state dependent properties of the parts by determining correlations among these probability distributions. Quantum Theory (QT) claims that the states are entangled. Whatever entanglement may be, it is a relation among quantum states or quantum systems.

*“Being entangled with” is a property, predicated of at least two quantum systems and also it is a relational property.*

This type of relation cannot be described in the framework of the present concept of space-time. When the state of one quantum object is altered, the other will instantaneously change state to exactly the opposite of its partner, independent of the distance between the two. In doing so, the information from one entity of the entangled objects propagates to the other through a speed greater than the speed of light ( $c$ ) hence it is acausal. The correlation or entanglement is independent of distance i.e. do not depend on the spatio-temporal locations.

According to Ithaca interpretation of Quantum Theory (QT) (Mermin [4]), *“The only proper subjects of physics are correlations among different parts of the physical world. Correlations are fundamental, irreducible, and objective. They constitute the full content of physical reality. There is no absolute state of being; there are only correlations between subsystems.”*

In this framework, one speaks in favour of metaphysics of relations that do not require any intrinsic properties of the related quantum systems. At some fundamental level unconditional joint objective probabilities have meaning, but certain conditional probabilities have no meaning because of the absence of any objective reality - only correlations- i.e., objective reality is associated with the joint distributions only. From a different perspective, Rovelli [3] proposed that *Quantum states were nothing more than expressions of relations between subsystems*. Now, before going into the details of metaphysics of relations, let us discuss another concept called Quantum teleportation in modern quantum theory.

## **2.2 Quantum Teleportation**

In general, different views regarding teleportation concepts have been identified and discussed by various authors. Among these, the concept connected to the present work is based on the well known phenomenon of quantum entanglement. This phenomenon can be described as an exploitation of entanglement. The general idea is that some of the attributes or form of quantum object can be transported to a distance without moving the matter associated to this form. This does not require any intervening medium. This is, as if, scanning an object in such a way so as to extract all the possible information from it and then transported to the receiving location and used to construct the replica of the original. According to the basic tenets of quantum theory, the state of the original object is lost during the process of scanning. Quantum teleportation, from the quantum entanglement point of view, can be defined as the disembodied transport of the quantum state of a system and its correlations across the space to another system. There, the system can be referred to any single or collective particles of matter and or energy, for example, protons, neutrons etc., (baryons), leptons (electrons, positrons etc.), photons, *paramāṇus*, ions etc. The concept of entanglement is used in teleporting the form or some of the attributes of the object. Quantum teleportation has been performed in several laboratories around the world (*Jin et al.* [21]). So this is no more a fiction but a physical reality.

Now, we try to give an overview about the characteristics of quantum entanglement as a relation.

## **3. Metaphysics of Relations**

The metaphysics of relations has been extensively discussed by various schools of Indian philosophy including Buddhist and Jaina. It is clear from the above analysis that Quantum Entanglement can be thought of as relations having the following characteristics:

1. This kind of relation is not causal.
2. It is beyond the space-time description.
3. The relation contains the information about the relata.

4. The relation has intrinsic property.
5. The relatum (i.e., single object) does not have intrinsic properties but has propensity of being entangled.
6. Some quantum entities can be entangled although quantum theory can describe some entities which are not entangled (product states).
7. Since this relation is acausal and beyond space-time description, is it a mental construct?
8. The concept of entanglement can be used to produce teleportation of quantum objects which can be produced even in the laboratory [21]. So, the entanglement is real.

### 3.1 Western Perspective

According to western perspectives (Lewis [15]), the world consists of independent individual things that are embedded in space-time. These things are stated as individuals because:

1. They have a spatio-temporal location.
2. They are a subject of the predication of properties of each.
3. There are some qualitative properties by means of which each of these things is distinguished from all others (at least the spatio-temporal location is such a property).

Aristotle assumed that there is a plurality of individual things (substances), characterized by intrinsic properties (forms) of each. Esfeld [10] on the other hand, claimed that quantum entanglement may be considered as relation containing the information about the relata and there is no need to consider the intrinsic properties of the relata as claimed within the domain of western perspectives. Recently, structural realism has drawn much attention of the scientific community (Stachel [14]) where the concept of structure refers to some set of relations between the things or entities that they relate, called *the relata*. People have used the term “structural realism” to describe different approaches to the nature of the relation between things and relations. All these differences seem to be variants of three basic possibilities:

- only relations without relata.
- relations, in which the things are primary and their relation is secondary.
- relations, in which the relation is primary while the things are secondary.

### **3.2 Indian Perspective**

The nature and ontological status of relation have been widely discussed by various schools of Indian philosophy [13]. Before going into the details of their analysis, one needs to discuss the basic question: what is a relation? [13]. A relation connects one entity with another entity and the basic characteristic of a relation is that it rests on two entities (*dviṣṭhaḥ sambandhaḥ*). This means: when it is observed that many individuals form one class, the relation (inherence) subsists in both the class and the individuals. Symbolically speaking, a relation between object a and object b is aRb.

Now, the next question: Is the relation real?

- “No” is the answer by idealists i.e., Buddhists and *Advaitins*.
- “Yes” is the response from realists who are conventionally identified as *Nyāya-Vaiśeṣikas*, the *Mīmāṃsakas*, Jains and other pluralists.

In fact, the idealists consider the entire world as the creation of mind and so, any revelation out of our experiences is to be termed as relation and invariably an imaginary entity. The proponents of this view i.e., Buddhists introduced the role of the mind, connected to things inherently with language. The idealists also advance their argument further by introducing the role of projection of the mind on the appearance of the existence of mind.

*Nyāya-Vaiśeṣikas*, *Mīmāṃsakas* and other pluralists are the proponents of realist view. In the language of realists, say *Nyāya-Vaiśeṣikas*, the determinate cognition (*savikalpaka-jñāna*) takes the vital role in which a structure of qualifier-qualified type is revealed and consequently this structure is not possible without the involvement of an entity called Relation.

### 3.3 Dharmakīrti's View

Dharmakīrti, a Buddhist scholar of around 7<sup>th</sup> century and one of the founders of Buddhist logic discussed the metaphysics of relations in great depth. In one of his seven treatises of valid cognition (*Sambandhaparikṣā*), *Dharmakīrti* made an extensive study on the analysis of relations. His arguments can be briefly summarized in the following way:

*Sambandha* or Relation (R) are of two types: *pāratantrya* (dependency) and *rupaśleṣa* (close connection).

Again *dependency* can be of two types: *niṣpanna* and *aniṣpanna*. He claimed that dependency is not considered as relation since it is already *niṣpanna*.

He raised the next issue whether mixing or amalgamation between two things (*rupaśleṣa*) is a relation or not.

In case of mixing or amalgamation two cases arise:

- If the two things are distinct, then how they can be mixed up or amalgamated? So mixing or amalgamation cannot be a relation.
- If the two things are identical then how a relation can be established since the relation must be defined between two distinct things? So mixing or amalgamation is not a relation.

Symbolically speaking: If a and b are distinct, then how can we say they are related? Now if a and b are identical then either a or b or R exists and there is nothing like aRb. So R is not a reality.

Suppose, the relation is considered only as imagination which connects a and b. Depending on this imagination whether one can think of *kriyākāraśambandha*. This is also not possible since there is no relation of any “*kāraka*” with verb “*kriyā*” and everything is momentary. So *kriyākāraśambandha* (cause and effect relation) cannot be considered as a relation between a and b.

Now, cause and effect relation is considered to be one of the pillars

in modern physics. It is pointed out in *Sambandhaparīkṣā* that cause and effect relation is not a “relation” in the sense that cause and effect cannot exist at the same instant of time so the relation is not a reality. Now even if we consider that R exists in case of cause and effect in a sequence not in the sense of simultaneity, then either R exists in cause and not in the effect or the vice versa. In such a case, then, how a relation exists either without b or a respectively?

Again, if R does not exist in the cause or the effect, then how R produces the effect in b or vice versa?

The relation plays an important role in generating the cognition. According to realists, the ontological reality of relation must be considered to acquire an expressible cognition. However, idealists can do away with a relation and Dharmakīrti was in favour of idealism. Since Dharmakīrti wants to establish idealism of the type of *Yogācāra* philosophy, he has no other alternatives left than to deny all relations on the basis of which realists will explain a qualified cognition. The assumption of the realists that cognition is also produced by the external object cannot be accepted by the idealists. Let us, now, discuss the views of realists.

### 3.4 Realist View

1. Realists cannot portray the reality of this universe without accepting that the relations appearing in the qualified cognition are as real as the relata. *Navya Nyāya* have researched in detail and classified various types of relation which can be summarized and classified as follows (for details: see Jha [13]):
2. *Samyoga* and *Samavāya*:  $aRb$  where R is considered to be a distinct entity from a and b. Here, the “contact” and “inherence” can be considered as particular type of relations.
3. *Svarūpa* : If R is neither contact nor inherence. A causal relation implies: R is the property of being a cause or the property of being an effect. For example: father-son relation, teacher-taught relation etc.
4. *Navya Naiyāyikas* use the word *viśeṣaṇatā* for *svārūpa* and divided “*viśeṣaṇatā*” into two types as *daiśika viśeṣaṇatā* and *kālīka viśeṣaṇatā*.

5. *Paryāpti*: Here, the relation is called *Paryāpti-sambandha* in *Navya-Nyāya*. This can be expressed over and above the inherence-relation. It is used to explain a cognition in which *vyāsajya-padārtha* appears existing simultaneously in more than one locus.
6. *Kālika sambandha* or Temporal Relation which is *svarūpasambandha* and also known as “*kālikaviśeṣaṇatā*”.

The analysis of realist school clearly indicates that the relation is as real as the relata in the context of qualified cognition. *Dharmakīrti* refuted the arguments of the realists regarding the reality of cause and effect relation since relation presumes the existence of the relata simultaneously.

Recently, it has been argued by Ghosh [20] that *Nyāya* could justify in favour of admitting relation as real in the following sense. Firstly, the relation is exposed in terms of language and the reality is beyond the net of language. It is further argued

*The Nyāya could forward the following justification in favour of admitting relation. First, relations are disclosed in language and the real escapes the net of language. If so, is it not a sort of inconsistency on Dharmakīrti's part to argue for unreality at the level of ontology by making a linguistic statement?*

### 3.5 The Jaina View

Jaina school (Padmarajiah [18]), with the usual reconciliatory metaphysical standpoint offers an approach which is intermediary between the extreme externalism of the *Naiyāyika* and the equally extreme idealism of the Buddhist and *Vedānta* schools. Regarding reality and relational aspects a few critical points should be mentioned which contradicts directly with the different Hindu schools and Buddhist schools. Following Jaina philosophy, a few points need to be noted as follows:

- (i) The Jaina does not believe in the existence of absolutely simple entities. A real, say, even a *paramāṇu* is considered as a star, present in a constellation of similar entities, which assumes various patterns, have magnitudes, determined by the internal compulsive laws and external pressure. In this manner, infinity of

relation is assumed, an internal and external, total and partial, immediate and mediates with other phenomena of the universe. A real is, obviously, an independent existent but at the same time, a complex focus or network of relational forces, just like a knot into which the strands of such forces are woven.

- (ii) Jaina school postulates the reality as a deliverance of the direct or objective experience and as a result, the relations are posited not merely as inferable, but also as an indubitably perceptual (Padmarajah [18]).
- (iii) According to Buddhists, the basis for admissibility of relation is not possible due to lack of serviceability (*upakāritva*, *arthakriyākāritva*) attributed to relation. But Jainas (for details, see Prabhācandra [19]) established the fact about how the relational element is a constituent factor in making up objects. For example, if the *paramāṇus* producing an object, say a pitcher, are discrete entities as Buddhist maintain, then simply the aggregates of the *paramāṇus* will not produce pitcher. In modern science one needs concept of cohesion to produce such an object. Jaina scholars emphasized that the *paramāṇus* are capable of being connected to become concrete object. The Jaina looks upon the relation resulting from the combination of the relata in it as something unique (*jātyantara*) in comparison with the combining relata.
- (iv) Regarding “*pāratantrya-sambandha*”, as discussed by Dharmakīrti, Prabhācandra remarked that essential nature of “*pāratantrya*” is unification of the relata not mere “dependent” as observed by Buddhists. Accordingly, Jaina view of relation is that it is an identity of differentents or different terms.

In view of this perspective of Jaina view we will discuss the reality of Quantum entanglement as a relation in modern physics.

#### **4. Reality of Quantum Entanglement and Jaina View**

Whatever entanglement may exactly be, it is a relation among subatomic or quantum systems. It is not necessary that the states of quantum systems are entangled. In famous paper of Einstein (known as EPR) a state of two subatomic entities are prepared by a measurement



procedure: for example a singlet state of two electrons is prepared so that even the electrons are being far apart thereafter, the correlation exists hence called non-local correlation. A singlet state is formed because of Pauli's exclusion principle. This principle says that no two electrons can occupy the same state with the same spin states. So the two electrons may be in a particular state with their spins having different directions like if one is in up direction along plus z-direction, then the other one is along minus z-direction.

It is now clear that the entangled state of two electrons is not merely an aggregate of two subatomic entities but one needs to consider the restriction imposed by Pauli's exclusion principle. So this is a kind of relation where we need to consider the “propensity of the relata” to form a relation called “quantum entanglement” as emphasized by Prabhācandra [19] in contrast to Buddhist view of mere dependency. Moreover, this singlet state of two electrons remains invariant under permutation or exchange of the position of two electrons though the two electrons are in different spin states in this state. This is similar to the concept of identity of differents as discussed by Prabhācandra in the context of “*pāratantrya-sambandha*”.

## 5. Conclusions

The concept of entanglement is used in teleporting an object from one place to another distant place without transporting it physically but transporting its form or attributes only. Since quantum teleportation is real and can be produced in the phenomenal world, the quantum entanglement is a reality.

Now, following Buddhist doctrine of *Paṭiccasamuppāda* or dependent origination, the world we see, is not a collection of isolated objects, but as a network of phenomena that are fundamentally interconnected and interdependent. The Buddhist worldview, therefore, is holistic because it sees the world as an integrated whole rather than a dissociated collection of parts. It recognizes the fundamental interdependence of all phenomena in the world, everything being dependently connected.

Owing to the causal relations, we gain empirical knowledge between physical things and our senses. But knowledge obtained in this

way, obviously points to the intrinsic properties of physical things. The way we gain this knowledge, puts constraints: we identify the physical properties of a system only through relations in which they enter. So to say, fundamental physical properties can be stated as describing these properties as relational. It is interesting now, to note that identity of relation does not necessarily imply the identity of intrinsic properties attached to physical things, but the way they are related to us. So, the quantum entanglement can be interpreted in terms of non-separability; we can claim that the specific relations do not need the intrinsic properties of the related systems, whereby, quantum physics, in virtue of exhibiting entanglement, offers us the arguments providing means to avoid difference between epistemology and metaphysics i.e., what is at the base level of the world are relations of quantum entanglement only. Summarizing the above arguments we emphasize that the quantum entanglement as a kind of relation which is neither incompatible with Realist view nor with Dharmakīrti. Here the relation is real but not real in the sense of reality of relata.

The analysis of Prabhācandra is based on the distinction between the two meanings of “having parts” i.e.

- (a) Physical partition and
- (b) Infinite diversity or manifoldness of nature exhibiting a varied relational structure.

He agreed with Buddhists regarding the impartiteness of the ultimate units or *paramāṇus* of nature but put forward the vital aspect of the manifold nature. For example, he suggested the fact of the infinitely manifold relatedness of a *paramāṇu* to the other *paramāṇus* similarly located. According to Jaina views a *paramāṇu* is not a lonely being but in a constellation of similar entities which assumes in their multitudinous determined by the laws of their internal compulsions and external pressure:

*“A real is indeed an independent existent but it is also a complex focus or network of relational forces. It is as it were a knot into which the strands of such forces are woven”*

It is clear from the above arguments of Prabhācandra [19] that the quantum entanglement is a kind of relation between the two “identical sub

atomic entities” (say electrons) but identity of differents since each subatomic entity has infinite diversity. This infinite diversity associated to each subatomic entity is nothing but the various attributes like “spin” states of the entity. The spin states of the subatomic entity in the entangled state may be in different directions like x, y or z. If one entity is in *up x-direction* then the other entity in the entangled state will be in *down x-direction* and similar situation occurs in other directions. So even when we consider the entangled state of identical subatomic particles like electrons, we need to consider the diversity in their attributes too as emphasized by Prabhācandra [19] in his analysis.

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## SECTION II: Jain Metaphysics & Science

### 6. Atoms and Life - A New View from Science

*Kazuyuki Akasaka<sup>1</sup>*

#### **Abstract**

How atoms in the universe turn into life as we see it today has been a fundamental and long-standing question in philosophy and religion from old times. However, the same question became the target of science rather recently, particularly in the last fifty years of the 20<sup>th</sup> century, by the dramatic advancement of bioscience. Nowadays, fundamental events in physiology and medicine are commonly discussed as molecular events. In fact, we are facing the new era of bioscience, where the gap between atoms and life is fundamentally disappearing, allowing us to reach a new stage of understanding of all life on earth.

#### **1. Introduction**

While I study protein structure and dynamics in terms of physicochemical laws governing atomic and molecular events, I can also enjoy the dynamism of life as flowers come up from the soil to bloom, grasses grow and vegetables ripen in my garden. Luckily, I am approaching the nature from both ends and this leaves me to find that the connection between atoms and life in terms of the delicately controlled

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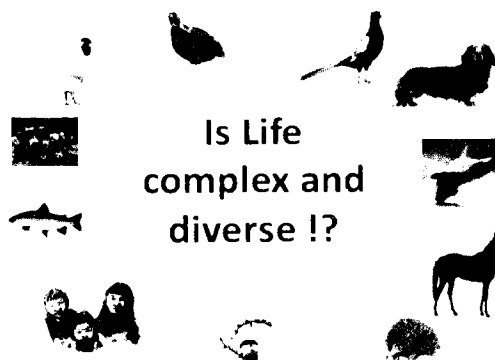
dynamics of protein molecules. In turn, this leaves us to feel how intimately our human life is connected to all other forms of life on earth as one family, sharing and exchanging limited supply of atoms constantly. In this talk, I discuss the long-cherished concept of complexity and diversity on living creatures on earth based on the modern biomolecular science including my own contribution.

## **2. The Unlimited Universe with Space, Matter and Time**

The unlimited universe, with stars, space, matter and time, has fascinated and overwhelmed humans for its simplicity, regularity and scale and puzzled them throughout the human history. The fascination and the wonder of the nature with its scale, variety and dynamism remain the same for us today. A couple of thousand years ago, questioning on these puzzles was only possible through philosophy and religion, which remained to be the same for centuries until 16<sup>th</sup> -18<sup>th</sup> century, when the scientific mind like Galileo Galilei (1564-1642) and Isaac Newton (1642-1727) came onto the stage and found that there are some fundamental rules of physics in the universe and in our surroundings.

### **2.1 The Puzzling Diversity of Life**

The puzzle of the diversity of life (Fig. 1) on the other hand, came to be the target of scientific mind only in 19<sup>th</sup> century, when Charles Darwin (1809–1882) published a book “*The Origin of Species*” in 1859



**Figure 1. Is life all complex and diverse?**

based on the evidence he found for the evolution of biological species through years of natural selection. This concept is strengthened now at the molecular level in 20<sup>th</sup> century by what is called “molecular biology”. It is intriguing, however, that the concept of evolution remains unaccepted even today by a large number of people connected with certain religious groups, notably in the United States. For example, on the internet, Christian Answers. Net bluntly denies the evolution and says “Kangaroos are wonderful examples of God's craftsmanship, designed by a Creator who knew perfectly what He was doing.

"To Him all praise, glory and honor are forever due". This would not be the case for Jain philosophy, which places all lives on equal ground. Closing eyes on one side of the scientific findings, while relying on the other, may become the source of conflicts among people in the contemporary society. We must try to avoid such conflicts by delivering an advanced, but fair scientific view on our natural surroundings to the people in the world.

### **3. Historical Progress of Scientific View on Matter and Life**

In the latter half of the 19<sup>th</sup> century, progress was made in understanding all matters in terms of atoms, protons, neutrons and electrons, and started forming the periodic table of atoms, as we see it completed today. Furthermore, they admitted the existence of molecules as combination of atoms, which allows a variety of compounds and biomolecules. In the early 20<sup>th</sup> century, the basic rule for combining atoms into molecules was put forward by Erwin Schrödinger (1887-1961) as quantum mechanics, which established the foundation of chemistry and later that of molecular biology. He is also known by questioning the relation between matter and life in his lecture in 1944 “What is life?”[1].

The development of chemistry prompted biologist to explain some fundamental phenomena in biology like genetics and physiology based on dynamic structures of bio-macromolecules. In the middle of the 20<sup>th</sup> century, Watson and Crick predicted the chemical structure of the genetic material DNA and its role in genetics in a correct way [2], which began a new era of biology called “molecular biology”. It is now well established that the base sequence information on the DNA molecule directs, via RNA, the sequence of amino acids to be joined into a polypeptide chain. In

early 70's, Anfinsen established that the polypeptide chain automatically (according to a thermodynamic rule) folds into a unique three-dimensional structure, by which he assumed that the protein performs its function [3].

The surprising fact is that, essentially, the process called “*Central dogma*”

[DNA → RNA → Protein → Function]

operates commonly in all living creatures on earth. The central dogma is one direct manifestation of the fact that lives on earth are all connected as “a family” and supports the evolution concept of Darwin. The central dogma represents “*the simplicity and uniformity aspects of life*” on earth, despite of “the complexity and diversity” which we consider *superficially* most typical of life on earth. The central dogma also leaves proteins as a major player in life activities of all creatures on earth.

### **3.1 Behind the Dynamism of Life is the Dynamism of Proteins**

Proteins are chemically simple molecules consisting of combinations of amino acids, which are made of carbon, hydrogen, nitrogen and sulfur atoms, but, on the other hand, each protein has a unique



**Fig. 2. Life is dynamic and is supported by the dynamism of proteins.**



amino acid sequence that distinguishes itself from others. When expressed in the cell, they undergo practically all the variety of functions that keep the dynamism of life going on earth, like trees to grow and flowers to bloom (Fig. 2). The simplicity of the chemical composition of proteins (20 kinds of amino acids) provides a basis for uniting all creatures as a big family on earth.

The picture shows the flowers of peony that appear from inside the soil in my garden in spring after a long winter. Behind the growth of the peony is the dynamism of various proteins, including the enzyme dihydrofolate reductase (inset) that works for the synthesis of DNA.

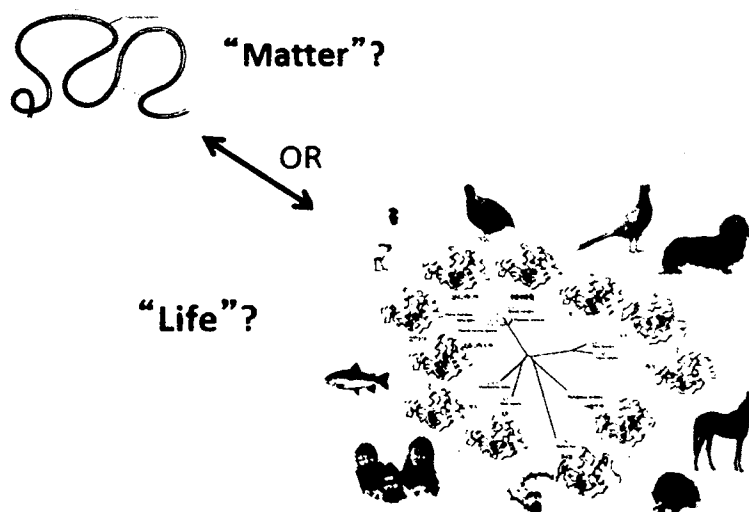
### 3.2 Is protein just a matter or a part of life?

This simple and unified view of life on the level of protein molecules, despite the common view on the macroscopic level that life is diverse and complex, would bring new impact on the concept of life. Function is expressed in proteins in versatility as the most fundamental level of life. Thus protein itself may be considered to represent the smallest unit of life (Figure 3). This concept may be acceptable, when one considers that any protein molecule we find in nature today is a consequence of the biological evolution in which life itself has been engaged. In other words, proteins are the molecules “designed” by life itself using fundamental laws of nature after countless number of trials over billions of years of time, but using the physical laws that any atoms in the universe would obey.

The concept “*unity of all lives on earth*”, now established on the molecular level by the contemporary science as above, would strengthen the basis of Jain philosophy of “*Ahimsā*”. The same concept should now be shared with all peoples in the world and be recognized as a common platform of all philosophy and religions of our time.

### 3.3 The chemical simplicity vs. the functional diversity of proteins-how to reconcile them?

A question may arise as to how the chemical simplicity of the protein molecule, i.e., the linear linkage of amino acids, can bring about the functional diversity that is inevitable for the diversity of lives on earth.



**Fig. 3. Is protein just a matter or a part of life?**

The figure 3 (upper left) represents a polypeptide chain, consisting of a linear combination of amino acids whose sequence is directed by the base sequence in DNA. The figure (lower right) shows the folded structures of enzyme “lysozyme” originating from the different biological species, in crystals; they depict a higher similarity in their basic folded structure.

Since Anfinsen reached a hypothesis that protein can perform its function by “folding” into a unique three-dimensional structure [3], enormous efforts have been made to determine folded structures of proteins in atomic scale details using X-ray crystallography and NMR spectroscopy since the latter half of the 20<sup>th</sup> century and now the atomic coordinates of an enormous number of protein molecules have been deposited in Protein Data Bank (cf. <http://www ww pdb.org/>). A majority of scientists have been seeking roots for the functional diversity in subtle differences in their crystal structures, but, in general, have not been successful: the same kind of proteins performing the same kind of reaction in different biological species show surprisingly similar structures to each other (for example, see Fig. 3, lower right, for the case of an enzyme “lysozyme”). This implies that the answer to the origin for the functional diversity of proteins, must be sought anywhere other than the stable folded structures such as those found in crystals.

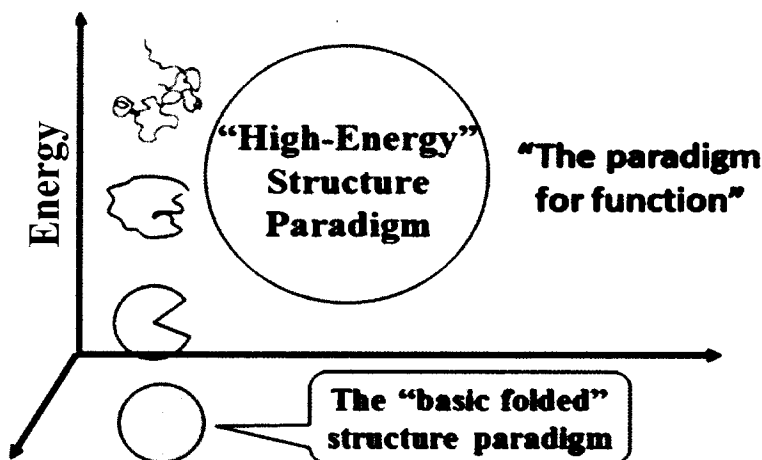


Fig. 4. The high-energy paradigm of proteins for function and evolution disclosed by high-pressure NMR spectroscopy [4-9].

### 3.4 High-pressure NMR discloses the high-energy paradigm of protein structure for function and evolution

A new technical development has brought the answer to this question: the high-pressure NMR spectroscopy for proteins developed in the last stage of 20<sup>th</sup> century by Akasaka and Yamada [4].

Importantly, research with this technique has disclosed the reality of protein structure, such that most proteins have high-energy structures in equilibrium with the basic folded structure (such as that found in crystal) [5]. The important point is that the population of high-energy structures is often invisibly low at 1 bar, but can be increased dramatically with increasing pressure so that they become visible in NMR spectroscopy, because, generally, the high-energy structures have smaller partial volumes in solution [6]. Another important point is that the same kind of proteins performing the same kind of reaction in different biological species shows structures and/or populations very different to each other. In the high-energy paradigm (Fig. 4), each protein assumes a structure specific to its function, thus producing the diverse function among diverse biological species [7].

### **3.5 Where does the variety of biological species come from?**

Here we reach the conclusion that the diversity in protein function among diverse biological species may largely originate from the diversity in high-energy structures or sub-states of proteins, normally invisible at 1 bar. These invisible structures or sub-states of proteins at 1 bar, however, are likely to be decisive in providing a variety of living creatures in our world. Since specific structures of proteins will be selected through generations primarily based on their function, the high-energy structure paradigm is considered responsible also for the evolutionary selection of amino acid sequences in proteins and therefore for the creation of the macroscopic diversity of living creatures as we see them today.

### **3.6 Connection between Atoms and Life**

The high-energy domain of protein structure would form the basis for the versatility of protein function, which is inevitable for all apparent complexity and diversity of lives on earth. Here I see a crucial connection between the choice of atoms constituting the polypeptide chain and the resultant function of the protein (life) (Fig. 3), namely a crucial connection between atoms and life [8]. It is intriguing that this connection is disclosed by the action of pressure by bringing the normally “hidden” high-energy paradigm of proteins to the light of NMR and other spectroscopic visibility [9, 10].

## **4. Concluding Remarks**

How atoms in the universe turn into life as we see it today on earth has been a fundamental and long-standing question in philosophy and religion as well as in science. The last fifty years of biological science has contributed dramatically to narrow the gap between atoms and life. Nowadays, it is rather common that many fundamental phenomena of life are discussed and understood in terms of molecular or atomic events in the field of biological and medicinal science. In fact, we are facing a new era, in which the fundamental gap between atoms and life is materially disappearing, or allowing us to reach a new stage of understanding all life on earth. As a scientist who studies protein dynamism in terms of the universal laws governing atomic and molecular events and as an observer of the dynamism of life daily in my own garden, I find that the fundamental

gap between atoms and life is basically disappearing, in terms of the dynamic nature of protein molecules, each of which has been so intricately designed for function by Nature (in reality by time spent for countless number of years for evolution). On the other hand, this leaves me to feel how intimately our life is connected to all other forms of life and how much commonness we share among all lives on earth. After all, we share and exchange limited supply of atoms on earth among all lives on earth constantly at present as well as in the past and in future, keeping the continuity of life in a variety of different forms. I believe *this reality to be the fundamental platform for all philosophy and religions in our time*. In this way, any conflict between science and religions and among religions should disappear.

In my understanding, Jain philosophy, Buddhism philosophy and Shinto (Japanese Nature-worshipping tradition) have basically no contradiction to the modern scientific view of life as above, and I insist that this be the knowledge for all modern philosophy and religions to accept and be the common platform for them to be based. Finally, I may dare to point out that the classical concept that *our world with the diversity of living creatures is created by "God"* can now be replaced with the purely scientific concept of our time that *all lives on earth are made of atoms and therefore all connected mutually through atoms. In this way, all lives on earth make one family.*

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## **7. Many, One and None? – Reflections on Science and Jaina Philosophy in the Indian Traditions**

*Ranjit Nair<sup>1</sup>*

### **Abstract**

An overview of the relations between Jaina philosophy and modern science is presented in the context of the major philosophical traditions of India. Three leading traditions with differences and links in equal measure are considered. A brief summary of Jaina contributions to science is given, ranging over logic, linguistics, mathematics, astronomy and physics. Soteriological concerns were routinely aired in every field of activity, not merely in philosophy. The twist in the tale comes at the end when in the light of humanity's current plight, soteriology turns out to be an overriding and universal concern.

### **1. Origins of Philosophy in India**

In the echo chamber that the traditions of learning in India represented, there were from the very beginning a number of voices in perpetual contention. The big questions concerning the nature of reality,

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the fundamental constituents of reality, the knowledge of reality accessible to sentient beings, the nature of sentience, the valid means that lead to knowledge of the real, the destiny of human and other beings, the nature of right conduct that led to the fulfillment of our destiny, were relentlessly debated over millennia. The traditions ranged over the whole philosophical spectrum encompassing ontology, epistemology, logic, ethics and soteriology.

If Plato could locate the origins of Greek philosophy in the questioning of the gods of Homer who displayed an all-too-human capriciousness, the origins of philosophy in India must be located as I have long maintained, in the open and unconstrained debate that took place between rival view-points from the very beginning. The so-called *āstika* or 'orthodox' traditions which owed allegiance to the *Vedas* were challenged by the *nāstika* or 'heterodox' traditions, creating a public sphere in which rival contenders debated questions and the canons of argument were developed to distinguish between valid arguments and fallacies. The *āstika* were those who asserted the existence of a world beyond (“*asti ca paraloka: iti*”) which the *nāstika* denied. The freedom to speculate and argue with one another led traditions to ramify endlessly, both internally and externally, leading to a rich shared vocabulary and treasure trove of ideas which remain, in several areas, fecund to this day. The genealogy of philosophy in India vouchsafed to me by the texts themselves is something for which I own responsibility, aware that it is a sweeping generalization over an enormous corpus. Although superficially similar, it is a thesis that is very different from, for instance, Amartya Sen's well-known archetype of the 'argumentative Indian' [1].

### **1.1 Jaina Pluralism, Vedānta Monism, Bauddhist Nihilism**

While Jaina philosophy became the standard-bearer of a thorough-going pluralism (*anekāntavāda*) with a dualism of *ajīva* and *jīva*, *Vedānta* was noted for its emphasis on monism with just one *ātman* which was the same as *Brahmn* the essence of reality (*advaita*), the Bauddhist schools maintained that there was no *ātman* (*anātmavāda*). It is in the incessant jousts between philosophers of such varied persuasions that philosophy in India became a highly specialized undertaking, requiring the study of opposing views which had to be stated fairly and accurately as the *pūrvapakṣa* before it was methodically taken apart in debate.



Philosophical writing in India was not required to have literary merit and when it did, no special virtue was attributed on that count. The format followed was to state the problem, then the solutions suggested by the *pūrvapakṣins*, followed by a rebuttal, all in the most economical prose, much like modern scientific texts in which an impersonal style is adopted to suggest an objectivity in which the author's individuality is effaced. The *apauruṣeyatva* (impersonality) claimed for the *Vedas* was perhaps a forerunner of this trope. In the light of the counter position of reason and revelation that characterizes Western thought and which resulted in the persecution of the pioneers of the scientific revolution, it is perhaps worth noting that the *Vedas* were regarded as *śruti* which refers to what is heard by the novitiate directly from the preceptor, thus making it the original and unvarnished narrative, unmediated by commentaries.

The Jaina and Bauddhist canons followed much the same demarcation between what was originally imparted by preceptors to their pupils, which subsequently became the object of commentaries, elucidations and glosses. The intensification of debates occurred when the Vaidikas, Jainas, Bauddhas, *Ājīvikas* and *Bārhaspatyas* vied to establish their positions as valid based on argument (*tarka*), not the *ipse dixit* of preceptors. Remarkably, these schools also taught astronomy, mathematics, medicine and even statecraft, all of which benefited from the rules of *tarka-śāstra* which commanded universal acceptance. From antiquity down to recent times, the great centres of civilization had a flourishing trade in ideas as much as it did in commercial goods. The ground was prepared for the sixteenth century scientific revolution by Indian mathematics with its use of zero and the decimal place value system which made arithmetic child's play. The geometrical framework of the Greeks was leavened by the arithmetic, algebra and trigonometry that were carried by the Arabs from India to the West. A similar claim can be plausibly made for the 20<sup>th</sup> century scientific revolutions with European Indologists as intermediaries.

## 1.2 Science and Ancient Philosophical Traditions in India

Few civilizations have been able to exchange ideas freely and not feel threatened by scientific advances. In the Indian case, a benign attitude towards science was reinforced by the distinction between *parā vidyā* and *aparā vidyā*, transcendent knowledge and its everyday counterpart,

adumbrated in the *Mundāka Upaniṣada*. The latter realm, comprised even the four *Vedas* and six *Vedāṅgas*, texts which were regarded as propaedeutic, stepping stones to the knowledge of reality, virtually at par with standard routes to worldly knowledge which did not threaten transcendent knowledge that was sanctified and linked both to theory and to meditative practices. The other-worldly and this-worldly – the latter including the canonical texts as well – were placed in distinct realms. Modern science thus posed no threat and was eagerly embraced by our forebears.

The power and prestige of modern science is such that even the most hallowed of ancient traditions seek to engage with it and even to enlist its support which is a sure sign that the victory of science is complete. From scientific studies of meditative states which commenced half a century ago, to ideas that overlap with modern science, the traditions of transcendence choose science as the universal yardstick of knowledge. This raises a plethora of questions. Science is notoriously fickle; yesterday's heresy could well become today's dogma. It is knowledge based on the human senses and its amplification via instruments, which allows us to probe an extraordinary range of scales, from the smallest constituents of matter, hypothesized to be strings that are of Planck length size,  $10^{-35}$  m, to the observable universe  $\sim 10^{27}$  m. (Fig. 1).



**Fig. 1:** The evolution of the Universe from Big Bang, 13.7 billion years ago, to the present [2]. The time = 0 when Big Bang occurred (left) and increases towards right. Various important events in the evolution of the Universe, leading to the formation of galaxies and stars are shown.

Science is irreverent and the community of seekers recognizes no rank or authority. A distinction between supersensory and sensory knowledge holds in science as homologues of instrumentally enhanced and unaided human cognition, which is not, however, adequate for traditions of transcendence, though I must confess I did at times find the temptation to hold such a view irresistible. Even more telling is the fact that the very idea of alternatives to modern science sought in ancient traditions is also in thrall to science as we know it today. That is not meant to be a criticism of the tradition or of modern science.

## **2. Modern Science at the Crossroads**

The presiding genius of the 17<sup>th</sup> century scientific revolution, the incomparable Isaac Newton, was characterized by Keynes as the 'last of the great Magi'. Newton spent more time and energy on biblical prophecy, Judaeo-Christian theology and alchemy than in mathematical physics, making him a transitional figure between the old and the new philosophies of nature. Indeed Newton was an arcadian who thought that the ancients were omniscient and that discoveries such as his must be found in the Biblical texts if only they were properly deciphered, a task he felt compelled to undertake himself. To engage in dialogue with modern science, votaries of ancient wisdom must come to terms with this prominent tendency.

Even as our traditions have perforce to adapt to the modern world, it is not a one-way street. I recall an anecdote which an Indian student of Wittgenstein at Cambridge, K.J. Shah (whose Wittgenstein lecture notes have been published) narrated to me. Once as they went on a walk together, Wittgenstein stopped and turned round to ask Shah whether he was Muslim, which Shah denied. Wittgenstein then asked if he was Hindu, to which too his student gave the same answer. A perplexed Wittgenstein went on to ask him what his faith was, upon which he said he was a Jain. Wittgenstein asked Shah what the Jain religion was about and the latter gave a somewhat distanced account of Jain beliefs, to which Wittgenstein reacted: "so you think you are cleverer than your ancestors, do you?" This conversation had a salutary effect on Shah who went on to become one of India's leading philosophers in his time, as he began to explore our philosophical legacy on returning to India [3].

## 2.1 Parallels with Quantum Theory

What can science learn from Jaina thought? One might plausibly argue that science as a body of organized reasoning that forever questions itself is the polar opposite of spiritual schools which exalt their scriptures to the level of unquestionable truth. Let me side-step the issue of meditative practices and their effects on the human mind as that is a field that has been ploughed for quite a long time, indeed for at least half a century. My concern is with ideas and I ask whether modern science makes sense when viewed through the prism of Jaina philosophy. It is generally agreed that within Western philosophy, quantum theory is highly unconventional. Pioneers like Niels Bohr maintained that quantum theory makes great demands on human understanding and emphasized similarities with Eastern philosophy, specially “that kind of epistemological problems with which ... thinkers like Buddha and Lao Tzu have been confronted, when trying to harmonize our position as spectators and actors in the great drama of existence [4]”.

The Jaina concept of '*avaktavya*' or 'inexpressible' which applies to statements in addition to the standard truth values, true and false, has parallels in quantum theory. In a double-slit experiment conducted with a weak beam of light that emits one photon at a time, one can either observe interference or establish through which slit the photon arrived at the screen. The concepts of a discrete quantum particle and that of an extended wave are distinctly at odds with one another. When wave-like properties are manifested, we are unable to say anything about the slit through which the photon passed. One is then led to the conclusion that it is *avaktavya*, a predicate whose homonym appears in the *Upaniṣada*'s “*yato vāco nivartante aprāpya manasā saha*” i.e. where words return, unable to reach it with the mind.

## 3. Jaina and Cartesian Dualism

The dualism of *ajīva* and *jīva* parallels the Cartesian divide which was essential for the scientific revolution insofar as it made possible the treatment of the *ajīva* as a closed causal system subject to natural law. In Jaina thought the *ajīva* consisted of *pudgala* (matter), *dharma* (dynamics) and *adharma* (statics), *ākāśa* (space) and *kāla* (time). Here, instead of translating *dharma* as the 'principle of motion' and *adharma* as the

'principle of rest' as many scholars do, I have substituted 'dynamics' and 'statics' respectively, which, while being accurate, resonate with the ideas of modern physics formulated in the scientific revolution. What is striking in this context is that *jīva* or soul is an entity to which *none* of the qualifiers of *ajīva* apply. Hence *jīva* is neither a spatiotemporal entity nor one subject to the causal order of dynamics or statics.

If the realms of the *ajīva* and *jīva* are so sharply differentiated, how do the two interact? This is a problem which all dualist ontologies, the Cartesian included, are confronted with. Descartes speculated on the possible locus of the interaction which he thought was the pineal gland, without clarifying how such an interaction is possible at all. It was necessary in the Cartesian account for there to be such a connection in order to explain free will, which contrasted with the clockwork universe of matter. In the Jaina case, soteriology depends on removing through renunciation, defilements that obscure the *jīva*, raising the analogous problem of how two entirely distinct orders of reality could impact one another.

In view of the non-spatiotemporal and acausal character of the *jīva*, the Advaitin could argue that the *ātman* (which is the near equivalent of *jīva* for the *āstika*) is in fact one. The principle of individuation for physical systems adopted by Albert Einstein following his favourite philosopher Arthur Schopenhauer's *principium individuationis*, involved separation in space and time. Schopenhauer was influenced by the *Vedānta* translated into Latin from Dara Shikoh's Persian translation, involved separation in space and time [5]. The *Nyāya* school suggests that the unity is in the genus or *jāti*, much as the Jainas suggest that the unity lies in all constituents sharing the property of existence. Bauddha schools eloquently filled the gap left by Gautama Buddha's silence about matters metaphysical. *Mādhyamika* philosophers like *Nāgārjuna* suggested that all conceptions are bedeviled by contradictions and the *anātman* doctrine stemmed from the apparent impossibility of describing the concept of the *ātman* consistently. Their *sūnyavāda* was not nihilism, but an assertion that taken in isolation, the component entities posited by the theory were not in themselves part of reality; they partook of reality in a relational sense.

### 3.1 The Premises of the Jainas and Modern Science

The shared set of concepts thus permitted a range of ontologies, from those populated by many entities, to one and to none. All three traditions began with a set of works accepted as the source of revelation, usually in groups of three. Alongside a logic of debate, *tarka*, philosophers employed the *pramāṇa* framework in which the sources of knowledge were laid out. While the skeptical *Lokāyata* philosophers accepted perception and disdained inference, the Jainas looked upon perception itself as a species of inferential knowledge. There was resistance to the use solely of *tarka* without authoritative starting points, such as the *āgamas*. The argument was the *apratitiṣṭhatvam* or instability of *tarka*. *Śaṃkara Bhagavatpāda* says “*asampradāyavid sarva śāstravidapi mūrkhavat upekṣaniya*.” i.e. someone who does not know the tradition must be shunned as a fool even though he may know all the sciences. This may sound elitist and exclusivist, but this epistemological maxim may be compared to accepting a set of axioms from which truths are deduced through the rules of *tarka*. This is true of science as well, with the exception that the instability induced by reason is accepted as a legitimate route to overthrowing old theories in the light of new evidence and theory, not always without resistance.

Modern science was hailed as a revolutionary departure from the natural philosophy which preceded it. An alliance of the inductivism of Francis Bacon who foresaw a *Novum Organum Scientiarum* and the deductivism of René Descartes, the hypothetico-deductive method of modern science, in which hypotheses designed to 'save the phenomena' were experimentally tested, cultivated human powers of ratiocination in a radically new and productive manner. Galileo proved prophetic when he averred that the Book of Nature is written in the language of mathematics but his outré views invited the wrath of the Church as it was believed to contradict the teachings of the Bible which, as the Holy Book, was for them the repository of all knowledge.

At the end of the 20<sup>th</sup> century, the first quarter of which saw the twin revolutions of relativity and quantum theory, a new revolution arose in cosmology, with the discovery that the expansion of the universe, far from slowing down as expected, had in fact gone into overdrive immediately after it was formed, suggesting the existence of dark energy. Studies of



galactic rotation curves showed that there had to be dark matter which, though invisible, interacted gravitationally. The matter, of which the visible universe is made, turned out to be some 4.6% of the energy content of the universe, which is dwarfed by dark matter's share of 24% and overwhelmed by dark energy's share of 71.4%. No cosmological theory had anticipated such a profound revision in the understanding of our universe, if it had, it would have been dismissed as fanciful (Fig. 2).

This most recent example makes painfully obvious how limited human understanding can be and counsels what may be called epistemological humility. Here the Jaina advocacy of non-absolutism and non-violence offers a compelling message, namely, be respectful of opinions other than one's own and engage in debates with people who do not share your views in the effort to persuade them through the use of argument.

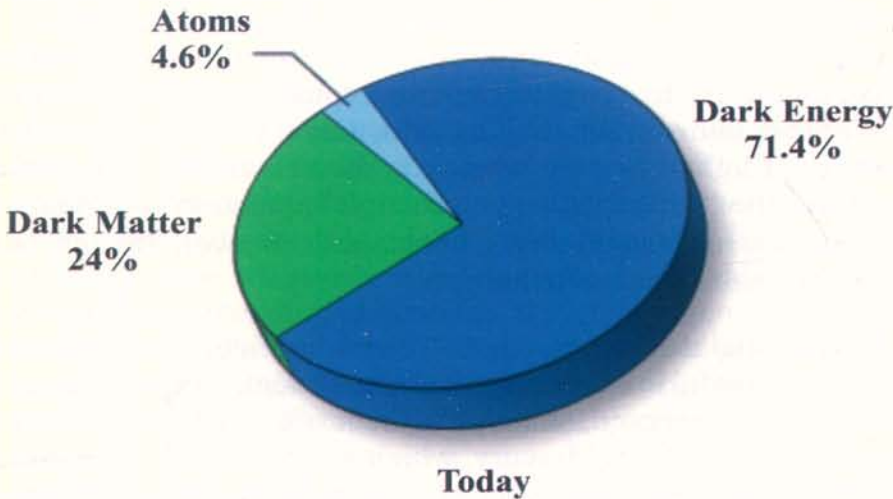


Fig. 2: Relative abundance of visible matter in the universe (stars, galaxies, *paramāṇus* etc. = 4.6%), Dark, invisible matter (24%) and Dark Energy (71.4%). We are able to directly study only the visible matter in detail and others (Dark Matter and Dark Energy, which are dominant), are inferred from their effects [6].

**The 'essential tension':** In contemporary science, competition between rival theories is encouraged, as is competition between different groups in huge experimental facilities such as Fermi laboratory in the US and CERN in Switzerland. What matters above all is clinching the argument, which does involve discomfiting the opposition.

Epistemological tolerance is followed in the matter of arguing with opposing views, acknowledging their existence without conceding that they could be right. This marks a subtle difference from the Jaina view although the latter enjoins argument with all rival standpoints. The difference is that modern science evolved by trial and error over millennia to put in place the scientific method which produces reliable knowledge that is accepted as valid by the majority of scientists, even if there are some who remain skeptical, pointing to vulnerable areas. The dissenters are regarded as having backed theories that failed the test of experiments and are often not given a hearing. Anomalies that the skeptics point out are met with stoic silence and the victors get busy exploring the areas where their theory is judged to have triumphed and acquired the status of the new standard theory.

There is an 'essential tension' to use Thomas Kuhn's phrase, between tradition and innovation in physics and indeed in all science [7]. The traditional theory which an innovative new theory displaces is often explained as being valid within limits. Newtonian mechanics, which is sufficient for mechanical engineering is accepted as an effective theory for macroscopic systems in the limit of velocities  $v$  very much smaller than the velocity of light, i.e.  $v \ll c$  where  $c$  is the velocity of light. Similarly, according to the "correspondence principle" quantum mechanics yield classical mechanics as Planck's constant  $h \rightarrow 0$  even though, strictly speaking,  $h$  remains a non-zero number.

In celestial mechanics, where Newtonian theory of gravitation was incredibly successful in explaining the solar system, there was an anomaly which was usually ignored, namely the precession of the perihelion of the planet closest to the Sun, Mercury, which was a tiny 43 arc-seconds per century. Einstein was able to explain the anomaly by applying his General Theory of Relativity. While his Special Theory of Relativity applied to inertial frames of reference which were either at rest or moving with constant velocity, the general theory he formulated ten years later, applied to non-inertial frames of reference.

In the development of scientific theory, new theories are required to subsume theories they supplant in some limit which is invariably an approximation. If  $T_n$  stands for theory now and  $T_{n-i}$  for the  $i^{\text{th}}$  predecessor,



we have

$$T_n \supset T_{n-1} \supset T_{n-2} \supset \dots \supset T_{n-i} \supset \dots$$

The standard theory is held to be true even in the overlap with its predecessor, as a proper superset and if the theory can be tested in this region, it must hold true. For instance, in the case of quantum mechanics, which is taken to be a proper superset of classical mechanics, macroscopic quantum effects such as superconductivity and super-fluidity can be observed. Thus quantum theory is a more universal theory than classical theory, which allows us to conclude that physical theory progresses with time.

### 3.2 Progress in Jaina and Other Philosophical Traditions in India

Do Jaina philosophy and coeval philosophies in the Indian tradition have a notion of *progress*? One might perhaps be tempted to assert that in these wisdom traditions, the progress that matters is that of the spiritually adept attaining emancipation from the natural state of bondage to phenomenal reality that they begin with. The great preceptors are people who are exemplary in having attained the *summum bonum* of existence. Their discourses, deeds and disciples are studied with veneration by those who wish to follow in their footsteps. Yet this is not the full story as contending philosophical systems even as they professed fealty to tradition *did* develop novel arguments which transformed the landscape of ideas. Bimal Matilal highlighted the *Nyāya* philosopher Jayanta Bhatta's (late 9<sup>th</sup> to 10<sup>th</sup> century CE) modest disavowal in his *Nyāyamañjarī* - *kuto vā nūtanam vastu vayam utprekṣitum kṣamā:/ vācovinyāsavaicitryamātram atra vicāryatām//* "How can we bring out a new fact? Novelty may be thought of solely in the paraphrasing of sentences". The longevity of philosophical systems lay in affirming tradition while extending it in novel ways in the course of philosophical debate over three millennia, which persists to this day. As for the ideal of emancipation, Daya Krishna [8] has pointed out that in the Indian traditions there was hardly any endeavour that was not represented as being directed towards that end, being a form of ritual obeisance that did not interfere with innovation.

### 3.3 Innovation in the Jaina Tradition

Innovation becomes necessary when fresh challenges appear. To the philosophical traditions of India, as indeed to the larger family across the globe to which they belong, the most recent challenge has been the world-transforming advance of science and technology. In the West, the Enlightenment thinkers assimilated the new worldview of the scientific revolution and disseminated it within popular culture. This in turn had a profound impact, engendering social revolutions that abolished an *Ancien Regime* founded on immutable dogma.

In the area of logic, the Jainas must be credited with having introduced three-fold predication in the earliest period of the *Āgamas* which subsequently produced the seven-fold predication of the *syādvāda*. The statistician P.C. Mahalanobis thought that the *avaktavya* predicate expressing ignorance could usefully furnish “qualitative” foundations for probability theory. A quantification which suggests itself is to regard the probability  $P(E)$  of an event  $E$ , a number which lies between 0 and 1, i.e.  $0 \leq P(E) \leq 1$  as a fractional truth-value.

Besides logic, linguistics and mathematics were areas where Jaina contributions were considerable and stimulated a great deal of research. So far as linguistics is concerned, the considerable body of work that emerged from the incessant cross-talk between the schools, in the light of the contributions of *Pāṇini*'s magisterial *Aṣṭādhyāyī* and *Patañjali*'s *Mahābhāṣya* among others, that created a whole new science which was paradigmatic in the classical traditions of India, in the manner that Euclid's *Elements* was in Mediterranean civilization. Jaina linguistics, while sharing the paradigm developed for *Samskṛt* also extended to *Prākṛt* and *Drāvida* languages. Much scholarly work remains to be done in this area.

In the period following the *Vedāṅga Jyotiṣa* and prior to *Āryabhaṭa*, Jaina mathematical astronomy may have played a key role in paving the way to the astronomy of the *Siddhāntas* indigenously, which is otherwise considered to have been influenced by Babylonian astronomy. The lively millennia-long debates on *paramāṇu* doctrine between the *Brāhmaṇa* (*Vaidic*) and *Śramaṇa* (*Jaina etc.*) schools need to be explored more thoroughly in order to elucidate the development of the concept of fundamental particles, the *paramāṇus*.

### 3.4 Soteriology has the last word

Above all, however, towers the ethics of *ahimsā*, which the Jaina exemplified in their daily conduct towards all beings, living and non-living, whose centrality was accepted in the *Paurāṇic* (as in the *Mahābhārata*'s *ahimsā paramo dharma*;) as well as the Bauddha traditions, making it a distinctive feature of India's plural traditions [9]. In his autobiography Mahātmā Gāndhī acknowledges the profound influence of the Jaina savant Shrimad Rājchandra whom he personally met and corresponded with. The practice of *ahimsā* became the cornerstone of Gāndhī's political activism, resisting tyrannical power through non-violent protest. That became an inspiration worldwide in the struggle for freedom from alien rule, influencing the course of human history.

Soteriology, which Daya Krishna saw as a ubiquitous nostrum in every traditional text and practice may well have the last word. Living as we do in turbulent times, with country after country racked by senseless acts of terrorism in which innocents are willfully slaughtered, the doctrine of *ahimsā* acquires a special poignancy. Humanity's plunder of the Earth's fossil fuels, the remains of long-dead living creatures, poisons the air, water and earth, triggering climate change. Five mass extinctions of species have already occurred naturally during the past 450 million years and we are on the verge of the sixth mass extinction, which will be man-made. The current extinction rate is 1000 to 10000 times the natural background rate, with the likelihood of 30 to 50 percent of species becoming as dead as the dodo by mid-century. Unlike previous extinctions, the last being of the dinosaurs some 65 million years ago, this time climate change is caused by just one species, homo sapiens [10]. Science without conscience has led humankind to the brink of an abyss, from which it cannot step back without the practice of *ahimsā*.

### Acknowledgements

It is indeed a great honour for the Centre for Philosophy and Foundations of Science (CPFS) to be associated with the International Conference on Science and Jaina Philosophy, as a knowledge partner. This talk is a modest offering to Bhagavān Mahāvīra, the 24<sup>th</sup> *Tīrthankara* of the Jaina tradition.

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## 8. Whose Science is it, anyway?

*N. Krishnaswamy<sup>1</sup>*

**Science without religion is lame, religion without science is blind.**

**-Albert Einstein**

### **Abstract**

This paper argues that the universalization of Western science destroys the plurality of traditional sciences and knowledge systems and puts Western science at the top of the hierarchy of scientific methods. It is also pointed out that we must evolve a 'global science' that gives a comprehensive idea of all sciences irrespective of the methods used- be they intuitive, rational, empirical, constructivist, analytic, or heuristic. It is also argued that a religion like Jainism with its profound philosophy and practical ideas must be considered scientific not on the Western terms but on global terms.

### **1. The Etymology of 'Science'**

Let me start with the etymology of the word 'science'. The etymological dictionaries point out that the word is derived from Latin '*scientia*' (stem of 'scire') and from Old French 'science', both meaning 'to

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know' or 'the state of knowing' and probably originally related to 'scindere' meaning 'to cut', 'divide', akin to Sanskrit '*chyati*'. The use of the word 'science' started from mid 14<sup>th</sup> century and by late 14<sup>th</sup> century it came to mean 'collective human knowledge'. The modern, Western, meaning of the term-'body of regular or methodical observations or propositions concerning a particular subject or speculation' was attested from 1725. In 17<sup>th</sup>-18<sup>th</sup> century, this concept was called philosophy (*Online Etymology Dictionary* and *The Concise Oxford Dictionary of English Etymology*).

The English word *scientist* is relatively recent—first coined by William Whewell in the 19th century. Previously, people investigating nature called themselves 'natural philosophers'.

There is no equivalent for the word 'science' either in Sanskrit or in any other Indian language. The word 'science' now used in the Indian context in the Western sense is a borrowed word; in Sanskrit '*viññānamaya*' is used in *Taittiriya Upaniṣada* and the word '*viññāna*' means 'intellect' or '*buddhi*'; the other near equivalent words may be '*śāstra*' or '*vidyā*' but they do not refer to 'science' in the Western sense. It is necessary to remember that 'science, since people must do it, is a socially embedded activity. It progresses by hunch, vision, and intuition. Much of its change through time does not record a closer approach to absolute truth, but the alteration of cultural contexts that influence it so strongly. Facts are not pure and unsullied bits of information; culture also influences what we see and how we see it. Theories, moreover, are not inexorable inductions from facts. The most creative theories are often imaginative visions imposed upon facts; the source of imagination is also strongly cultural. (Stephen Jay Gould, Introduction to "The Mismeasure of Man," 1981).

### 1.1 Non-Western Science

If I cite some Indian sources, we may think that I am only glorifying our past, saying that all wisdom lies in our ancient texts like the *Vedas*, *Āgamas*, and other ancient scriptures; so, let's listen to a Western authority, Dick Teresi, a noted science writer and the author of "The God Particle," which he wrote with the Nobel Prize-winning physicist Leon Lederman. Here is a gist of what Teresi says. According to Teresi, the "standard model" of the history of science locates its birth around 600 BCE in ancient Greece, where the *dramatis personae* typically include

Pythagoras, Empedocles, Democritus, Aristotle and other sages, who laid the foundation for modern mathematics and the sciences. It was this foundation, buried during the Dark/Middle Ages, that was rediscovered during the Renaissance in Europe. He reminds us of the forgotten sources. The Babylonians developed the Pythagorean Theorem at least 1,500 years before Pythagoras was born. Indian mathematicians performed multiplication and algebra, and even ventured toward calculus, a millennium before Europeans. An Arab astronomer, Ibn al-Shatir, spelled out the theory of planetary motion 150 years before Copernicus. The "Mercator projection" was used by Chinese cartographers centuries before the birth of Mercator. In the third century BCE, physicists in China pretty neatly summarized Newton's first law of motion. Centuries before Gutenberg, the Chinese used movable type; by 868 CE block printing was very widespread. Francis Bacon once commented on the "obscure and inglorious origins" of the magnetic compass, gunpowder, and paper and printmaking, three inventions that he claimed transformed civilization. "They all came from China," Teresi writes, and were invented centuries before the West became aware of them.

Teresi examines the roots of mathematics, astronomy, cosmology, physics, geology, chemistry and technology. The sections on mathematics, astronomy and geology are particularly strong. "If we are to say that non-European cultures had science long before the Europeans exported it to them," Teresi says, "we must prove they had math." His evidence is overwhelming. The Egyptians first mastered fractions, and Babylonian mathematics essentially created a B.C.E. version of the calculator, with its tables of reciprocals, squares, cubes, square roots and cube roots. The Babylonians and the Indians independently created a "place-value notation system" - a way of writing numbers, for example, with a place for ones, tens, hundreds, and so on which was similar in impact to the invention of the alphabet. The Mayans and the Indians of Asia independently created the number zero in the early centuries after the death of Christ. In discovering algebra, the ancients invented a language of science that wasn't appreciated for several millennia. Similar advances were recorded in astronomy. Teresi notes that "the ancient Indians, long before Copernicus, knew that the earth revolved around the sun and, a thousand years before Kepler, knew that the orbits of the planets were elliptical; the Arabs invented the observatory and named most of our popular stars; the Chinese mapped the sky; and the Amerindians noted

important events with daggers of light or optical snakes that thrill us to this day." Humankind's ancient skills in hydrology, metallurgy, mining and steel making, to mention a few areas of practical endeavor, inspire awe. "The Crusaders encountered the sharp end of Saracen weapons, which were made of steel mined in Africa, forged in southwestern India and fashioned in Persia and the Middle East." *Vedic* Indians mastered the use of square roots to build sacrificial altars in proper proportions. There is the Chinese geologist Chang Heng, who in 132 BCE invented an early seismograph that not only detected earthquakes but indicated the direction from which the primary shock wave originated. We meet the mathematician al-Khwarizmi, one of the early directors of Baghdad's "House of Wisdom" in the ninth century, whose name survives in the term we use for any special method of solving a problem (algorithm). The caliph al-Mamun built an observatory in 829 CE with a quadrant 20 feet in radius, dwarfing the celebrated instrument of Tycho Brahe seven centuries later. For those of a more pragmatic bent, the ancient Harappan culture, which flourished from about 3000 to 1500 BCE in what is now Pakistan and western India, is credited with developing wood-covered sit-down lavatories, built into the outer walls of houses and connected to a sophisticated network of municipal drainage. We even learn that the ancient Egyptians concocted potions using hippopotamus fat to control dandruff.

Teresi also notes that 'Morris Kline, a prominent American historian of mathematics, once dismissed the mathematical achievements of the Egyptians and Babylonians as "the scrawling of children just learning how to write" and called the Indian mathematicians "fools"' (p. 87), despite the mathematical sophistication of all three cultures in relation to the ancient Greeks and medieval Europeans'. Today many academics continue to dismiss the scientific knowledge of non-European cultures on the grounds that it is either merely "practical" or insufficiently "abstract," as the case may be, or that it is mixed with religious ideas, while Greek and older European sciences are evaluated against no such standard. At the most, the typical attitude has been condescending. Teresi points out that the European Dark Ages were not global, for elsewhere scholars and researchers continued their studies and experiments unabated. While until recently medieval Islamic scholars were credited solely with preserving classical knowledge, Teresi makes it clear that they not only synthesized Classical, Indian, and Chinese science and technology, but made



numerous scientific advances which filtered into Europe from the Middle Ages through the Renaissance — contributions that are still generally ignored. 'By the time we encounter the Arab scholar al-Biruni, active around 1000 CE, who brilliantly analyzes the geology of India as a vast alluvial plain while contemporaries in Europe still interpret the earth through the prism of the biblical flood, we emerge with a tremendous respect for cultures that have had the courage to confront their own belief systems by the logical, systematic and rigorous collection of factual evidence, which is why science has always been considered such a threatening enterprise by defenders of hierarchies and orthodoxies' (See also Stephens Hall, 2002).

## 1.2 More on Science in Ancient India

Let's look at some more facts on the Indian scientific knowledge systems in ancient India which Teresi has not mentioned in detail in his global survey, maybe for want of space.

In ancient India, there were many astronomers who were very much aware of the universe and its mysteries; the famous ones among them are: Āryabhaṭa (4<sup>th</sup> century CE), *Varāhamihira* (6<sup>th</sup> century CE), and *Bhāskarācārya* (11<sup>th</sup> century CE). They were well-versed in advanced mathematics, calculus, and trigonometry. They have written about the spherical nature of the Earth, its gravitational force, the Sun as the centre of the solar system, about comets and other planets, the seven colours of sun light, the stars and the comets, and the measurement and division of time. Āryabhaṭa, the renowned astronomer and author of *Āryabhaṭīya*, knew that the Earth was round and he even calculated the diameter of the Earth. Varāhamihira, another famous astronomer, mentions that the 'spherical Earth' is made up of the five elements/ '*pañcabhūtas*'. Another famous mathematician, Bhāskarācārya, in his book '*Līlāvati*' says, 'Whatever your eyes see is not the reality; the Earth is not flat as you see it. It is a sphere. '*Siddhānta Śiromaṇi*', an astronomical treatise, was written by Bhāskara.

In the West, it was only in the 16<sup>th</sup> and 17<sup>th</sup> century that scientists like Kepler, Copernicus, and Galileo discovered that the Earth is spherical and faced religious persecution. In India, there was no conflict between religion and science.

Varāhamihira knew about the gravitational force. Bhāskarācārya mentions that the Earth naturally attracts every object in the space towards itself and that because of the [its] attracting force all objects fall on the Earth. Brahmagupta, another great mathematician of the 7<sup>th</sup> century, and ĀdiŚaṅkara, mention the fact that the Earth attracts objects. They might not have explicitly stated the Laws of Gravitation like Newton, but they were all aware of the nature of the universe (i.e. solar system). Even the *Rgveda* says that the moon is revolving around its motherly planet Earth and the Earth is revolving around its fatherly planet sun. Ancient *Vedic* knowledge had revealed that sunlight consists of seven colours.

In mathematics, the use of negative numbers came into existence because of the notion of zero. (Once Albert Einstein said, “We owe a lot to the Indians, who taught us how to count through the decimal system, without which no worthwhile scientific discovery could have been made.”). *Piṅgala* (second century BCE) mentions 'zero'. *Brahmagupta*, in his mathematical treatise written in 620 CE, proves that any number divided by zero becomes infinity. *Vedas*, *Upaniṣadas*, Buddhist and Jain texts, and many other classical texts in India have dealt with 'zero' in various ways. In Sanskrit '*pūrṇam*' is used to denote 'zero' or 'completeness'; it also refers to '*śūnya*' (Arabic translations of the Indian astronomers' texts were soon available in the Islamic world, introducing what would become Arabic numerals to the Islamic World by the 9th century).

The word 'geometry' is a Sanskrit word; it is derived from '*jyāmiti*', which means the 'measurement of the earth' ('*jyā*' is 'earth' and '*miti*' is 'measurement'). In *Baudhāyāna Śulba Sūtras*, written five or six hundred years before Pythagoras, it is stated that in a right angled triangle, the square of the diagonal or the hypotenuse is equal to the squares of the other two sides. The Indian astronomer Āryabhaṭa had calculated the value of Pi as 3.1416, which is accurate up to four decimals. Many others like Mahavīrācārya and Bhāskarācārya have also calculated the value of Pi. In trigonometry, the notions of sine and cosine were evolved by Indian mathematicians. Calculus was called by Indians '*Kalana Gaṇana Śāstra*', which deals with the concept of differentiation and its application by considering the temporal positions of various planets. In Jain manuscripts of *Bakhśālī*, we find about negative numbers, fractions, sequences of arithmetic progression, and geometric progression. Another Jain text

'*Anuyogadvāra*' describes numbers up to 10 to the power of 140 ( $10^{140}$ ). A Buddhist text called '*Lalita Vistāra*' (1<sup>st</sup> century BCE) describes numbers upto 10 to the power of 53 ( $10^{53}$ ) and called the numerical value '*tallakṣaṇa*'.

*Āyurveda* as a 'science' of medicine owes its origins to ancient India. *Āyurveda* consists of two Sanskrit words - '*āyur*' meaning 'life', and '*veda*' means 'knowledge'. Thus, the literal meaning of *Āyurveda* is the science of life or longevity. *Āyurveda* consists of ideas about ailments and diseases, their symptoms, diagnosis and cure, and relies heavily on herbal medicines, including extracts of several plants of medicinal values. It is India's own system of medicine, which was looked down upon till recently, but is now becoming global because of the failure of allopathy in providing cures without serious after-effects. Allopathic doctors have dismissed *Āyurveda* as 'unscientific' since they go by the Western concept of 'science' which is very different from our concept of science. Dhanvantarī, it is said, received the system from *Brahma*. The Father of Medicine, Caraka, consolidated *Āyurveda* 2500 years ago. *Suśruta*, regarded as the Father of Surgery, and his team conducted complicated surgery including cataract, caesareans, fractures, urinary stones, plastic, and brain surgery. He wrote a medical compendium called *Suśruta-Saṃhitā*. This ancient medical compendium describes at least seven branches of surgery. The compendium also deals with matters like rhinoplasty in plastic surgery and ejection of cataracts in ophthalmology. The compendium also focuses on the study of human anatomy by using a cadaver. Usage of anesthesia was well known in ancient Indian medicine. Detailed knowledge of anatomy, embryology, physiology, etiology, metabolism, digestion, genetics and immunity is also found in many ancient Indian texts.

Yoga is a system of exercise for physical and mental nourishment; it connects the body and the mind; it makes the body flexible and breathing conscious and relaxing. The origins of yoga are shrouded in antiquity and mystery. By Vedic times or perhaps even thousands of years before, the principles and practice of yoga had crystallized. But, it was only around 200 BCE that all the fundamentals of yoga were collected by Patañjali in his treatise, named *Yogasūtra*, that is, "Yoga-Aphorisms". Patañjali surmised that through the practice of yoga, the energy latent within the human body may be made live and released, which has a salubrious effect

on the body and the mind. Now, in modern times, clinical practices have established that several ailments, including hypertension, clinical depression, amnesia and acidity, can be controlled and managed by yogic practices. The application of yoga in physiotherapy is also gaining recognition. Yoga and meditation have therapeutic value.

Some of the earliest linguistic activities can be found in India (1st millennium BCE) with the analysis of Sanskrit for the purpose of the correct recitation and interpretation of Vedic texts. The most notable grammarian of Sanskrit was Pāṇini (ca. 520–460 BCE). His grammar formulates close to 4,000 rules which together form a compact generative grammar of Sanskrit. Inherent in his analytic approach are the concepts of the phoneme, the morpheme and the root. Actually it was Europe's discovery of Sanskrit, the 'America of languages' as Raymond Schwab calls it, which signaled the onset of an Oriental renaissance in Europe. William Jones, also called Oriental Jones, a judge of the Supreme Court in Calcutta, managed to find a non-Brahmin (since no Brahmin was willing to teach him) to teach him Sanskrit under the most stringent conditions. The researches of William Jones (1746-1794), the father of the Indo-European hypothesis, laid the foundations for the development, mainly by German scholars, of comparative philology that gave rise to modern linguistics. But, historians of linguistics in the West have generally attributed Jones's contribution exclusively to the European lineage, without ever acknowledging the most important impact of the Sanskrit grammatical tradition on Jones's Indo-European hypothesis.

In Indian sculpture and architecture, the intricacies, the depth of details, and the subtleties and maturity bring out the spiritual zeal and vigour of the sculptors in their presentation and make them masterpieces of aesthetic elegance. Many ancient temples, cave sculptures and paintings in various parts of India that exist even today are standing monuments of Indians' artistic talent based on proportion and precision. In ancient India the temples were community centers and all activities like in the spheres of education, art and architecture, dance and music, in addition to religion centered around the temples. The *Brhadeśwara* temple in Tanjavur, Tamil Nadu, built by Chola kings and renovated by Vijayanagar rulers, has the highest temple tower and its construction is an architectural marvel. The shadow of the tower never falls on the ground on any day of the year whatever be the direction of the sun. The shore temple in

Mahabalipuram near Chennai still standing on the seashore braving the waves of the sea is also another monument of marvel. The Meenakshi temple in Madurai, Tamil Nadu, is another piece of sculptural excellence; it has a '*saptaswara*' (the seven musical notes) made of rock that reverberates with seven musical notes. There are many more like the Lepakshi temple in Andhra Pradesh, Chennakeshava Temple of Beloor, the ruins of Hampi and the statue of Gomatheswara in Karnataka, the sun temple of Konarak in Odissa, Bauddhagaya, Buddhist temples in Bihar, Khajuraho temple in Madhya Pradesh, the step-well architecture in Gujarat, and so on that testify to the glory of the architectural talent of India. The murals in the rock caves of Ajanta, Ellora, and Elephanta in Maharashtra are a product of immaculate teamwork.

Colonialism strived to cover these achievements as insignificant to science. As Bernard Cohn says: 'The conquest of India was the conquest of knowledge' (Cohn, 1985). This resulted in the glorification of the West and the positioning of the white Christian Europe at the centre of contemporary world civilization and all knowledge systems. This project very effectively 'museumized' India, which was safely pushed to a glorious past. As the Kenyan novelist, N'gugiWaThiongo aptly puts it: 'The bullet was the means of physical subjugation and language the means of spiritual subjugation'.

### **1.3 Macaulay's Ignorance**

Though the initial reaction of the British to Indian knowledge systems was one of awe, their imperial attitude did not allow their admiration to last too long. Macaulay, for example, in his Minute of 1835, debunked the Indian knowledge systems. Sheer ignorance! He wrote:

"There are no books on any subject which deserve to be compared to our own; whether, when we can teach European science, we shall teach systems... medical doctrines, which could disgrace an English furrier, astronomy, which would move laughter in girls at an English boarding school, history- abounding with kings thirty feet high and reigns thirty thousand years long- and geography made up of seas of treacle and seas of butter.

I have no knowledge of Sanskrit or Arabic. But I have done what I

could to form a correct estimate of their value. I have read translations of the most celebrated of Arabic and Sanskrit works.... I have never found one among them who could deny that a single shelf of good European library was worth the whole native literature on India and Arabia.

It is, I believe, no exaggeration to say that all the historical information which has been collected from all the books written in the Sanskrit language is less valuable than what may be found in the most paltry abridgements used at preparatory schools in England".

Regarding the printing of books in Sanskrit and Arabic, he was against wasting public money on printing those books which, he said, were less valuable than the paper on which they were printed, while it was blank. Thomas Reid, who is credited as the one who applied Bacon's method of reasoning and Newton's scientific objectivity, attacks Indian philosophy and says 'it is all conjecture'. He remarks: 'We laugh at the Indian philosopher, who to account for the support of the earth, contrived the hypothesis of a huge elephant..... his elephant was a hypothesis and our hypotheses are elephants'. Charles Trevelyan, the brother-in-law of Macaulay, did not approve of Kālidāsa's Shakuntala as a text for study in Indian schools and colleges, since, according to him, the more popular forms of Oriental literature are marked with 'greatest immorality and impurity'.

## **2. Changing Perceptions and Shifting Paradigms in Western Science**

Let's look at the changes that took place in the West in the concept of science from natural philosophy, alchemy, and magic to quantum physics, from Aristotle to Stephen Hawking and from Newton's apple to Steve Jobs' 'apple'.

It is customary to trace the origins of all human knowledge systems to the Greek tradition! It is true that in very many ways all the seminal ideas of the Greek intellectual tradition were absorbed and adopted by the Europeans and the Arabs but without debunking the Greek tradition; on the contrary, the West not only absorbed and adopted the Indian traditions without acknowledging them but also debunked them. In ancient times alchemy played a significant role in the development of

early modern science and it was recognized as a proto science that contributed to the development of modern chemistry and medicine.

The pre-Socratic philosopher Thales (640-546 BCE), called the "father of science", was the first to postulate non-supernatural explanations for natural phenomena. Thales' student Pythagoras founded the Pythagorean School, which investigated mathematics for its own sake, and was the first to postulate that the Earth is spherical in shape. Leucippus (5th century BCE) introduced paramāṇuism, the theory that all matter is made of indivisible, imperishable units called paramāṇus. Subsequently, Plato and Aristotle produced the first systematic discussions of natural philosophy, which did much to shape later investigations of nature. Their development of '*deductive reasoning*' was of particular importance and usefulness to later scientific inquiry. Plato's student Aristotle introduced empiricism and the notion that universal truths can be arrived at via observation and induction, thereby laying the foundations of the scientific method. Aristotle's writings profoundly influenced subsequent Islamic and European scholarship, though they were eventually superseded in the Scientific Revolution.

With the division of the Roman Empire, the Western Roman Empire lost contact with much of its past. In the Middle East, Greek philosophy was able to find some support under the newly created Arab Empire. With the spread of Islam in the 7th and 8th centuries, a period of Muslim scholarship, known as the Islamic Golden Age, lasted until the 13th century. This scholarship was aided by several factors. The use of a single language- Arabic, allowed communication without translations. Access to Greek texts from the Byzantine Empire, along with Indian sources of learning, provided Muslim scholars a knowledge base to build upon. During most of the 16th and 17th centuries, fear of heretics spreading teachings and opinions that contradicted the Bible dominated the Catholic Church. They persecuted scientists who formed theories the Church deemed heretical and forbade people from reading any books on those subjects by placing the books on the Index of Prohibited Books. A kind of war between science and religion was in play but there were more casualties on the side of science. Nicholas Copernicus and Galileo Galilei held the same theory that the Earth revolved around the sun; but the Church disapproved of this theory because the Holy Scriptures state that the Earth is at the center, not the Sun. However, condemnations by the

Catholic Church, in a way, accelerated the growth of scientific scholarship.

The willingness to question previously held truths and search for new answers resulted in a period of major scientific advancements, now known as the Scientific Revolution. The Scientific Revolution is traditionally held by most historians to have begun in 1543, with the astronomer Nicholas Copernicus (1473-1543). The thesis of Copernicus' book was that the Earth moved around the Sun. The period culminated with the publication of the *Philosophiæ Naturalis Principia Mathematica* in 1687 by Isaac Newton, representative of the unprecedented growth of scientific publications throughout Europe. Francis Bacon (1561-1626), the founder of 'modern scientific method', also contributed to the scientific revolution.

The Age of Enlightenment was a European affair. The 17th century "Age of Reason" opened the avenues to the decisive steps towards modern science, which took place during the 18th century "Age of Enlightenment". Directly based on the works of Newton, Descartes, Pascal and Leibniz, the way was now clear for the development of modern mathematics, physics and technology. The impact of this process was not only limited to science and technology, but it also affected philosophy (Immanuel Kant, David Hume), religion (the increasingly significant impact of science upon religion), and society and politics in general (Adam Smith, Voltaire), the French Revolution of 1789 setting a bloody caesura indicating the beginning of political modernity. The early modern period is seen as a flowering of the European Renaissance, in what is often known as the Scientific Revolution, viewed as a foundation of modern science.

The scientific revolution established science as a source for the growth of knowledge. During the 19th century, the practice of science became professionalized and institutionalized in ways that continued through the 20th century. As the role of scientific knowledge grew in society, it became incorporated with many aspects of the functioning of nation-states.

The history of science is marked by a chain of advances in technology and knowledge that have always complemented each other.



Technological innovations bring about new discoveries and are bred by other discoveries, which inspire new possibilities and approaches to longstanding issues in science.

Science was divided into two main branches: Natural science and Social sciences. Natural science got diversified into physics, chemistry, biology, geology, astronomy, botany, medicine, genetics, neurology, ecology, etc. Social science branched off as history, political science, linguistics, economics, psychology, sociology, anthropology, etc. Many emerging new sciences like communicology, computer science, artificial intelligence, and many other material sciences are also emerging. Copernicus, Roger Bacon (who introduced empirical method to Europe), Isaac Newton, Charles Darwin, Galileo, Benjamin Franklin, Marie Curie, Michael Faraday, Louis Pasteur, Graham Bell, to Albert Einstein, Robert Oppenheimer (the father of the atom bomb), Stephen Hawking and many others contributed to the growth of modern science. During the second half of the twentieth century and the twenty first century, Information Technology created the IT revolution, pushing basic sciences to the background; one can see the application of IT in every field.

## **2.1 The Impact of Western Science and Technology, and the Hegemony of the West**

Science, like any other tool, can be “misused as well as used”. Western science was carefully used to the advantage of the West and to the disadvantage of the rest of the world. There is no denying the fact that science and technology have improved the quality of life: good infrastructure, better transport facilities, better communication, better medicines and health care, good machines to help human effort, etc. Anyone in the 'developed' countries can see the conditions there; the conditions are not so in the 'developing' and underdeveloped' countries. Science and technology gave birth to industrialization, colonization, imperialization and the present globalization, which in turn are furthering the hegemony of the West. During the colonial era supported by industrialization, as we all know, there was huge exploitation, destruction, and humiliation inflicted on colonized societies. Western values, Western capital, Western institutions, Western technology- all resulted in Westernization, though projected as modernization.

Now, the current wave of contemporary globalization is actually a child of the two earlier forms of globalization- colonization and imperialization, and it is heavily supported by technology and Information Technology- a postmodern avatar of industrialization. It is a giant wave with many tidal waves; it is a tsunami. Information technology has taken control of the entire globe and the whole world has become 'window-centric' or 'apple-centric'. The result is global warming, climate change, deforestation, urbanization, mindless expansion, materialism and greed. Science and technology coupled with modern nation states, has created the war machine. Every country is keen on developing nuclear weapons and the world is living in constant fear of all kinds of wars- 'cold war', 'local wars', 'religious wars', 'racial wars', 'conventional wars', 'fundamentalism', 'global terrorism', 'digital terrorism', 'expansion of territories', etc. Millions of innocent people are killed. This is the flip side of applying new inventions, science, and technology to the social and political sphere.

### **3. Science Wars' in India**

The impact of Western science was felt in India even during the nineteenth century. Raja Ram Mohan Roy in his famous letter of 1823 to Lord Amherst on Western education pleaded for a more liberal and enlightened system of education, embracing mathematics, natural philosophy, chemistry, and anatomy and other useful sciences. He was well versed in Sanskrit, Arabic and Persian and he tried to synthesize Western rationalism and Eastern idealism. He wanted to create a bridge between the pragmatism of Western material science and wisdom of the East. But he was used by the colonial rulers in anglicizing urban India as part of the colonial politics. English and Western education were introduced 'to enlighten the ignorant natives of India'.

The difference between Gandhi and Nehru's approach to the development of India can also be attributed to the impact of Western science. A "Statement" on the "Scientific Temper" was put together at the end of a seminar organized in October 1980 by the Nehru Centre, an organization that propagates the ideas of Jawaharlal Nehru, India's first prime minister. The Nehru Centre had invited some thirty scientists, historians, and public intellectuals of all stripes for the seminar. The signatories looked to Jawaharlal Nehru's Enlightenment faith to find a cure

for the cultural malaise which they believed India was afflicted with. They zeroed in on the concept of “scientific temper” culled from Nehru's writings. Following Nehru, the “Statement” described the scientific temper as an attitude of mind which is universally shared by all and is applicable to all aspects of life, including the evaluation of values. It called for cultivating science education and scientific thinking as a social force for “changing the intellectual climate of our people”, using Nehru's reference to science in his *Discovery of India* -

“The adventurous and yet critical temper of science, the search for truth and new knowledge, the refusal to accept anything without testing and trial, the capacity to change previous conclusions in the face of new evidence, the reliance on observed fact and not on pre-conceived theory, the hard discipline of the mind (Nehru, 1988: 36)”.

The 'Statement' was vehemently opposed in a “Counter-statement on Humanistic Temper” by Ashis Nandy (1981), Ramachandra Guha and many others including Jayaprakash Narayan. They argued that the industry-heavy modernization policies of Nehru will result in marginalizing the social message of Gandhi and that science is a socio-cultural phenomenon. Nehru's approach was juxtaposed with Gandhi's visualization of rehabilitation of village-based cottage industries, utilizing local knowledge, raw material and skills, and managing their affairs through village assemblies or *panchayats*. Decentralization of power, patterned after traditional social arrangements, was to be the answer to modernization which had been promoted by Nehru. This 'Science War' – a conflict between “scientific” and “humanistic”- went on for some time without any resolution (See also Meera Nanda's article and her book *Breaking the Spell of Dharma*). The debate was more theoretical. The ground situation was very different. Globalization and the IT revolution have invaded India and the internet has deeply penetrated into interior rural areas; smart phones, i-pads and tablets have become essential accessories of everyday life of every Indian.

Now, what we see is two Indias- a 'globalized India' and the other India. The globalized India is the India of IT parks, MNCs, new corporate hubs like Gurgaon, Electronic Cities, Cyberabads, Corporate executives, and white-collar workers who are 'cyber coolies'. The Other India, Bharat, as we used to call it, is the land of small farmers whose land is usurped by

the Corporates, of tribals clinging to the forests that are fast disappearing, the landless Dalits living in the shadow of upper caste atrocities, women facing constant sexual harassment, the urban poor and the shivering construction workers living in shanties next to sky-rise buildings and gated-communities, shrinking agricultural land as IT companies and MNCs are buying up all the agricultural land; farmers are left with two choices- either migrate or commit suicide, the number of the urban poor is increasing, corruption reigns from the cradle to the grave, criminalization in the name of politics is affecting modes of expression. Air, water and noise pollution is creating health hazards, garbage is a new subject. These problems too are another global phenomenon- rural and the urban areas face the same problems.

What is called globalization is nothing but 'economic globalization' for a select few and 'virtual globalization' for the tech-savvy technocrats. There is no sign of 'political globalization' or 'ideological globalization' and the dream of 'one world' coming true. Real globalization will always remain a dream. India, under globalization, is actually getting more and more fragmented.

At the cultural level, we witness a 'hybrid' culture emerging; this hybrid culture started in the metros but is fast spreading to all other parts of the country, both 'urban' and rural. This hybrid culture has abandoned all that was good, valuable and time-tested in the older systems of India and has taken all the undesirable and 'unwanted' superficial elements from the West. The old values like respect for nature or fellow human beings are lost. There is no compassion for fellow beings or elders. We see materialism and only materialism and selfishness in the emerging hybrid culture. My concern is not just 'hybrid culture', but the kind of hybrid culture that is evolving. We do not want to blindly follow the West but go our own way, adjusting some of the Western ideas to our own needs- spiritual, moral, cultural and economic circumstances, based on our own heritage. Such a synthesis has been at the core of Indian civilization.

#### **4. Another Serious Consequence of the 'Impact' of Technology**

According to Futurologists, transhumanism is a social and philosophical movement that explores the uses of technology for the positive transformation of human capacities.

Transhumanism is an international and intellectual movement that aims to transform the human condition by developing and creating widely available technologies to greatly enhance human intellectual, physical, and psychological capacities. Transhumanist thinkers study the potential benefits and dangers of emerging technologies that could overcome fundamental human limitations, as well as the ethics of using such technologies. The most common thesis is that human beings may eventually be able to transform themselves into beings with greatly expanded abilities as to merit the label post human (Wikipedia).

While acknowledging the value of the scientific method – based on the principles of precision, objectivity and falsifiability – transhumanism foregrounds its relevance for improving the human condition! In transhumanism, science is viewed differently than in humanism, where it was a symbol of human intellect, ingenuity and a key to the “truth”. Looking only at the last hundred years or so, for example, we find scientific breakthroughs that have radically altered human existence, even though they are now so closely assimilated into our lives that we often take them for granted. To name just a few of these changes which have reinforced our dependency on machines: transport (planes and aviation technology has facilitated rapid global travel, trains, buses, cars, two wheelers, etc.), internet banking, medicine and health care (all testing gadgets and the pharmaceutical industry, antibiotics that have obliterated previously fatal diseases), the kitchen (gadgets have liberated women and the structure of the workforce), e-learning and multimedia, and many more. Because of such developments we have better control over our bodies, enjoy longer life spans and can make multiple and fast relocations to different parts of the planet, radically changing our life experiences. If these machines can be incorporated into the human body through micro-chips, the physical and mental capabilities will get enhanced multiple times. A trans-human or beyond human is a hypothetical future being whose basic capacities will so radically exceed those of present humans as to be no longer unambiguously human by our current standards. The creation of intelligent robots is a step in this direction and there won't be any difference between humans and robots! These things will happen in future. Transhumanism will kill the human element and all humans will be robots. Should this happen?

## **5. Traditional Indigenous Knowledge Systems are Science**

Western science has been defined as a systematic approach, a methodological approach to answering questions. Western Science is equated with knowledge and Western scientists have a tendency to reject the traditional knowledge of native peoples as anecdotal, non-quantitative, without method, and unscientific. But traditional knowledge *is* science. The difference may be broadly formulated as an opposition between 'local knowledge' and 'scientific knowledge' -/ the first which is plural (hence particular) and everywhere, the second which is singular (hence universal) and uniquely Western, though they follow different logical pathways. As *Science International* points out:

Traditional and local knowledge systems as dynamic expressions of perceiving and understanding the world can make, and historically have made, a valuable contribution to science and technology, and there is a need to preserve, protect, research and promote this cultural heritage and empirical knowledge (*Science International*, September 1999, p.4).

The imposition of Western scientific ideas and methods and allowing Western science to be the final arbiter of the validity of knowledge, and to establish the threshold beyond which knowledge is not worthy of its name, would create the conditions whereby an astonishing diversity of cultural heritage is transformed into a monolithic structure. Instead, we should recognize the value of this heritage, and devise strategies for its preservation for the benefit of present and future generations. The universalization of Western science destroys the plurality of traditional sciences and knowledge systems and puts Western science at the top of the hierarchy of scientific methods. Science itself shows the limitations of science.

The real world is too complex to be compressed into static conceptualizations. Dealing with this complexity requires approaches and strategies that maintain a continuous openness and willingness to discover and learn (Morin, 1990). For example, some authors (Freeman, 1992; Iaccarino, 2003) have suggested that traditional knowledge systems can be helpful in dealing with complex systems:

The understanding of complex systems remains a major challenge

for the future, and no scientist today can claim that we have at hand the appropriate methods with which to achieve this. Thus, we cannot discuss the future of science without taking into account the philosophical problems generated by the study of complexity. Modern, or Western, science may not be best suited to fulfill this task, as its view of the world is too constrained by its characteristic empirical and analytical approach that, in the past, made it so successful. We should therefore remember the contributions of other civilizations to the understanding of nature. Now, such traditional or indigenous knowledge systems are increasingly being used not only with the aim of finding new drugs, but also to derive new concepts that may help us to reconcile empiricism and science (Iaccarino, 2003).

An increasing number of critical voices argue that an approach based on reductionism—helpful as it has been in the past—might no longer be sufficient to analyze and understand higher levels of complexity (Kellenberger, 2004; van Regenmortel, 2004). Moreover, scientists work only at specific levels of analysis. The theories formulated at each level are based on key observations, and, therefore, can explain only a specific set of facts (Iaccarino, 2003). Hence, the integration of methods and results from different approaches and levels of analysis can become essential.

Not only are they (traditional knowledge systems) more holistic, they also seem to be better suited to coping with the uncertainty and unpredictability that are viewed as intrinsic characteristics of natural systems. Western science and traditional knowledge constitute different paths to knowledge, but they are rooted in the same reality. We can only gain from paying attention to our cultural history and richness. (Mazzocchi, 2006). This exercise would lead to the creation of a pantheon of knowledge systems without hierarchy.

## 6. Indian Science/*Śāstra*

*Śāstra* is the knowledge which is based on principles that are held to be timeless. *Śāstra* has a similar meaning to English 'scientific' and basic knowledge on a particular subject. The principles of *śāstra* may be subjective or objective but they work; that's the beauty of it.

Indian science can be classified into three broad areas-

- 1) Inner Sciences -- yoga, meditation, mindfulness, *vipasyanā*, *Adhyātma-vidyā* or inner science is the disciplined and systematic knowledge of the inner-self/inner nature.
- 2) Social Sciences -- *ahimsa*, *aparigraha*, *asteya*, *anekānta*, *brahmacarya*.
- 3) Outer Sciences -- astronomy and astrology, *āyurveda*, *siddha*, herbology, mythology or myth studies, *unāni* culture, *arthaśāstra* (the science of wealth), *nītiśāstra* (political science), *rasāyanaśāstra* (chemistry), *bhautikaśāstra* (physics), *vāstuśāstra*, *śilpaśāstra* (sculpture), *āgamaśāstra*, *nāṭyaśāstra*, *nāḍīśāstra*, *manośāstra* (psychology), etc. The outer nature/environment is attained through careful observation, exploration, and critical reasoning for a complete knowledge of all 'reality'.

How did the ancients arrive at the basic principles without any instruments to help them? (Modern doctors, with all the sophisticated instruments, sometimes remove the wrong part instead of the diseased one from the human body!). Certainly, the discoveries and inventions must have been based on an initial flash, keen observation, repeated trial and error, careful calculations, contemplation, and formulations of principles – obviously, this is what science is.

How many observations does one need when studying the relationship between a particular phenomenon and the construction of insightful generalizations? Western science demands a very large number of observations – hundreds, perhaps thousands – in order to provide the statistical power to detect a relationship of a given magnitude. Traditional knowledge suggests that a very much smaller number of observations may be optimal. All important discoveries happened during 'eureka' moments. One of science's most well-loved stories is that of Archimedes, fresh from discovering the principle of buoyancy during a bath, running naked through the streets of Syracuse yelling “*Eureka!*” (“I have found it!”). Whether it is Newton or Einstein, it is the 'eureka' moment that gives birth to great scientific theories. The philosopher of science Karl Popper sharply distinguishes truth from certainty. He writes that scientific knowledge "consists in the search for truth", but it "is not the search for certainty ...". All human knowledge is fallible and therefore uncertain.



Recent studies have highlighted the therapeutic effects of yoga and shown that, meditation and mindfulness can bring about structural changes responsible for calming emotions, better memory and lower stress; these practices have a definite effect on depression, memory loss, and can cure many mental problems. Western science has reduced mind into brain and treats the brain for mental illnesses. Instead of saying that all the modern scientific concepts are found in the ancient texts like the Hindu scriptures and other religious texts, it is better to assert that our 'sciences' have the solutions to the strife ridden problems of the present-day world and can save humans from extinction. If that is not done, the local sciences will always remain in the periphery.

Take, for example, some of the scientific principles in Jain philosophy. Jain tenets are based on individualistic humanism; in other words, based on individual personality, chemistry and requirements and humanistic principles.

*Ahiṃsā* means not harming any living being, in action or words or by any other means; it involves universal love, which is a sociological principle. '*Hiṃsā*' means 'harm' and '*ahiṃsā*' means 'non-harming'; the word is often translated by mistake as 'non-violence'. '*Hiṃsā*', properly understood, denotes all forms of harm; even harming the environment is *hiṃsā*; harming animals is *hiṃsā*; that is why Jainism advocates vegetarianism. *Ahiṃsā* also applies to languages and cultures; cultural and linguistic genocide implies the systematic elimination or suppression or harming of other religions, languages, ways of life, and customs and that too is *hiṃsā*. *Hiṃsā* is the systematic destruction of the identity of an individual or a group, and a deprivation of their sense of pride and history, and of their relationship with nature. The colonial rule has to be viewed against this definition of *hiṃsā*. Even corruption is *hiṃsā*. What goes on in the name of the Western concept of 'development' at the expense of nature and environment is also *hiṃsā*.

Another tenet of Jainism that follows from *ahiṃsā* is '*aparigraha*', which means not developing attachment towards anything and never craving for possessing it exclusively for oneself; if one develops attachment towards a thing, maybe one's own body or any material object, *hiṃsā* will follow. We may try to grab what belongs to others (maybe, another country or land or money or any other article) leading to invasion,

robbery or exploitation. So, non- possession is advocated because it is allied to non-stealing.

This again leads to '*asteya*', which means not stealing or not taking anything (maybe, in business or public life or private possessions) which is not properly given. It is impossible for a person to steal and, at the same time, claim to know the truth or cherish *ahimsā* or love. *Brahmacarya* (removing lust for all kinds of objects in thought and deed which is the real meaning of the word) is also related to *ahimsā* and other principles mentioned above.

All these qualities take us to the fundamental principle of '*Satya*' or truthfulness. *Ahimsā* and truth are so intertwined that they are like the two eyes; it is not possible to separate them. Without *ahimsā* it is not possible to seek and find truth. At this juncture, one is tempted to ask, 'What is truth?' The answer can be given only through '*Anekānta*' - a multi-faceted point of view. '*Anekānta*' has one rule: co-existence of opposites. Not only is existence in pairs; they have to be opposing pairs. In the entire world of nature, in the entire universe of existence, opposing pairs exist. If there is wisdom, there is ignorance. If there is vision, there is lack of it. If there is happiness, there is sadness too. If there is loss of consciousness, there is awakening. If there is death, there is life. There is the auspicious and the inauspicious, high and low, the disturbed and the undisturbed. There is gaining of strength and the loss of it. Opposing pairs define *Karmaśāstra* (the philosophy of karma)' (Mahāprajña 2002, p5). The famous declaration of Mahāvīra is: 'Reality is relative'. This doctrine of relative pluralism known as '*anekāntavāda*' necessitates tolerance because nothing could be affirmed absolutely.

Thus, the basic tenets of Jainism - inclusiveness, non-harming, not grabbing what belongs to others, non-attachment, *satya*, and *anekāntavāda* and tolerance should be actually the foundations of any civilized society. What we call 'culture' and 'civilization' can never exist without the principles listed above. It is very strange that such a religion as Jainism with a profound philosophy and practical ideas is not considered scientific!

Similarly, many other concepts in other religions (Hinduism, Buddhism, Sikhism) and the philosophical notions have scientific validity.

## 7. Global Science in a Global Language

Diversity is the law of nature. There is diversity everywhere- in nature, in culture, in language, in religion, in fashion, in food habits, and in human nature. But when it comes to science, we are not prepared to accept diversity! It is not fair to evaluate one form of knowledge using the criteria of another system. Why not apply *anekānta* to science and say that there is no one path to reality? If 'Reality is relative' as pointed out by Lord Mahāvīra, science too must be relative. This brings us to the assertion that science too is relative and local knowledge systems are nothing but science. The assumption that inner experiences like yoga and meditation may not follow predictable lines of causation and that only the outer world of physical matter can be studied objectively is erroneous. It is clear that there is inter-dependence between object/subject, percept/concept, body/mind, outer nature/inner nature. The inner sciences too were developed through observation, experimentation, critical inquiry and debate. Moreover, in India/Orient 'scientists' like Āryabhaṭa, Varāhamihira, Suśruta, Caraka, and many others have never rejected the outer sciences and there has never been a conflict between the inner and outer sciences. We have subjected the inner world to the same kind of observation, experimentation, empiricism that the West has done with the outer world. For example, Buddhist and Jain practices are based on systematic observation of the inner world. Now with the development of neuro/brain science, Western science is turning its attention to the inner world. Developments in biology, ecology are also revealing that all life forms are connected, and the inner and outer are also connected.

### 7.1 Towards Global Science

It may be a good idea to work on 'global science' that gives a comprehensive formulation of all sciences.

Oh East is East, and West is West  
And never the twain shall meet,  
The earth and sky stand presently at  
God's great judgment seat.

Wrote Rudyard Kipling (1865-1936), the Bombay-born British

author. That was in the nineteenth century; but now with globalization the world has become a 'global village' and there is one language – English-to start the dialogue, it is the right time to start it. Each system has a lot to learn from other systems; a synthesis or fusion may also emerge as another system.

What is at stake is Western scientific heritage and pride. It is a good idea to convene a global symposium for formulating global science; it can be an inter-scientific exchange: a round-table meeting not only with Aristotle, Galileo, and Newton, but also with Āryabhaṭa, Varāhamihira, Suśruta, Pāṇinī, Bhartṛhari, Dinnaaga, Nāgārjuna, Jain Ācāryas, the Persian mathematician Nasir al-Din al-Tusi, Al-Biruni, scientists from China and Japan, and the modern and contemporary scientists like Einstein, C.V. Raman, Abdul Kalam, Srinivasa Ramanujan and other 'local scientists', philosophers, and thinkers to create Global science, irrespective of the methods used - be they intuitive, rational, empirical, constructivist, analytic, or heuristic. There can't be a better place than the Bhagawan Mahavira International Research Center for a meeting for this kind of work.

We have the talent and the resources; what we need is the will.

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## **9. The perception of Indian and Jaina Thought in the Western World**

*Robert J. Zydenbos<sup>1</sup>*

### **Abstract**

As a researcher of Jainism from the West, who has studied Jainism for more than 35 years and now is teaching at Germany's foremost university, I wish to offer some thoughts on (a) the perception of Jainism, and of traditional Indian thought in general, in the Western world, (b) the difficult relationship between scientific thought on the one hand and philosophy and religious thought on the other, in the context of Western intellectual history, because this will help to explain possible obstacles for a dialogue between Jaina philosophy and science, (c) the role which Jaina philosophy can and should play in an emerging global culture, and (d) how to present Jaina philosophy in a manner that demonstrates its contemporary relevance and significance.

### **1. The Perception and Relative Status of Science, Philosophy and Religion in the West Today**

To understand how Indian thought (whether we wish to call this 'religious' or 'philosophical': a question to which we will have to return

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later) is perceived and valued in the Western world, it is first of all necessary that one acquaints oneself at least briefly with notions of religion and philosophy in the West. Only then will Western perceptions of Indian philosophy become clear.

The general tendency of thinking in the Western world, from the highest academic levels down to the very popular, in recent decades has been largely guided by the attitudes that are typical of researchers in the natural sciences: whatever is objectively measurable and can be subjected to experimentation (innumerable times, in theory) and statistic analysis forms the basis of knowledge; by contrast, ideas whose veritableness cannot be demonstrated through experimental means and are not open to the methods of statistics, can be recognized as 'opinions', 'beliefs' or 'hypotheses', but cannot qualify as 'knowledge' because they are not 'objective'. The historic theoretical base is a variety of philosophy known as positivism. Theoreticians and philosophers of science have striven to methodically remove any mental obstacles that might come in the way of achieving objective knowledge that is universally acceptable, and the collective intellectual achievement of these thinkers in this regard has had great consequences, not only in the form of the applied sciences and technology, but also in the ways in which people think in general. In the industrialized Western world, the scientific mindset has greatly influenced the way in which people think of themselves and of their fellow human beings, with consequences in law, politics, education, art, public morality, and other social spheres.

Science in its contemporary form seeks to be perfectly objective and above and beyond cultural constructs that have developed under specific historical circumstances; for this reason, scientists (if they wish to be taken seriously by the majority of the scientific community) wish to steer away from anything that could be considered religious, because religious thought typically cannot be subjected to scientific investigation and is considered a social phenomenon that has its own specific historical reasons that may be of sentimental value in a certain society but have no universal validity. Also philosophy is often viewed with suspicion by scientists if a philosopher makes statements that are beyond verification through objective scientific investigation. To the scientific mind, a traditional system of religious or philosophical thought can be a subject of scholarly investigation, but itself cannot provide guidelines or methods for scholarly or scientific investigation.

Although science strives to be objective and thereby universally valid, it would be wrong not to recognize that contemporary science, as it has spread throughout the entire industrialized world and continues to spread still further, is clearly the intellectual product of specific historical circumstances in a certain part of the world, namely, western Europe. Here we should emphasize that only *contemporary* science is relevant in the context of the present discussion. If we use the word 'science' as is nowadays customary in the English language (namely 'natural science') and understand science as a body of systematic knowledge that is experimentally verifiable and can be applied to bring about changes in the material world through technical means, then it is obvious that natural sciences have existed in various parts of the world since a very long time, to various degrees of development. But it is also clear that today, the kind of science that dominates the industrialized world, irrespective of the continent on which we observe the process of industrialization, is the science of Western Europe. It is a mode of thought that began in the historical period known as the Renaissance and gained momentum in the period which is called the Enlightenment, when most scientific progress was made in the part of Europe that comprised France, Britain, the Netherlands and Germany. There were very specific cultural reasons why science, at that time in those countries, went through such a rapid development.

If we wish to investigate how, in the context of the present conference, Jaina philosophy (or, more broadly, Indian philosophy) can play a role in the further development of science, then it is necessary that we understand (a) what in Jaina and Indian thought can be considered to be of universal validity, like science, and (b) what can fruitfully supplement modern western European thought – because that is the kind of thinking that has produced contemporary science. Any question about 'Jaina philosophy and science' essentially is a question about Jaina philosophy and western European thought. Acceptance of Jaina ideas by the scientific community means acceptance by persons whose mode of thinking basically follows the modern western European mindset, which *is* the mindset of science<sup>1</sup>.

Although science is an open field of inquiry, with differences of opinion within each scientific discipline, there is an underlying implicit philosophical basis that one cannot understand without at least some basic



knowledge of the intellectual history of Western Europe. Swami Vivekananda, living towards the end of the nineteenth century, repeatedly spoke of the 'materialistic West' and the 'spiritual East'. Strictly speaking, this is a plain untruth: all of us can see persons in India whose lives are governed by grossly materialistic desires, just as there are many persons in the West whose lives are guided by values which should be called spiritual. On an academic level, however, it is understandable why Vivekananda could make such statements: in his time, the natural sciences were making such rapid and spectacular progress that science in general began to successfully occupy the position of intellectual authority which previously had been held by philosophy and theology. This was the natural result of a long development in which, firstly, philosophy as a tool of critical thinking came to be seen as something separated from, and opposed to, religious thought; and secondly, science came to be seen as the path to true knowledge and overshadowed philosophy, which was seen as untestable and too speculative.

Here one should also realize that European philosophy, throughout most of its history, was 'the handmaid of theology', in other words: philosophical thought was not really free, but was constantly subjected to scrutiny by, and the approval of, religious authorities. The writings of the French philosopher René Descartes, who played a role of great importance in the development of the modern scientific mentality, were banned in his native France and were published in the Netherlands, because the Catholic churchly authorities in France disapproved of his ideas, whereas the Protestants in the Netherlands were considerably more tolerant of different views. The development of philosophy and early modern science in Europe was a lengthy battle against the Catholic church, which claimed unique and absolute authority for itself in all intellectual and cultural matters. As a reaction to this, philosophers and scientists increasingly developed attitudes that were deeply suspicious of everything on which the religious leaders based their claims to authority: everything that was not immediately visible and that could not be materially tested. Anything that could not be perceived and measured came to be considered suspect and probably merely imaginary, and any ideas that were based on such probably imaginary things were considered to be nothing more than fantasy and superstition.

Indian philosophical and religious history is quite different from that of Europe, because of the fundamentally different nature of Indian and

European religious thought<sup>2</sup>. Religion as understood in Europe is thought to be based on revelation: on God speaking to humanity through his prophets, and the word of God as recorded in scriptures is basically an absolute truth and holy law which cannot be questioned. Most schools of religious thought in India do not claim such absoluteness for themselves. Already the *Rgveda*, in an oft-quoted passage from its tenth book, admits that theories about the divine are a matter of open debate between the learned<sup>3</sup>.

Although there have been unfortunate instances of religious persecution and the suppression of free thought in Indian history too<sup>4</sup>, these tended to be exceptions. For educated Europeans, who are conscious of their history of religiously motivated wars, it is hard to imagine that the exchange of religious thoughts could take place so peacefully and rationally.

There are numerous anecdotes about scientists in the West who considered themselves deeply religious people (Albert Einstein is one example that is frequently mentioned). The fact, however, is that in Western culture, religion is more or less by definition considered the opposite of science: religion is based *not* primarily on reasoning and an open and free exchange of thoughts and debate, but is considered to be something essentially irrational, if not anti-rational. Religion is seen as a social force that is opposed to objective, scientific truth; it is seen as a force that often seeks to deny what is scientifically proven but itself proclaims 'truths' for which apparently no other 'proof' is required other than that an ancient text that traditionally is considered authoritative can be quoted, or, that some charismatic person declares that he has 'seen' such truths while apparently nobody else has seen or can confirm their validity.

Throughout Western religious history, which is mainly Christian history, churchly authorities have sought absolute intellectual authority and have used all means at their disposal, ranging from indoctrination of uneducated people to physical torture and threats of the death penalty, to suppress free thought and limit scientific progress. This is of course not all that can be said about Western religious history; but it is of utmost relevance for understanding the relationship between religion and science in the West. The Roman Catholic church, which was the oldest established variety of Christianity in western Europe, is known for its history of

banning the books of innovative scientists, who were brutally intimidated (and sometimes murdered): Galileo, Kepler, Copernicus, Bruno are merely a few of the better-known names of scientists who fell into disfavour with the church. The list of books that the church banned is much longer than the list of names of the persons who were persecuted. Although the history of Catholic persecution of scientists is the most brutal, other Christian groups have also propagated, and today still propagate, anti-scientific attitudes in favour of mere faith. Science developed not with the support of religion, but *in spite of* religion. The situation appears to have been more favourable in the case of the Jewish religion, but also there, religious life is basically determined by faith and obedience to ancient rules that are said to have been laid down by an omniscient god.

If today religious leaders in the West claim that their beliefs are supported or justified by scientific findings, this is the result of the enormous popular prestige which science has gained, with considerable difficulty, over the past few centuries. Religious authorities finally had no choice but to accept that scientific research leads to a highly concrete, graspable kind of knowledge whose validity cannot be denied.

Against this background of history of the relationship between science and religion, it is understandable that scientists are deeply suspicious about religious thought and will tend to resist any suggestions or criticism that are made by religious thinkers. This attitude is spreading ever further, also among less highly educated people. 'Science' is nowadays popularly equated with 'truth', and 'religion' is increasingly becoming a matter of mere traditional social custom: folklore and superstition. Throughout most of the Western world, the numbers of people who are formal members of religious communities have been decreasing over the past few decades. Ever more young people declare themselves non-religious, or they seek non-religious, philosophical answers to life's questions, or they seek religious/ philosophical alternatives which, from a Western point of view, are untraditional and unconventional: for instance, from India.

## **2. The Perception of Traditional Indian Systems of Thought in the West**

The European words 'religion' and 'philosophy', as these terms are

used today, are terms that carry with them a load of European intellectual history. After the great intellectual freedom that existed in ancient Greece and Rome, there followed the Christian period, in which philosophy was made subservient to religion and the churchly authorities. Scholastic philosophy in the Middle Ages is an attempt to justify the Christian faith and make it acceptable to doubting persons by rational means. Only from the Renaissance onwards, as already has been mentioned above, independent European intellectuals cautiously tried to challenge the intellectual authority of the church: scientists, but also philosophers. From this time onwards, after a gap of several centuries, philosophical thought began to develop to full-fledged, alternative worldviews. Religiously inspired philosophy, both Christian and Jewish, continues to exist in the West until today; but in the popular perception, there is a fundamental difference: religion is based on faith, philosophy is based on reason.

India had a very different intellectual history, and the typically Western divide between religion and philosophy never occurred. For this reason, to the Western mind, religion in India has a rather 'philosophical' character, and Indian philosophy has something of a 'religious' character. It is very difficult to describe traditional Indian thought as either 'religious' or 'philosophical', because it seems to encompass both these spheres of activity.

For almost two centuries, the West has been learning about classical systems of the three main currents of Indian thought: Hindu, Buddhist and Jaina. Broadly speaking, Western attitudes to these three main currents of Indian thought are quite different.

Hinduism is respected as a way of life (or rather: a wide collection of different ways of life) of a large section of humanity that lives in India, one of the cradles of human civilization. Only two particular and radically different varieties of Hinduism have gained serious interest among the broader public in the West. One is the devotional Hinduism of ISKCON (International Society for Krishna Consciousness), which basically is a variety of Vaiṣṇava devotionalism from Bengal. It somewhat resembles certain kinds of devotional Christianity and therefore, as a type of religion, looks familiar to Westerners. The other is *Advaitavedānta*, popularized from the nineteenth century onwards, through theosophy and later by Indian teachers who taught in the West<sup>5</sup>. Advaita has a highly intellectual,

rationalistic charm for many; but for *Advaita* to spread in the West, it had to be 'cleansed' of traditional ritualistic aspects of teaching, because these are perceived as mere traditional customs and superstition. In general it can be said that Hinduism in any other form has hardly any chance of gaining a following in the West or to be taken intellectually seriously, because Hinduism as a whole is viewed as a set of practices of a purely ethnic character. One is born a Hindu, or not; one generally does not become one, because too much in Hinduism is pure traditionalism that is never rationally and acceptably explained, including the caste system in society, which is seen as fundamentally incompatible with contemporary notions of democracy and social justice.

Buddhism has seen a steady and great growth in interest in the West over the past several decades on all levels of Western society. While Hinduism and Jainism are largely objects of curiosity or of academic interest, Buddhism is seen as a genuine religious and philosophical alternative to the schools of thought that have either originated or have traditionally developed in the West. Several prominent public personalities openly state that they are practicing Buddhists, and nobody thinks anything negative about such personal convictions. To see just to what extent Buddhism has become a part of mainstream cultural life in the West, one needs only to walk through the shopping areas of larger Western cities and to see the number of images of the Buddha and of illustrations and works of art with Buddhist imagery that are offered for sale in shops. In public intellectual life, Buddhism is very present. The academic study of Buddhism is a firmly established discipline in numerous Western universities, with intensive international and intercontinental exchanges. For instance, the centre for Buddhist studies in the University of Hamburg, Germany, regularly organizes symposiums with international participation, at which philosophical issues of immediate social relevance and importance are discussed from a Buddhist philosophical perspective. The views which are brought forward here are treated with exactly the same degree of seriousness as views from traditional Western perspectives. This is a degree of acceptance and seriousness which is impossible and unthinkable in the case of Hindu studies.

Jainism as an independent Indian intellectual tradition is hardly known in the Western world. The role which Jainism could play worldwide, its potential, is quite different from its present-day

recognition, or rather: lack of recognition. There is a growing interest in Western academic institutions in the study of Jainism, but until now this has been of a *strictly academic* interest, usually from the point of view of social studies: Jainism is studied as a purely historical phenomenon, in attempts to understand why Jaina people behave as they do, or why Jaina authors and artists have created works of literature and art in their particular manner. My readers may feel disappointed when I say, in utmost truthfulness, that until now Jainism (unlike Buddhism) has *not at all been taken seriously* as a meaningful worldview except for people who, by some odd coincidence, happen to have been born in Jaina families and who have been brought up according to Jaina traditions. If at all people in the West have ever heard of Jainism, their interest is comparable to the interest that is shown in Hinduism: an interest in exotic folklore which may be of sentimental interest to persons who were born in India, but definitely not something to which one pays serious intellectual attention.

However regrettable this situation is, the fact is that Jainism has not gained wide recognition as a style of thought that can make meaningful contributions to the solution of contemporary questions of universal importance. Jaina community media, both in print as well as electronically on the Internet, occasionally proudly mention rare non-Indian individuals who have become so impressed with Jainism that they have formally become members of the Jaina religious community and consciously live their lives according to Jaina principles. The number of such persons is negligible.

The reasons for this international lack of visibility and recognition of Jainism clearly lie with the intellectual leadership of the Jaina community as well as in the self-presentation of Jaina people who live abroad. If this is to be summarized very bluntly, one can say: if at all Jainism is known in the Western world, it is seen as a curious Indian sectarian movement which emphasizes the value of non-violence in a fanatical, irrational, totally unrealistic and superstitious manner; it may have been an interesting lifestyle in previous centuries for people in a pre-industrial tropical country, but it is not a viable lifestyle for the rest of the world. Nearly all writings on Jainism by Westerners in recent times<sup>6</sup> which express a positive appreciation of Jainism as a worldview are characterized by a highly emotionally charged interest in the protection of life, and such authors are often associated with organizations that act on

the fringes of society, such as pacifist associations, animal rights groups and organizations for the promotion of vegetarianism. Such fringe groups may earn some sympathy from broader sections of society, but they typically have no great influence on the general course of social, political and intellectual life.

Formulated differently, from a different point of view, Jainism has until now played no significant role in public debate, and it has not gained any significant recognition as a meaningful alternative worldview, because apparently Jaina thinkers have not turned their attention to questions that are considered of urgent universal importance. Here I wish to emphasize the word 'apparently', because any scholar who has made the effort to study Jaina philosophy can see that in its central ideas, Jainism deserves to be taken just as seriously as any major religious-cum-philosophical tradition in the world.

### **3. The Problem of Ethical Thought**

Science, by definition, deals with what *is*: it is based on precise observation of natural phenomena, exact and detailed documentation, and analysis according to methods of research that have become accepted within the relevant scientific discipline. The nature of science is such that spectacular progress has been made in the description, analysis and understanding of external natural phenomena (which can be observed relatively easily); but other spheres of life are much less easily accessible to a similar kind of study. Particularly, this is the case with man's inner life, the workings of the psyche and of consciousness. Typically, rapid progress has been made in the so-called neurosciences, with their extremely fine mapping of physical processes that occur in the nervous system; but this is (as is typical of the sciences) a purely objective study of a complex phenomenon. The neurosciences are invaluable tools for understanding *how* neurological processes occur; but they do not answer the question *why* they occur, or *what* they mean<sup>7</sup>. They are unable to tell us much about the subjective component of psychic processes. But it is only a thinking, conscious subject that can make statements about experience.

All knowledge obviously has a subjective component, because knowledge occurs in consciousness and is experienced as such by a thinking subject. All scientific and scholarly research consists of data, or facts, on the one hand and the interpretation and evaluation of those facts

on the other. In other words, there are data (which are objective) and there is the scientific or scholarly method (which is carried out by a conscious subject, namely, the researcher). Questions concerning which data are relevant for a certain research project, and concerning what is to be done with collected data, are answered by the research method that is followed. This is largely a philosophical matter and is in no small measure determined by the worldview of the researcher. Because the modern scientific mindset is skeptical of whatever is invisible, cannot be made visible and is unmeasurable, it will become clear why the development of psychology in the Western world was so slow in comparison to India. It is no exaggeration to say that the state of psychology in India in the time when the *Tattvārthasūtra* of Umāsvātī and the *Yogasūtra* of Patañjali were written (perhaps the first or second century CE) was more advanced than that of psychology in the West during most of the nineteenth century. However great Western progress in the natural sciences has been, progress in psychology, like any study that demanded introspection and profound self-analysis, was difficult.

Philosophy concerns itself not only with what is, but also with what may become. Ethics is that aspect of applied philosophy that concerns itself with questions of the likely consequences of our actions and the desirability of those consequences; in other words, it concerns itself with the future and thereby with what not yet is (and perhaps never will be). For this reason, science is essentially non-ethical and amoral. It deals with facts and the physical understanding of facts, and not with values.

The question of ethics in science is therefore essentially a non-scientific question: it is a philosophical one. Scientific knowledge may, of course, contribute to the making of ethical decisions if such knowledge can be extrapolated to make convincing predictions about the likely results of our decisions. But ultimately, the basic values that underlie our decisions are not determined by science. An orthodox Jaina may decide to lead a life in agreement with his understanding of the ethical value of non-violence; but this decision is in itself not more or less scientific than the decision of a suicide bomber who kills himself and possibly many other persons in a terrorist act. The ethical values of the suicide bomber differ from those of the Jaina *ahimsāvādī*; this is a philosophical matter<sup>8</sup>.



Ethical values concern the quality of our lives, and the question of the quality of our lives is a matter of how we experience our lives. In other words, ethical values by their very nature are subjective. Here again, modern Western, scientifically inspired thought has a fundamental problem. Values are invisible, cannot be measured and quantified, cannot be subjected to statistic analysis. Because the tendency in Western thought in modern times has emphasized objectivity as the basis of real knowledge, about which meaningful discussion is possible, ethical thinking has been rather weak. This is a problem which several leading philosophical scholars in the West have recognized<sup>9</sup>. Of course the Western world is not without ethical values; but the basis of those values, and of ethical thinking in general, lies in traditional religion, with which (as has been explained above) science has a very difficult relationship. New ethical problems arise with modern demographic shifts, e.g., the great influx of people from parts of the world where social values were not based on the traditional religiosity of Europe. Because religion is a 'subjective' and 'personal' matter, Western Europeans are hesitant about asserting their own values in the face of challenges from, for instance, Muslim immigrants from northern Africa and the Middle East. The scientific mindset offers few tools for discussing ethical issues, and the result is a cultural relativism in which traditional ethical values are not defended.

Similarly, developments in science pose new questions, e.g., in the field of genetic engineering. The manipulation of genomes has become technically possible; but is it also desirable? The possible benefits of genetic manipulation are great (for instance, the eradication of certain diseases, or the increase of agricultural production).

The risks are difficult to calculate. Persons who are guided by the scientific mentality tend to do whatever is possible, simply because it is possible: because of curiosity, because of an eagerness to learn more, but also because of the thrill of possessing technical power and using it. Is this an acceptable ethical value<sup>10</sup>? Characteristically, opposition to the use of new technology in the life sciences is mainly based on traditional religious values, which are a matter of faith and not of rational argumentation. This is an area where traditional Indian thought can play an important role.

#### **4. The True Strengths of the Indian Intellectual Tradition, and the Character of Jaina Ethics**

Ethics is an area where the Indian intellectual tradition can contribute much in a globalizing world. If one looks at the fields of intellectual enquiry where Indian thinkers have made exceptional achievements, one notices a common aspect. I am thinking of, for instance: (a) Linguistics. The work of the ancient Sanskrit grammarian *Pāṇini* has been of great inspiring influence in the development of modern linguistic science. (b) Mathematics. The invention of the zero and of the decimal notation of numbers had a revolutionizing effect on science and technology. (c) Psychology. Analysis of consciousness and of the workings of the psyche has been a traditional focal point in Indian philosophical thought practically from its very beginnings. (d) Logic.

What is common to all these achievements is that they essentially are based on an analysis of the inner workings of the mind. India has a long and highly developed tradition of introspection and self-analysis, as is also clear from the importance that traditionally is given to meditation and contemplation as aspects of spiritual life. It may not be wrong to assume that because of this tradition of introspection and self-analysis, India acquired its famed religious tolerance: instead of assuming that religious intuitions were the words of an all-powerful god whose words were law, such intuitions were patiently and rationally analysed, which made it possible to discuss them inter-subjectively. This is also exemplified in the Indian tradition of writing doxographies, in which various systems of thought are compared on the basis of key concepts<sup>11</sup>.

The practical ethics of Jainism centres first of all on the five primary *vrata-s* or vows, which all Jainas, whether laypersons or monks or nuns, are supposed to follow. Typically, all these five (*ahimsā*, *satya*, *asteya*, *brahmacarya*, *aparigraha*) directly concern the psychology of a person in relationship to his surroundings and serve the purpose of controlling the mind instead of allowing the subconscious inclinations of the mind to control one's actions. Jaina ethics thus is firmly rooted in introspective psychology and can be analyzed in inter subjective terms which are open to discussion. This means that Jaina ethics is *not* a matter of mere subjective faith. For an exchange of ethical ideas this is a highly valuable feature.

It is popularly assumed that Jainism is 'the religion of non-violence', and that its ethical teachings are based on the value of *ahimsā*. It is obviously true that the value of non-violence is strongly emphasized in Jainism, and Jaina ethical teaching has had far-reaching influence also outside the Jaina community. One obvious modern example is the influence of Raychandbhai Mehta on the thoughts of his pupil Mahatma Gandhi; and indirectly, through Gandhi's example, this influence reached other parts of the world. But there are reasons to doubt the centrality of *ahimsā* in Jaina thought. *Ahimsā* is merely one of the five central *vrata-s*. Also, it needs to be explained what is so special about the vow of *ahimsā*<sup>12</sup> and why adherence to it has a special effect. A scholar in Delhi, Padam Chand Shastri, has argued in a short book that actually the vow of *aparigraha*, the conscious limiting of possessions, is the cardinal Jaina virtue<sup>13</sup>.

There is much to say in favour of Shastri's idea, because if one examines the five *vrata-s* and seeks their common basis, it becomes clear that it lies in what Jaina philosophy has termed *bhedajñāna*, the 'knowledge of separateness', namely, the fundamental irreducibility of either *jīva* or *ajīva* to the respective other: the living and the non-living, the conscious and the non-conscious. Jaina thought posits that the *jīva*, the core of every living being (usually translated into English as 'soul'<sup>14</sup>), is the only entity that can live; life is largely synonymous with consciousness, and it is only that living core of every living being which is conscious. Also, the *jīva* possesses, as another of its innate qualities, the potential of perfect happiness, which is realized when it is cleansed of all karma. Karma obscures the innate qualities of the soul, and this has various consequences for the state of our consciousness.

In Jaina theory, the elimination of all karma leads to omniscience, perfect happiness, and total self-sufficiency. It is only because of the influence of karma that this realization of self-sufficiency does not occur to us; we wrongly believe that we need external things. Transgressions of the five *vrata-s* only make sense if one assumes that their opposites (violence, untruthfulness, theft, sensual indulgence and the unlimited accumulation of possessions) are beneficial to us because through them we acquire the external things that bring happiness. *Bhedajñāna*, the knowledge of the fundamental separateness of *jīva* and *ajīva*, together with the belief that the Jaina concept of the *jīva* is correct, will naturally lead to detachment.

Just as one no longer seeks large quantities of possessions, one will become disinterested in sensual indulgence, and one will also refrain from violence, untruth, and theft, which are unjust means for acquiring that for which one should not at all feel excessive interest.

The main strength of Jaina thought, as with other systems of Indian philosophical thought, lies in its analysis of the workings of the mind, in its psychology.

#### **4. Obstacles to the Reception of Jaina Philosophical Views**

From what has been said above about the history of scientific, religious and philosophical thought in the West, it will have become clear where obstacles to an exchange of thoughts between Jaina philosophy and science may lie. My readers will hopefully forgive me for pronouncing some hard truths here.

One serious obstacle is the existence of what may be called Jaina fundamentalism. This can be seen when uninformed laypeople believe that they promote the acceptance of Jaina thought throughout the world by claiming how 'scientific' it is. This idea is basically wrong and shows ignorance of what science, philosophy and religious thought are. In recent years numerous publications have appeared with titles such as 'Jainism and science', 'the scientific foundation of Jainism', etc. Such writings, which are apparently aimed at a general public, usually have one of two goals: (a) to 'scientifically prove' 'the correctness' of Jainism as a worldview, or (b) to show that Jaina philosophy, or ideas that are found in some ancient Jaina text or the other, 'prove' that ancient Jaina thinkers knew more than scientists today know. Such writing and publishing often actually harms the image of Jainism, rather than that the goals are reached. Such writing tends to reveal a disturbing ignorance of what science as an intellectual activity is, how scientific theories are validated, and also of what the place and value of philosophy are. Scientific theories and Jaina philosophical ideas are placed side by side on the basis of the most superficial resemblance in terminology<sup>15</sup>, and often the simplest of facts are distorted and misrepresented<sup>16</sup>. Such writings are not only useless, but harmful, because they create the impression with a scientifically and/or philosophically educated reading public that Jainism is not worth one's serious attention. This type of writing debases Jainism to the same level as

the kind of Christian fundamentalism of which the followers claim that they can 'scientifically prove' that the world was created in six days<sup>17</sup>.

It should also be understood that in any elaborate system of ancient thought one will be able to find some ideas which show superficial resemblance to ideas that today have found a certain degree of acceptance in the natural sciences. For instance, if ancient Jaina thinkers developed an atomic theory of physical reality (on the basis of the concept of the *paramāṇu*), this does not mean that Jainism is a 'scientific religion', as some popular authors have claimed. The ancient thinkers were not in the first place interested in explaining physical nature; they were interested in understanding experience, the nature of joy and suffering, the nature of consciousness, the processes of learning and knowing; they were looking for reasonable explanations for life and what the purpose of a human life that lasts for not more than several decades could be. Starting with observations of what is given in experience, they were more concerned with questions of what can be and should be, from the point of view of the experiencing subject, all of which can be studied through introspection.

It needs to be recognized that whatever thoughts are found about the physical universe in a few ancient Jaina texts simply cannot compete with the amount of knowledge in this field that has been acquired through the methods and tools that have been developed in modern times on the basis of ideas that first arose in western Europe. Ancient thinkers simply did not have access to these modern tools: their observations of external nature were those of the naked eye, and the possibilities of experimentation were limited. Pre-modern Indian thinkers were in the same situation as pre-modern European thinkers. Where classical Indian – also Jaina – thought excels are those areas of inquiry where not modern tools and laboratories, but introspection and critical logical investigation are needed.

Other obstacles may occur where traditional Jaina ideas are beyond scientific validation and appear highly unrealistic. For instance, the Jaina concept of *kevalajñāna* is consistent with Jaina ideas about consciousness and epistemology; but as soon as a Jaina person claims absolute validity for an ancient idea because according to tradition it was pronounced by a Tīrthaṅkara, who possessed *kevalajñāna* and therefore was omniscient, any discussion with a scientifically trained person will

end very soon, because there is no common basis for a discussion of the validity of such ideas. Jaina persons who aggressively propagate vegetarianism and thereby selectively and opportunistically quote results of scientific nutritional studies (but who, at the same time, omit the results of such studies when these do not support vegetarianism) do not serve the cause of spreading Jaina ethics but are merely regarded as arrogant and hypocritical people<sup>18</sup>.

In general, it may be said that too many persons who present themselves as representatives of Jainism towards the non-Jaina world have not given sufficient thought to finding a firm and common intellectual ground which can serve as a basis for the successful exchange of thoughts.

## **5. How Jainism can contribute to an Evolving World Culture**

The question of how the Jaina intellectual tradition can position itself in the modern world is largely the same question that concerns all traditional worldviews anywhere in the world. In ancient times, philosophers searched for answers to any questions that could be asked. In the course of time, specialized research disciplines were developed, which led to the enormous diversity of scientific disciplines which we know today. These range from mathematics, linguistics and psychology to geology and astrophysics. The sciences collect data and have their own, firmly established ways of determining what is factual and what is not. For this they possess tools which ancient thinkers did not have.

What has not fundamentally changed, however, is the other half of scientific research: the subjectivity of the researchers. Science is not only about collecting data: it is also a matter of asking relevant questions, which is the starting point of the interpretation of collected data. Human happiness is not only a matter of physical functioning. One of the great mysteries of medical science is the existence of psychosomatic illnesses: how our thoughts can harm our physical well-being. The mind-body problem in philosophy has never been conclusively solved. Humans have psychological needs that apparently have no corresponding counterpart in the physical world: for instance, the need for a sense of meaning and purpose in life<sup>19</sup>. Humans continue to need comprehensive, holistic plans for their lives.

Jaina philosophy offers a set of ideas and values that can serve as a basis for a person's orientation in the world and that can also inspire the pursuit of certain sciences in certain directions.

First and foremost, psychology is an area where thoughts from Jaina philosophy can serve as guidelines for further research. Much of Jaina karma theory is psychology, is a finely detailed description of mental processes. I can also imagine that Jaina philosophical thoughts could also inspire research in the life sciences, such as biology; it would be worth pursuing the question to what extent Jaina theories of consciousness can contribute to understanding the process of evolution<sup>20</sup>. Jaina thoughts on psychology may also prove useful for the social sciences: for psychologically understanding how individuals behave in collectives.

For the valuable core ideas of Jainism to be heard more widely, it is necessary to distinguish these from the non-universal, purely local, traditionally grown accretions which it has gathered throughout the many centuries of its history. Buddhism has succeeded in doing this and today is a worldview of worldwide significance. Hinduism has not thus succeeded, and perhaps never will. Jainism could succeed. Jainism's *anīśvaravāda*, its philosophical atheism, makes its core ideas independent from traditional ethnic beliefs and is an important factor in its universality, just as in the case of the successful broad acceptance of Buddhism; but Jainism in its theory of the *jīva* does not have the nihilistic undercurrent (*kṣaṇikavāda* and *śūnyavāda*, the doctrines of momentariness and emptiness) of Buddhism, and this could make Jainism more widely appealing. If Jainism is to contribute to today's evolving global culture, it is crucial that modern Jaina thinkers separate the thoughts that are of universal human significance from what is local and mainly of sentimental value; and science should be recognized and respected for what it is.

### End notes

1. This applies also to scientists living and working in North America, Oceania, East Asia, India, or anywhere else, insofar as such people work as scientists and not as something else (philosophers, theologians, artists, etc.).
2. For a detailed discussion of the difference, please see my article (Zydenbos [9]).

3. *Ekam sadyad viprā bahudhā vadanti.*
4. For instance, the Śaiva persecution of Jainas in Tamilnad: see Indira Viswanathan Peterson, “Śramaṇas Against the Tamil Way: Jains as Others in Tamil Śaiva Literature”, in: Cort, John (ed.), *Open Boundaries. Jain Communities and Cultures in Indian History*. State University of New York Press: Albany, 1998, pp. 163-185.
5. The effect of Swami Vivekananda's tours seems to have been rather limited in comparison to the lasting influence of later teachers such as Yogananda Paramahansa, Maharishi Mahesh Yogi and others.
6. I am not referring here to scholarly studies of Jainism by academic researchers, which have their own, historical and social-scientific value.
7. One increasingly common answer from the scientific community to such questions is that there is no answer because the questions are wrong and should not be asked in the first place: there is no reason for the existence of life, and life has no purpose, just as there is no reason for the existence of anything and nothing has any purpose, but things simply are. Such an answer is in itself, of course, implicitly philosophical, namely: nihilistic, just as, for instance, the philosophy of the Buddhist thinker Nāgārjuna can be termed nihilistic.
8. Also the question whether terrorist acts are legal or not is, ultimately, a philosophical one, because the values that underlie the legal system are ethical, i.e., philosophical values.
9. In an attempt to remedy this weakness, my university in Munich has established a separate centre of ethical studies within the department of philosophy. Such undertakings are found also at other Western institutions of learning.
10. This is the main question that is raised in the famous European drama Faust, reworked by several authors, most famously by the classical German poet Goethe.
11. Such writings were produced especially by Advaitin and Jaina authors: the perhaps best known example is the Śaḍdarśanasamgraha of Haribhadra.
12. There are numerous other religious groups in the world that give



importance to non-violence, and some of them, one could argue, are more strict in the observance of non-violence: it is not forbidden for Jaina laypersons to serve in the armed forces, whereas this is forbidden, for instance, among the Amish Mennonites, a Christian community in North America who condemn all violence towards other people, also in self-defence.

13. See Śāstrī [3] and Shastri [4].
14. One ought to be careful when speaking about the *jīva* as the 'soul', because the Jaina concept of *jīva* presupposes certain specific assumptions that are not thus presupposed when, for instance, a Christian thinker speaks about the 'soul'.
15. For instance, when it is claimed that the Jaina logical doctrine of *syādvāda* is a form of 'relativism' and 'therefore' predates Einstein's theory of relativity and, by the way, is superior to it. This is blatant nonsense. *Syādvāda* is a theory of logic and epistemology, not a theory of physics. They cannot be compared.
16. For instance, when it is claimed that the Jaina symbol of the svastika has its arms pointing in the direction opposite to that of the Nazi svastika (see K.V. Mardia, *The Scientific Foundations of Jainism*, Delhi, 1990). First of all, it is pointless to discuss what different people have done in different times and places with the same sign, and what meanings they have given to it; secondly, the claim is factually plainly wrong. One need not be a scholar to realize that a quick glance at any of innumerable photographs from the Nazi period is sufficient evidence. An informed person who sees that the author of that book fails to recognize such extremely simple facts is likely to laugh and throw the book away without reading any further.
17. For a more detailed criticism, please see the chapter "Jainism and Science, and Jainism's Self-Image" in Zydenbos [8], pp. 69-82.
18. I have discussed this in greater detail in Zydenbos [8], pp. 76-77.
19. I believe that it is very significant that the nineteenth-century French philosopher Auguste Comte, the father of the philosophical current known as positivism (which played an important role in the development of the modern sciences and denied the reality of whatever is invisible), repeatedly suffered serious problems of

mental health. Positivism is the historical basis of the sciences as they are practiced today.

20. Here I would suggest a comparison of Jainism and the work of the modern British philosopher A.N. Whitehead, e.g., his lectures that were published under the title *The Function of Reason* (Whitehead [5]). The full text of these lectures can be found on more than one internet website.

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## SECTION III: Consciousness & Life

### 10. The Jain Concept of Origin of Life vis-à-vis Scientific Theories

*Samani Chaitanya Prajna<sup>1</sup> and Samani Him Prajna<sup>1</sup>*

#### Abstract

The question of origin of life has always been a dilemma. The intellectuals of all times have tried to resolve this dilemma. They have dealt with the life phenomena from different perspectives. The Jain philosophers have also addressed the issue of the origin and evolution of life. They studied it very deeply and have discussed elaborately all its aspects.

Being a dualistic philosophy, Jainism regards that the Universe consists of two fundamental reals, viz. Living beings (*Jīva*) and Non-living elements (*Ajīva*). Both are real and eternal. They have no beginning and no end. Hence, life has always been there in the universe. The question of origin of life in a particular era of time, therefore, is meaningless.

The question of the origin and evolution of different species in different epochs and the cause of differences in their developments is addressed here. The words 'origin' and 'evolution' denote nothing but the birth, rebirth, and physical and mental development of the living beings.

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The birth, rebirth, and physical and spiritual growth of any living being depend on its karma and self-efforts. In the present paper, we discuss all the aforesaid issues to have better understanding of the origin and evolution of life from Jain perspective.

At the heart of Jainism are the three principles: soul, karma and reincarnation. Every living being has a soul which is bonded, shrouded by the karmas. It is due to the karmas that living beings undergo birth and death in different species and realms of existences.

## **1. Philosophical Background of Birth and Death**

It is necessary to ponder over substantive reasons for birth and death in order to understand their reality. The philosophers and seers identified the causes behind birth and death, as described in Mahāprajña's book [1], which are:

1. The universe (*loka*) is eternal (*śāśvata*).
2. The mundane existence (*samsāra*) is without beginning (*anādi*).
3. Every soul (*jīva*) is eternal (*nitya*).
4. There is abundance of karmas.

### **1.1 The Universe is Eternal**

The universe, better to say cosmos, is a sum of living and non-living entities. According to Bhagawān Mahāvīra, the whole universe is teeming with animate and inanimate as described in *Uttarājjhayaṇāṇi* [2, 36/2]. The universe (*lokākāśa*) has only two fundamental realities – animate (*jīva*) and inanimate (*ajīva*). The animate includes mobile (*trasa*) and immobile (*sthāvara*) living beings. The inanimate includes the medium of motion (*dharmāstikāya*), the medium of rest (*adharmaastikāya*), space (*ākāśa*), time (*kāla*) and matter (*pudgala*). All these entities are eternal and therefore the universe is also eternal. While describing the order of the universe *Bhagavatī Sūtra* states [3, 1/310]:

- 1) The air (*vāyu*) rests on the space (*ākāśa*).
- 2) The water rests on the air.

- 3) The earth (*pr̥thvī*) rests on the sea-water.
- 4) The mobile (*trasa*) and immobile (*sthāvara*) living beings (*jīva*) rest on the earth.
- 5) The non-living (especially karmic matter) is dependent on the living beings.
- 6) The embodied living beings are dependent upon the karmas.
- 7) The non-living (karmic and other matter) is accreted/ attracted by the living beings.
- 8) The living beings are affected by the non-living.

Space, air, water, earth, living beings and karmas are the foundational substances of the Universal System. In the system, the embodied soul and karma have a supporter-supported relationship. The embodied soul provides support to the karmas earned. Other way round, it can also be said that karma provides support to the embodied soul [1, p.219]. It is because the embodied soul only attracts and converts subtle invisible karmic matter into karma and without karma the soul cannot be embodied. It is the karmic matter which is responsible for the embodied state of soul. So long as karma is attached the soul undergoes cycles of birth and death.

According to Jain philosophy, the universe is without beginning and without end. It was, is and will exist forever. As hen and egg both exist simultaneously, none of them is prior or posterior, so is the universe (and trans-universe). None of them is prior or posterior [3, 1/295]. The most accepted scientific view is entirely different and assumes that the universe was created in a great explosion termed 'Big Bang'. Science asserts that creation of matter, space and time is the creation of the universe. Thus, according to science, the universe which is embodiment of living beings and non-living is not beginning-less [4, p.119].

## 1.2 The Mundane Existence is Without Beginning

In Jain view-point the universe is eternal, and the total number of souls is constant and is infinite. Neither a single soul nor a single *paramāṇu* (indivisible unit of matter) destroys or originates. Also, animate

never converts into inanimate and vice versa [5, 12/60]. A living being will always remain a living being and an inanimate matter will always remain so. The non-living entities especially *paramāṇus* are also infinite. The mundane living beings are infinite and so also are liberated souls. The mundane living beings are bound by karmas. Those souls which annihilate their karmas attain liberation (from mundane existence) and are called '*siddha*' [2,36/48]. Even after infinite number of living beings gets liberated, the universe never gets exhausted of living beings. This is because there are two sets of living beings: 1) *Vyavahāra rāśi* i.e. the living beings interacting with the practical world, and 2) *Avyavahāra rāśi* i.e. the living beings not interacting with the practical world.

The latter set comprises the subtle one-sensed living beings called *Nitya Nigoda*. *Nigoda* is a term peculiar to Jain vocabulary. Literally, it means a source and shelter of infinite number of living beings. *Nitya Nigoda* is an inexhaustible source of living beings. This is the reason why the universe will never gets exhausted of the living beings.

The *nigodas* are again of two types: gross and subtle. The *avyavahāra-rāśi-nigoda* are subtle. Whatever number of souls from *vyavahāra rāśi* attains liberation, an equal number of souls from the *avyavahāra rāśi* are transferred to *vyavahāra rāśi*. Thus, even if infinite number of souls attain liberation, the universe never gets exhausted of the living beings [6, p.6], because *avyavahāra-rāśi-nigodas* are infinitely infinite in number.

The subtle *nigodas* are very small in size (infinitesimal) and exist everywhere in the universe. Their number is infinite. All the *nigodas* are similar in many respects. There is no difference in their size, life-span, food, breathing etc. They take birth and die together as *nigoda* species at the same time [8,1/48/53-55]; such similarity is not found in any other living species. The life-span of these beings is very small. In a period of one human breath (inhalation and exhalation, about 10 seconds), they are born and die seventeen times. After remaining in the *nigoda* state for a very long time some of them enter the practical world, higher state, at a propitious time (*kāla-labdhi*) [4, p.307].

### 1.3 Life in Modern Science

Biological sciences recognize birth and death of a living being, but

assert that the living beings are created initially from inanimate matter and are reproduced from living beings thereafter. According to it the elementary life forms on the earth as single celled algae like species were formed, probably in the sea, about 4 billion years ago, by chemical reactions in an anoxic environment between ammonia, water, carbon dioxide and methane etc. due to some energy source by a process called abiogenesis, i.e. creation of animate beings from inanimate matter. Since then the living beings have been reproduced by living beings only. And it will continue so in the future. The fossil records indicate that the early life forms evolved around a billion years after the earth was formed, i.e. about 3.5 billion years ago. Prior to this there was no life on the earth. The earliest life forms were prokaryotes. In the process of evolution complex multi-cellular forms (eukaryote) were formed. About two billion years ago, the proportion of oxygen in the atmosphere increased and the atmosphere became oxidising and then came mobile beings i.e. moving in water, on the earth, and flying in the air. Then followed the mammals and lastly came the humans [7, p.3].

Evolution to human species took place about 5 million years ago in the form of Chimpanzee. In contrast, in view of Jain theory, living beings are reproduced from living beings only and never from inanimate matter [4, p.307].

#### 1.4 Abundance of Karmas

Every mundane living being is affected by eight types of karmas, e.g. 1) knowledge-obscuring (*jñānāvaraṇīya*), 2) perception-obscuring (*darśanāvaraṇīya*), 3) feeling-experiencing (*vedanīya*), 4) deluding (*mohanīya*), 5) life-span-determining (*āyusya*), 6) body-determining (*nāma*), 7) status-determining (*gotra*), 8) obstructing (*antarāya*) [8, p.284]. Out of these eight, the former four karmas are regarded as destructive (*ghātī*): knowledge-obscuring, perception-obscuring, deluding, and obstructing, as these karmas destroy the intrinsic qualities of the soul. The intrinsic qualities of the soul are infinite knowledge (*anantajñāna*), infinite perception (*anantadarśana*), infinite bliss (*anantasukha*) and infinite energy (*anantavīrya*). When the destructive karmas are totally destroyed, the intrinsic qualities of the soul manifest in their full glory. The other four karmas, viz. feeling-experiencing, body-determining, status-determining and life-span-determining, are called

non-destructive karmas. These are of two types – auspicious (*śubha*) and inauspicious (*aśubha*). Auspicious karmas bring about favourable experiences and inauspicious karmas unfavourable ones. Feeling-experiencing karmas are responsible for pleasure and pain to a living being and are called pleasure-bearing feeling (*sātāvedanīya*) and pain-bearing feeling (*asātāvedanīya*) karmas. Body-determining karmas are the cause of progress or adversity of a living being. It is also of two types – auspicious and inauspicious. The auspicious body-determining karmas endow a living being with loveliness, sweet talk, success and attractive personality. The inauspicious body-determining karma acts exactly in the opposite manner. The karma which determines the superiority or inferiority from the point of view of race, lineage, power, fame, pelf etc. is the status-determining karma. It is also of two types – auspicious and inauspicious. The karma responsible for life-time is called life-span determining karma. It too is of two types – auspicious and inauspicious [1, p.307-308].

The karma is very subtle and weird. In a human body, a large number of cells are created and destroyed every second. In other schools of philosophy in India, the karmic body is called *kārmaṇa śarīra* (literally, causal body) or subtle body (*sūkṣma śarīra*) because without karmic body the gross body of any living being cannot be formed.

In the body of all the living beings there is 'something' which does not perish with the gross body. According to Jain philosophy, the soul of a living being at the time of death is not alone but is accompanied by the two subtle bodies: karmic (*kārmaṇa-śarīra*) and electric body (*taijas-śarīra*). Attempts have been made with some instruments to photograph soul leaving a gross body at the time of death. Scientists think that it is a photograph of the soul, but the soul being non-material cannot be photographed. Such a photograph may be of the subtle body [12]. It is through the medium of karmic body that the soul takes rebirth and forms a new gross body. It is related to the process of enculturation for several life spans in various species. According to genetic science, the basic reason for the size, type, enculturation etc. is the 'gene'. There are 30 000 types of genes in a human body. In each gene chain there are 2.5 billion pairs of nucleotide bases [11, p.53]. These are responsible for determining the personality of a person. According to the theory of karma, the basic reason



of queerness of personality is the karmic body which shapes the gross body [12, p.50].

Thus, the basic reason of the birth and death, as also of personality, is karma, and the basic reason for bonding of the karma is attachment (*rāga*) and hatred (*dveṣa*) [2, 32/7]. It is because of the attachment and hatred that the soul binds itself the karmas. The karmas force the soul to wander in the four-fold mode of mundane existence (*saṃsāra*) and be born as different species.

## 2. Place of Birth (Yoni)

A living being can take birth only in suitable structures. Such a place or structure of birth of a living being is called *yonī*. In other words, the place where the physical (*audārika*) body, or transformational (*vaikrīya*) body, combines with the fiery (*taijasa*) body and karmic body is called the *yonī*.

### 2.1 Types of Yoni

In Jain philosophy, the places of birth of living beings have been discussed from two points of views: i) types of species and ii) nature of birth places. Indian thought in general and Jain thought in particular recognizes 8,400,000 *yonis* [13, 84/14]. Out of these one-sensed beings of earth-bodied (*prthvikāyika*), water-bodied (*jalakāyika*), and air-bodied (*vāyukāyika*) beings possess 7,00,000 type of *yonis* each. The two-sensed to four-sensed beings have 200,000 types of *yonis* each. The living beings belonging to gods (*deva*), hellish beings (*nārakas*), and five-sensed animal species have 400,000 *yonis* each and the humans (*manuṣya*) have 1,400,000 types of *yonis*. The individual-bodied plants (*pratyeka vanaspati*) have 1,000,000 types of *yonis* and common-bodied plants (*sādhāraṇa vanaspati*) have 1,400,000 types of *yonis* as shown in Table 1.

In Jain philosophy, the number of basic species of total *yonis* is worked out as under [14]. If we divide the number of a particular type of species by thousand and halve it, we get the number of basic species of that type. And to calculate all the combinations of them with 5 colors, 2 smells, 5 tastes, 8 touches, and 5 shapes we have to multiply the number of basic species arrived at by  $5 \times 2 \times 5 \times 8 \times 5 = 2000$ . For example, the number of

species of earth-bodied is 700,000 then the number of basic species of this type is  $700/2 = 350$ . And the total number of this species is  $350 \times 2000 = 700,000$ . Similarly, the number of basic species of water-bodied, fire-

**Table 1: The Number of *Yonis* and *Kulas* of various Types of Species.**

Type	Species (Yonis)	Lineages (Kulas)
Earth-bodied	700,000	1,200,000
Water-bodied	700,000	700,000
Fire-bodied	700,000	700,000
Air-bodied	700,000	700,000
Plant-bodied	2,400,000	2,800,000
Two-sensed	200,000	700,000
Three-sensed	200,000	800,000
Four-sensed	200,000	900,000
Five-sensed animal species	400,000	Aquatic 1,250,000 Aerial 1,200,000 Terrestrial 1,000,000 Breast-crawling reptiles 900,000 Arms-crawling reptiles 900,000
Human beings	1,400,000	1,200,000
Hellish beings	400,000	2,500,000
Deities (devas)	400,000	2,600,000

bodied, and air-bodied living beings is 350 each; of individual-bodied and common-bodied beings 500 and 700 respectively; of 2,3,4-sensed beings is 100 each; of deities, 5-sensed animals and hellish beings is 200 each; and of human beings is 700. Thus, the total number of species of all living beings will be:  $(4 \times 350 + 500 + 700 + 3 \times 100 + 3 \times 200 + 700) \times 2000 = 8,400,000$ . In fact, the actual number of birth-places of living beings is innumerable but the number of species is estimated to be 8,400,000.

In Vedic tradition, *Viṣṇupurāṇa* mentions the number of species as 8,400,000 consisting of 2,000,000 of immobiles, 900,000 of aquatics, 900,000 tortoises (*kūrma*, may be amphibians), 1,000,000 birds, 3,000,000 animals, 400,000 apes. These total to 8,200,000 after which the

living being enters the realm of human beings (8,200,00<sup>th</sup> birth) and in the 8,400,000<sup>th</sup> birth the living being enters the *brahma-yoni*. These *yonis* indicate different stages in evolution. We also come across the description of species in *Brahma Vaivarta Purāṇa* and *Padma Purāṇa* [15].

### 2.1.1 Nine Types of *Yonis*

In order to understand the nature of birth places there is mention of nine types of nature of the birth place structures in Jain philosophy. They are:

- 1) Animate (*sacitta*) – Worms are produced in the vagina of cow etc. and such vagina is called animate.
- 2) Inanimate (*acitta*) – When the birth place is free of any animate beings, it is called inanimate. Deities and hellish beings are said to have inanimate birth-places.
- 3) Mixed (*miśra*) – The birth place of the humans and animals, born off womb (*garbhaja*), is mixed since the life is conceived by union of semen of the male and ovum of the female in the vagina.
- 4) Cold (*śīta*) – The birth place of beings born in the first hell is cold.
- 5) Warm (*uṣṇa*) – The birth place in respect of fire-bodied beings is warm.
- 6) Mixed (*miśra* or *śītoṣṇa* - Cold-warm) – Deities, animals and humans born in womb have cold-warm birth places. The earth-bodied, water-bodied, air-bodied, plant-bodied, 2, 3, 4 – sensed beings, and asexually-born (*sammūrchhim*) 5-sensed animals and humans have cold, warm, and cold-warm birth places.
- 7) Whirled (*saṃvṛtta*) – Birth places of deities, hellish beings and one-sensed beings is whirled.
- (8) Non-whirled (*vivṛtta*) – the birth place of 2,3,4-sensed beings (*vikalendriya*) and asexually-born 5-sensed animals and human beings is not whirled.

- (9) Mixed or *saṃvṛta-vivṛta*- whirled-cum-non-whirled– The 5-sensed animals and human beings born in womb have whirled as well as non-whirled birth places.

## **2.2 Yoni and Kula**

A million species of insects and moths have been discovered by scientific studies. According to Jainism, there are 600,000 types of *yonis* of insects and moths which are two-sensed, three-sensed, and four-sensed beings. Scientists conjecture that there may be 8,000,000 and 9,000,000 species of insects and moths respectively [16, p.50-51]. Jain metaphysics recognizes that different types of beings which are termed as lineages (*kula*) can take birth in one type of *yonis*. Obviously, the number of lineages would outnumber the number of species. For example, dung is a type of species in which various lineages of worms, maggots, scorpions etc. can take birth. The total number of lineages in animal world is 15,750,000 [1, p.238].

## **3. Gati: Four Realms of Existence or Forms of Life**

The living beings can be divided into four categories, based on forms of life or realms of existence technically known as *gatis*. The four realms of existence are: 1) hellish beings (*naraka-gati*), 2) animal species (*tiryāṅca-gati*), 3) human beings (*manuṣya-gati*) and 4) deities (*deva-gati*). [18, p.2]. Contrary to the literal meaning of '*gati*' which is moving i.e. moving from one place to other, here it means going or transferring from one realm to another after death.

### **3.1 Hellish Beings**

The author of *Cūrṇi* of the scripture *Uttarādhyayana* has interpreted '*naraka*' (hell) as '*niyante tasmin pāpakarmāṇi iti narakāḥ/ na ramanti tasmin iti narakāḥ*'// i.e. the place where beings indulging in sinful acts are born is 'hell' (*naraka*); the place where beings are deprived of pleasures is 'hell'. [19, p.136]. Also, '*narakeṣu bhavāḥ narakāḥ*', i.e. those born in the hell are called hellish beings (*nāraka*). According to *Dhavalā*, the commentary of *Śaṭkhaṇḍāgama*, the *karmas* responsible for realm of existence in hell arise due to always performing inauspicious deeds [20,

1/1.1.24/201/6]. The hells are situated in the nether world (*adho loka*) in seven tiers named *Ratnaprabhā*, *Śarkarāprabhā* etc. [21, 3/67]. There, the pain due to extreme heat and cold is agonizing. Besides, the hellish beings are subjected to extreme physical and mental torture [22, p.159]. The hellish beings start wailing and lamenting as soon as they are born in their pitcher-like abodes. Hearing their cries, the punisher (*paramādhārmika*) deities approach them and take the hellish beings out of their abodes by cutting their bodies into pieces. However, as they have transformational (*vakraiya*) bodies, the pieces reunite to form the original bodies. They become quiver and panic by hearing the words and roars of the Satan-like deities as 'hit!', 'cut!', 'cut into pieces', 'burn!' etc. and are baffled as to where to run. Always wailing, they lead a very long life of great sorrow and pain. Not for even a moment they experience any comfort and peace. The '*naraka*' of Jain scriptures is presumed to be the same as '*pātālaloka* (netherworld)' of Hindu *Purāṇas*, 'hell' of Christianity, and '*dojakha*' of Islam. According to common view of these religions, a living being lands in the hell and chastised there for sinful acts committed in the earlier life/lives.

### 3.1.1 Causes of Birth in Hell

According to Jain philosophy, a living being is born in the hell for several reasons, as shown in the Table below [15a, 4/628; 15b, 5/4].

<i>Ṭhāṇam</i>	<i>Sūyagaḍo</i>
Intense actions by ill will	Cruel deeds
Meat-eating	Great violence
Killing living beings	Conduct without restraint
Intense greed for acquisition	Revel in inflow of inauspicious karmas

*Tattvārtha Sūtra* enlists two main reasons for beings born in the hell – i) Intensive actions with ill will and malice, ii) Intense desire for acquisition (greed) [23, 6/15]. Moreover, carrying out activities involving high violence, seven types of addictions, and vicious thoughts at the time of death are responsible for bondage of karmas for going to hells and a specified life-span therein.

### **3.1.2 Types of Hellish Beings**

According to Jain philosophy, there are seven types of hells: Ratnaprabha etc. in the lower part of the universe. The hellish beings are also of seven types depending on the first to seventh hell [13, 7/12-14].

### **3.1.3 Entry in the Realm of the Hellish Beings**

It is natural to ask 'where the living beings come from and go to on death from the hell'? The Jain seers have answered these questions in detail in the text *Gatāgata* (Going and Coming) which is summarized as follows:

- a) Entry in the realm of hellish beings (*āgatī*) – What type of living beings are born in the hells? As a rule, only living beings from the realms of humans and animals can enter various hells and beings from the realms of deities (and hellish beings) cannot be reborn in the hells. The five-sensed beings without mental faculties (*asamjñī*) cannot go beyond the first hell, arms-crawling five-sensed beings- not beyond second hell, birds- not beyond third hell, lions etc.- not beyond fourth hell, serpents - not beyond fifth hell, a female human - not beyond sixth hell, and aquatic beings can go up to the last (seventh) hell [25, 380-381].
  - i) Birth in the First Hell – Only human beings from 15 *karmabhūmis* i.e. lands of action, 5 types of five-sensed animals having mental faculties, and 5 types of five-sensed animals without mental faculties, i.e. a total of 25 types of fully developed (*pariṇāpta*) living beings, can be born in the first hell.
  - ii) Birth in the Second Hell – Only human beings from 15 *karmabhūmis* and 5 types of five-sensed animals with mental faculties, i.e. a total of 20 types of fully developed living beings can be born in the second hell.
  - iii) Birth in the Third Hell – Only human beings from 15 *karmabhūmis* and 4 types of five-sensed animals excluding fully developed arms-crawling ones, i.e. a total of 19 types of living beings can be born in the third hell.
  - iv) Birth in the Fourth Hell – Except the breast-crawling and aerial beings, the rest of 18 types of fully developed beings can be born in the fourth hell.

- v) Birth in the Fifth Hell – Only human beings from 15 *karmabhūmis* and aquatic beings and breast-crawling beings with mental faculties, i.e. a total of 17 types of fully developed living beings can be born in the fifth hell.
  - vi) Birth in the Sixth Hell – Only human beings from 15 *karmabhūmis* and only aquatics among the five-sensed animals with mental faculties, i.e. a total of 16 types of fully developed living beings can be born in the sixth hell [25, p.380-381].
  - vii) Birth in the Seventh Hell – Only human beings from 15 *karmabhūmis* excluding females and only aquatics among the five-sensed animals with mental faculties, i.e. a total of 16 types of living beings can be born in the seventh hell.
- b) Exit from the Realm of Hellish Beings – As a general rule, after completing their life-span in the hell, the hellish beings are reborn as five-sensed animals with mental faculties (*samjñī*) or as human beings [25, p.380-381]. To be specific, the living beings of the first to sixth hell on death are reborn as humans in the 15 lands of action, as developed and undeveloped aquatics among five-sensed animals with mental faculties [26, p.298]. In short, hellish beings, on death, can be reborn as humans or animals with mental faculties but not as deities or hellish beings. The hellish beings from seventh hell on death can be reborn as developed and undeveloped five-sensed animals with mental faculties. Thus, a being from seventh hell, on death, can never be reborn as a human.

### 3.2 Realm of Animal Species

*Tiryāṇca*, animals, are so called as they move in curved (*tiryaka*) path. It is also because the animal species are result of rise of animal-body-making karma. In the animal species there are one-sensed to five-sensed beings. The five-sensed beings are of two types – 1. *Sammūrchima*: those born asexually and 2. *Garbhaja*: those born of wombs. Both of these are again of two types: 1. *Samjñī*: Animals with mental faculties and 2. *Asamjñī*: Animals without mental faculties. [2, 36/170-171; 21, 1/34]. Excluding human beings and those born by emergence (*upapāta*), i.e. deities (born by emerging on a flower bed in the heavens) and hellish

beings (born by emergence in pitcher-like abodes in the hells), all other living beings belong to the animal species. The animal species, except the one-sensed subtle beings, exist only in the middle universe.

### **3.2.1 Reasons for being born in the realm of animals**

The reasons are deceit (*māyā*), intense deceit (*guḍhamāyā*), untruthful speech, fraudulent weighing (*kūṭatola*), fraudulent measuring (*kūṭamāpa*) etc.

### **3.2.2 Types of animal species**

There are five types of animal species having one-sense to five-senses as follows:

#### **3.2.2.1 One-sensed living beings**

There are 5 types of one-sensed or immobile living beings – 1) earth-bodied, 2) water-bodied, 3) fire-bodied, 4) air-bodied and 5) plant-bodied.

- a) Earth-bodied (*prthvīkāya*) – The living beings having the hard earth as their body are called earth-bodied beings. Intrinsically, clay, rock salt, ores of gold, mica, silver etc. are earth-bodied living beings [28, 4/4]. The earth is regarded as animate (*sacitta*) before application of force by implements and tools. The earth-bodied beings are innumerable (*asaṅkhyā*). There are two main types of earth-bodied beings – 1) subtle (*sūkṣma*) and 2) gross (*bādara*). The subtle earth-bodied beings are so small that they cannot be seen with naked eyes. Gross earth-bodied living beings have gross structure. If the body of each of the earth-bodied beings of a clay-ball is magnified to the size of a gooseberry (*Āvalā*) fruit then they cannot be accommodated even in *Jambūdvīpa* which has a diameter of 100000 *yojans* [27, p.138].
- b) Water-bodied (*apkāya*) – The living beings having water as their bodies are called water-bodied immobile living beings, e.g. pure water, dew, snow, pond (water), mist, fog etc. are some examples of water-bodied beings [28, 4/5]. Such beings are innumerable. If each of such beings in a drop of water is magnified to the extent of a mustard seed, all of them could not be accommodated even in



- whole of *Jambudvīpa*. Without the intervention of any implement or tools, the water bodies are animate beings [27, p.138].
- c) Fire-bodied (*tejaskāya*) – The living beings with body of fire (or energy) are the fire-bodied beings [2, 36/109]. Ember, burning chaff, fire, radiation, flame, meteor, lightening etc. are examples of the fire-bodied beings [27, p.138]. Their number is innumerable. If each of fire-bodied beings in a spark is magnified to the size of a louse, then they would not be accommodated even in *Jambudvīpa*.
  - d) Air-bodied (*vāyukāya*) – The living beings with the characteristics of moving air are called the air-bodied beings [2, 36/118]. Surging air (*utkalikā*), packets of air (*maṇḍalikā*), wind (*ghanavāyu*), reverberating wind (*guṇjāvāyu*), storm (*saṃvartakavāyu*) etc. are examples of air-bodied beings [1, p.280-281]. If not intervened by implements or tools, the air is an animate thing. They are innumerable such that if each of the air-bodied beings occupying an area touched by a leaf of *nīma* tree is magnified to the extent of a poppy seed, they would not be accommodated even in the whole of *Jambūdvīpa* [27, p.138].
  - e) Plant-bodied (*vanaspati*) – The living beings with the vine-like bodies are called the plant-bodied beings [18, p.11]. There are two types of plant-bodied beings – individual-bodied (*pratyeka śarīra*) and common-bodied (*sādhāraṇa śarīra*). Individual bodied is one where one plant has one soul only, e.g. trees like mango etc., vines like bitter gourd, cucumber etc., grasses like panicum (*dūba*) etc., green vegetables, lotus etc. [18, p.11]. In the individual-bodied plant, there is only one soul which creates the body. However, there can be innumerable living beings sheltered in its body. In common-bodied, there are infinite souls who create the body. In other words, common-bodied plant is one where one plant has infinite number of souls. All sorts of root vegetables belong to the common-bodied plant beings. In this category, the living beings are infinitesimally small in size. Infinite living beings of this size can be accommodated on the tip of a needle. There are two examples to clarify how infinite souls can reside in a body: 1) As in some of medicinal concentrates even the medicine occupying the tip of a needle may contain the properties of hundred thousand different medical recipes, in the same way infinite souls can live in

a body. 2) In the same way as fire enters into an iron ball, infinite souls enter a body. These examples reveal the minuteness of the common-bodied plant beings.

### **3.2.2.2 Types of birth of *vanaspati***

From the view point of birth (origin), plant-bodied beings can be divided in 8 classes [28, 4/8] :

1) Tip-seeded (*agrabīja*) – the tips of these plants serve as the seeds, e.g. yellow amaranth etc. 2) Root-seeded (*mūlabīja*) – the roots of these plants serve as the seeds, e.g. radish etc. 3) *Parvabīja* (node-seeded) – the knots of these plants serve as the seeds, e.g. sugarcane etc. 4) Branch-seeded (*skandhabīja*) – The branches of these plants serve as the seeds, e.g. *olibanum* (*śallakī*), eggplant (*kaṇṭakī*) etc. 5) Seeds only (*bījarūha*) – These plants sprout only from the seeds, e.g. wheat, rice etc. 6) Asexual (*sammūrcchim*) – These plants grow by themselves, e.g. fungus, moss etc. 7) Grasses (*trṇa*). 8) Vines (*latā*) – These are vines of *sampangi*, jasmine, watermelon etc. Without the intervention of tools, the plant-bodied beings behave like animate beings.

### **3.2.2.3 Two types of one-sensed beings**

The five types of immobile beings are subtle as well as gross. The entire universe is full of the subtle beings; the gross beings occupy only part of the universe [2, 36/78]. As mentioned before, among the subtle ones, the plant-bodied living beings are also known as *nigoda*. The point worthy to note here in regard to the five one-sensed living beings is that earth (*prthvī*), water (*apa*), fire (*tejas*) and air (*vāyu*) – these type of life-clusters are an assemblage or group of living beings. A clod of mud, a drop of water, a spark of fire and a draft of air are compact collections of innumerable bodies of innumerable souls. Their bodies are of infinitesimal size. One cannot see their individual bodies. Their assemblages only are visible [37, p. 74]. Jain philosophy asserts that plants are sentient beings. Now, 2500 years after Bhagawān Mahāvīra propounded that plants are living beings; scientific studies have confirmed this fact and other schools of thought have recognized it.

According to scientific studies, single-cellular beings like bacteria and virus etc. occupy the earth, water, air, and inhabit the bodies of

humans, animals, birds etc. These are invisibly small in size and their number doubles very fast. The biological sciences treat them in the class of plants. Jain concept of *nigoda* is parallel to this concept.

**Entry in and exit from the realm of earth-bodied, water-bodied and plant-bodied beings** – From what realm the living beings come to these realms and where do they go on death? Bhagawān Mahāvīra clarified that 101 types of human beings without mental faculties, 48 types of animal species, 30 types of developed and undeveloped human beings of 15 *karmabhūmis*, and 64 types of deities (10 mansion-dwelling deities, 15 satanic deities, 16 forest-dwelling deities, 10 demonic deities, 10 astral deities, celestial deities of first and second heaven, and first type of menial deity) on death can be born in the realm of earth/water/plant-bodied beings. On the other hand, earth/water/plant-bodied beings on death can be reborn in the realms of 101 types of human beings without mental faculties, 48 types of animal species, and 30 types of developed and undeveloped human beings of 15 *karmabhūmis*, i.e. in a total of 179 types of species.

**Entry in and exit from the realm of fire-bodied and air-bodied beings** – As narrated above, 179 types of living beings on death can be reborn in these realms (fire/air-bodied). On death from these realms (fire/air-bodied) the beings are born in 48 types of animal species.

### 3.2.3 Two-sensed beings

Beings having two sense organs of touch and taste are classified as two-sensed mobile beings. Their life-span is a minimum of an *antaramuhūrta* (period of two moments or one moment less than 48 minutes) and a maximum of 12 years [2, 36/132].

### 3.2.4 Three-sensed beings

These are living beings with three sense organs of touch, taste and smell. Their life-span ranges between a minimum of an *antaramuhūrta* and a maximum of 49 days [2, 36/141].

### 3.2.5 Four-sensed beings

These are beings having four sense organs of touch, taste, smell

and vision. Flies, mosquitoes etc. are considered as four-sensed beings. Their life-span varies between a minimum of an *antaramuhūrta* and a maximum of 6 months [2, 36/151].

**Entry in and exit from the realm of two- to four-sensed (imperfect) living beings** – The mini-commentary *Gatāgata* discusses about the realms from which living beings enter the realm of imperfect-sensed living beings and to which realm these beings go after death. The beings taking birth in the realm of imperfect-sensed beings are – 101 types of human beings without mental faculties, 48 types of animal species, and developed and undeveloped beings of 15 *karmabhūmīs*, i.e. a total of 179 types of imperfect-sensed living beings. On death they can be reborn in the same realms [25, p. 382].

### **3.2.6 Five-sensed animal species**

The five-sensed animals are of two types: 1) asexually born (*sammūrcchīm*) and 2) born of womb (*garbhaja*). Each of these can be further divided in three classes [28,4/9]:

- i) aquatic (*jalacara*) – those living in water, e.g. fish, crocodile etc.,
- ii) aerial (*khecara*) – those flying in the air, e.g. birds etc., and iii) terrestrial (*sthalacara*) – living on land, e.g. cow, buffalo etc. [2, 36/170-171; 21, 1/34].

**Entry in and exit from five-sensed animal species** - Souls of five-sensed animals can come from all the four realms of existence, viz. deities, human beings, animals, and hellish beings; on death they may be born in any of the four realms [28, 4/9].

## **3.3 Realm of Existence as human beings**

A human being is born in *manuṣya gati* and has the highest potential for (spiritual) development among all the living beings. Human beings are capable of thinking, contemplating and pursuing their goals.

### **3.3.1 Reasons for being born in the realm of existence of human beings**

- 1) Simplicity, 2) lack of envy, 3) kindness, and 4) modesty

determine the birth as humans [15, 4/630]. From karma point of view, the destruction of karmas obstructing the realm of human beings and rise of karmas of human structure (*manuṣya ānupūrvī*) are responsible for a soul to be born as a human.

### 3.3.2 Types of Human Beings

Human beings are of two types – 1) asexually born, and 2) born in womb [2, 36/197].

- a) Asexually born – The asexually born human beings take birth in 14 places including excreta of human body such as urine, blood etc. Mind does not develop in this type of living beings and they are called *asaṃjñī* i.e. human beings without mental faculties [2, 36/195]. They have very short span of life less than one *antarmuhūrta*
- b) Born in womb – These human beings are born in womb. They possess mind and are called *saṃjñī* i.e. having mental faculties. They are divided into following three categories [2, 36/196]:
  - i) **Human beings on lands of action** – These human beings are so called as they are born in *karmabhūmis* i.e. lands of action. For their subsistence they undertake the profession of a warrior (*asī*), writer (*masī*), agriculturist (*kṛṣī*) etc. There are 15 *karmabhūmis* –regions of 5 *Bharata*, 5 *Airāvata*, and 5 *Mahāvideha*.
  - ii) **Human beings on lands of non-action** – These humans do not undertake the professions of agriculture etc. in *akarmabhūmis* i.e. lands of non-action. Their needs are fulfilled by the wish-granting trees (*kalpavṛkṣa*). Here humans are born as twins (one male and the other female). There are 30 *akarmabhūmis* – the regions of 5 *Haimavata*, 5 *Harīvarṣa*, 5 *Devakuru*, 5 *Uttarakuru*, 5 *Ramyakavarṣa*, and 5 *Hairāṇyavata*.
  - iii) **Island-dwelling human beings (*antardvīpaja manuṣya*)** – There are 56 islands in the *Lavaṇa* Sea. The humans born on these islands are called as island-dwelling human beings. They are of 28 types.

### **3.3.3 Entry in and exit from realm of human beings with mental faculty**

According to the scripture *Thāṇaṃ*, to take birth as a human being, the soul can come from any of the realms of hell, animal species, human beings and deities, and, after death, can take birth in any of these four realms [15, 4/615]. The detailed treatment of entry in and exit from the human realm is available in '*Gatāgata*'. The specific details are as follows:

- a) **Entry in the realm of human beings having mental faculty-**  
According to the text, a total of 276 types of living beings can be born in the realm of human beings with mental faculties. They are as follows: 101 types of human beings without mental faculties residing in the unholy places such as excreta, urine etc., 101 types of human beings with mental faculties (of 15 *karmabhūmis*, 30 *akarmabhūmis*, and 56 islands of *Lavaṇa* Sea), 30 types of human beings (15 types of human beings (of 15 *karmabhūmis*) x2 (developed and undeveloped), 48 types of animal species (2 (earth-bodied, water-bodied) x2 (fine, gross) x 2 (developed, undeveloped) = 8, 6 (fine (*sūkṣama*) plant-bodied – developed and undeveloped = 2 + gross plant-bodied – individual-bodied, common-bodied – developed and undeveloped = 4), 6 (2,3,4-sensed beings – developed and undeveloped), 20 (aquatics, terrestrial, breast-crawling, arms-crawling, aerial – with/without mental faculties – developed and non-developed), 6 types of fully developed hellish beings, 99 types of deities (10 mansion-dwelling (*bhavanapati*), 15 satanic (*paramādhārmika*), 16 forest-dwelling (*vānavyantara*), 10 demonic (*trijambhṛka*), 10 astral deities (*jyotiṣka*), 3 *kilviṣika* (menial celestial beings), 9 deities in higher heavens (*lokāntika*), 12 celestial (*vaimānika*), 9 *graiveyaka* (deities in heavens just above 12 celestial heavens of *vaimānikas*), 5 *anuttaras* (deities in the heaven just above *graiveyakas*)). Thus, a total of 276 types of living beings can be born in the realm of human beings with mental faculties [25,381-382].
- b) **Exit from the Realm of human beings with mental faculties –**  
There are 563 types of living beings in all the four realms of existences. Human beings with mental faculties, after death, can be born in anyone of these realms depending on his/her past life. Hence, in Jain view, the Evolution Theory does not work in all

individual cases.

- c) **Entry in the realm of existence of human beings without mental faculties (*asaṃjñī*)** – Living beings lacking mental faculties are called *asaṃjñī*. The deities, hellish beings, fire-bodied beings and air-bodied beings – fine and gross, developed and undeveloped (8 types), on death, cannot be born as human beings without mental faculties. 101 types of human beings without mental faculties, 48 types of beings from animal species excluding the 8 of fire-bodied and air-bodied ones, and humans of 15 lands of action – developed and undeveloped (i.e. 30 types), on death, can be born as human beings without mental faculties, i.e. a total of 171 types of beings can be born as humans without mental faculties. [25, p. 380-381].
- d) **Exit from the realm of human beings without mental faculties (*asaṃjñī*)**: Humans without mental faculties can be born in any of the above mentioned 179 types of human and animal beings.

### 3.4 Realm of Deities (*deva gati*)

'*Divyanti nirupamakrīdāmanubhavantīti devāḥ*', i.e. those who experience heavenly enjoyments are called *devas* (deities) [30, p.77]. Their bodies are formed of excellent fiery atoms.

#### 3.4.1 Types of Deities

There are 4 types of deities – mansion-dwelling (*bhavanapati*), forest-dwelling (*vyantara*), astral (*jyotiṣka*), and celestial (*vaimānika*) [2, 36/204].

a) **Mansion-dwelling** – These deities are living in shelters on/in the earth and other earth like planets [31,p.702]. They are of 10 types – *asurakumāra* (demonic), *nāgakumāra* (serpent-like), etc.

b) **Forest-dwelling** – These deities have their abodes on hills, caves, gardens, forests etc. They are of 8 types: 1) *piśāca* (devil), 2) *bhūta* (ghost), 3) *yakṣa* (wish-granting demigod), 4) *rākṣasa* (demon), 5) *kinnara* (singing-dancing deities), 6) *kimpuruṣa* (horse-headed deities), 7) *mahoraga* (python-like demigod), 8) *gandharva* (musician deities) [2, 36/207].

c) **Astral** – The moving ships of these deities are luminescent [31, p.701]. They are of 5 types – moon (*candra*), sun (*sūrya*), planet (*graha*), asterism (*nakṣatra*), and star (*tārā*) [2, 36/208].

d) **Celestial** – The abodes of these deities are also like flying ships (*vimāna*) and hence they are called '*vaimānika*' deities. They are of 2 types – heavenly (*kalpopanna*, born in the lower 12 heavens) and super-heavenly (*kalpātīta*, born in heavens situated above the 12 lower heavens) [2, 36/210-211].

**Deities born in Lower Heavens** – These deities are born in heaven where the system of *Indra* (Chief of deities) etc. prevails. They are of 12 types: those born in heaven named 1) *Saudharma*, 2) *Īśāna*, 3) *Sanatkumāra*, 4) *Māhendra*, 5) *Brahmaloka*, 6) *Lāntaka*, 7) *Mahāśukra*, 8) *Sahasrāra*, 9) *Ānata*, 10) *Prāṇata*, 11) *Āraṇa*, 12) *Acyuta* [2, 36/212].

**Deities born in Super Heavens** – These are the deities born in higher heavens above the 12<sup>th</sup> heaven of *Saudharma* etc. These are the heavens of *Graiveyaka* and *Anuttara*. The system in these heavens does not have the hierarchies like *Indra* (Chief of deities), servicing deities, counseling deities etc. i.e. all deities have similar powers. These deities are of 2 types: those belonging to *Graiveyakas* and those belonging to *Anuttaras* [2, 36/212].

**Deities of *Graiveyakas*** – The universe is supposed to be shaped like a person standing with arms stretched. These deities stay in flying ships situated at the location of neck (*grīvā*) and hence they are called *Graiveyakas* [31, p.702]. They are of 9 types, viz. 1) lower-lower, 2) lower-middle, 3) lower-upper, 4) middle-lower, 5) middle-middle, 6) middle-upper, 7) upper-lower, 8) upper-middle, and 9) upper-upper according to the location of heaven [2, 36/213-215].

**Deities of *Anuttaras*** – As regards influence, pleasures, luster, disposition etc., these deities are regarded as the best (*anuttara*) and hence they are called so [31, p.702]. They are of five types – *Vijaya*, *Vaijayanta*, *Jayanta*, *Aparājita*, and *Sarvārthasiddhi* (for dwelling in ships of same names) [2, 36/215-216].



### 3.4.2 Causes to be born as Deities

The scripture *Thāṇaṃ* and the commentary *Sukhabodha* of the scripture *Uttarādhyayana* narrate the causes for being born as deities. According to *Thāṇaṃ*, the causes are – 1) restraint with attachment (*sarāga saṃyama*), i.e. the restraint observed by a monk with passions; 2) restraint- non-restraint, i.e. to observe the vows partially; 3) penances undertaken by heretic monks (*bālatapa*); 4) penances undertaken without the goal of emancipation (*akāma nirjarā*) etc. [15, 4/631]. Alternatively, the causes are stated as: i) observance of restraints and penances with attachment, ii) practicing mini-vows (*aṃuvrata*), iii) subduing of mind and senses, iv) attachment towards heretical penances.

Specific Causes for being born as demonic deities (*asura deva*): a) indulgence in heretical penances, b) intense anger, c) conceit over penances, and d) deep animosity.

Specific Causes for being born as forest-dwelling deities (*vyantara deva*): i) committing suicide by hanging oneself, ii) death by consuming poison, iii) death by fire, iv) death by drowning [35].

### 3.4.3 Entry in the Realm of Deities

The 10 types of mansion-dwelling deities, 15 types of punisher deities, 16 types of forest-dwelling deities, 10 types of demonic deities (i.e. a total of 51 types of deities) can come only from the realms of 101 types of human beings with mental faculties, 5 types of animals with mental faculties, and 5 types of fully developed five-sensed animals without mental faculties, i.e. a total of 111 types of living beings.

Living beings born as astral deities and celestial deities of first heaven: They come from only human beings from 15 *karmabhūmis*, twins of 30 *akarmabhūmis*, and 5 types of five-sensed animals with mental faculties, i.e. a total of 50 types of living beings [25II, p.381].

Living beings born as deities in the second heaven: They come from only the

realm of human beings from 15 *karmabhūmis*, 5 types of five-sensed animals with mental faculties, 20 types of twins from *akarmabhūmis*

(excluding 5 types of *Haimavata* and 5 of *Hairāṇyavata*), i.e. a total of 40 types of living beings.

**Living Beings born as first type of Menial (*Kilviṣika*) Deities:**  
They can come only from the realm of human beings of 15 *karmabhūmis*, 5 types of five-sensed animals with mental faculties and 5 types of developed human beings from each of *Devakuru* and *Uttarakuru*, i.e. a total of 30 types.

Living beings born as second and third types of menial deities and as celestial deities from third to eighth heaven: these can come from only the realms of human beings of 15 *karmabhūmis* and 5 types of five-sensed animals with mental faculties, i.e. a total of 20 types.

Living beings born in the ninth heaven upwards up to *Sarvārthasiddhi*. They come from only the realm of humans from 15 *karmabhūmis* [25II, p.381-382].

#### **3.4.4 Exit from the Realm of Deities**

After exiting from the realm of deities due to death, the living beings cannot be born again as deities or as hellish beings. The mansion-dwelling, forest-dwelling, astral deities and deities of first and second heavens, on death, can be born only as human beings on 15 *karmabhūmis* or as 5 types of five-sensed animals with mental faculties or as earth-bodied, water-bodied and plant-bodied beings. The deities from third to eighth heaven on death can be born only as human beings on 15 *karmabhūmis* or as 5 types of five-sensed animals with mental faculties. The deities of ninth heaven onwards up to the *Sarvārthasiddhi* can be born only as human beings on 15 *karmabhūmis* [14, p.53].

### **4. Pregnancy**

The end point of life is death and the starting point is birth. *Bhagavatī Sūtra* describes in detail the growth of a fetus in the mother's womb in respect of its time duration, development, sense organs, respiration etc. Indrabhūti Gautama, the Chief disciple (*Gaṇadhara*), asks Mahāvīra many questions related to pregnancy. For example, Gautama asks whether the soul entering a new realm (birth) does so with or without predetermined life-span. Mahāvīra replies that every being starts a new

life with predetermined life-span and not without predetermined life-span. This is because a being's life span is determined by the karmas in the previous life [3, 5/59-60]. A question about formation of sense organs in the womb was resolved by Mahāvīra by stating that, from 'substance' point of view, such living being is without physical senses but from 'essence' point of view it possesses sense organs [3, 1/340-341].

When questioned about body, Mahāvīra explains – from the point of view of gross body- soul (*jīva*) is without a body and from the view-point of subtle body the soul possesses a body [3, 1/342-343]. This implies that physical body is not formed merely by combination of five basic elements (*pañcamahābhūta*) but the previously bonded karmas are instrumental in the formation of the body. *Vātsyāyana*, in his commentary on *Nyāyasūtra*, while enlisting the contemporary theories, supports the theory of karmas being instrumental for the formation of the body. He declared that formation of body and incidences of sorrows and pleasures without interplay of karmas is a misbelief [32, 3/2/59, 60, 72]. The processes of birth and death have not been studied in depth by medical science in the modern times and combination of the semen of father and ovum of mother is taken as a cause of conception and formation of the body, and mind is formed later [7, p.106].

What sort of diet is consumed by a baby in the womb? What sustains the current life? In this respect Mahāvīra states that "When the soul discards the old body and enters the new womb, it first sustains itself on the diet of mixture of ovum of the mother and semen of the father [3, 1/344]. Diet is of three types – 1) for vigour (*oja*), 2) by thistledown or hair (*roma*), 3) by morsel (*kavala*) or by mouth intake (*prakṣepa*) [6, p.89]. During the first few moments of birth, the matter particles suitable for the formation of the physical body (like sperm and ovum) are absorbed. This is the vigour intake. Intake by skin pores is absorption of oxygen, air etc. and this takes place throughout the life. Thirdly, morsel (intake) diet includes all sorts of foods and drinks. The fetus in the womb does not take this diet but depends on the diet of the mother. The respiration of the fetus too depends on the mother's [3, 1/345-349]. According to Indian Medicinal system of *Āyurveda*, the oxygen and nourishing diet of the mother is transferred to the fetus through the placenta. Similarly, carbon-di-oxide, urine etc. are thrown out using the medium of the mother.

## **4.1 Life of Fetus and Number of Living Beings in Womb**

According to some Jain texts, the minimum life of fetus is *antaramuhūrta* (little less than 48 minutes) and the maximum is 8 years [3, 2/83]. In case of human beings such gestation period is a minimum of an *antaramuhūrta* and a maximum of 24 years. [3, 2/84]. If a being takes birth after staying in the womb for 12 years, it dies immediately and enters the previous body in the womb and stays there for another 12 years. For this reason the maximum life-span in the womb for human beings is 24 years. In the womb of a woman one, two up to 9,00,000 living beings can be conceived, but all of them do not develop fully and most of them die prematurely [3, 2/88].

## **4.2 Process of Body Formation in the Womb**

Jainism regards that a living being in the womb assimilates the food it receives and from that matter builds its body. On death the living being discards the body which becomes life-less. According to science, a life is created by unification of the semen of a male and ovum of a female. And, at the time of death various parts of the body stop working and all the processes in the body come to a stop. This is clinically termed as death [4, p.308].

In spite of some similarities in Jain and scientific views, there is a major disagreement in the concepts of birth and death. Jain view is that a soul enters the womb at the conception stage and it exits from the body upon death. The enculturation of previous births stays as records in the *kārmic* body which is carried forward with the soul and is responsible for formation of new physical body. Science describes this process in a rather different manner; the cells in the semen and ovum carry parental characteristics and help form the physical body. One can probably compare *kārmic* body of Jainism as 'form producing code' of the soul that enters the womb at the time of impregnation [4, p.308].

A living being takes birth and ultimately meets its death, but the death does not obliterate its existence. Death takes place at some place and is followed by birth at another place. The cycle of births and deaths is continuing from time immemorial and will continue till liberation of the soul from the karmas. According to Jainism, the body is perishable but this

mortal body carries an entity, i.e. soul, which is ever young, immortal and imperishable. Bound by karmas, it assumes different forms. This process of assuming a new body and discarding the old body by the soul is what one understands as birth and death respectively [4, p.277]. There are some agreements and some differences between Jain theory and scientific models of conception, birth and death.

## 5. Duration of Life

In Jain philosophy, duration of life has been discussed in the following two ways:

- a) **Duration of Life in a Realm (*bhavasthiti*)** – The duration for which a being lives in a particular realm (species) uninterrupted is called *bhavasthiti* or life-span [31, p.690].
- b) **Duration of Life in a Body (*kāyasthiti*)** – This is the total duration of being born repeatedly in the same realm continuously [31, p.690].

**Life-span and duration of living beings:** Briefly, the deities and hellish beings after death are not reborn within the same realm of existence. In these cases the life-span in a particular realm and the life duration of body are the same. The two/three/four-sensed beings can take birth repeatedly within their realm (animal) for thousands of years. The five-sensed human beings and animals can take birth in their own realms repeatedly seven or eight times. The five-sensed animals have the duration of their bodies for a minimum of an *antaramuhūrta* and a maximum of three *palyopamas* plus 2 to 9 *pūrvakoṭi*. The earth/water/fire/air-bodied beings can be born again and again in their class for innumerable number of ascending and descending time cycles (*utsarpiṇīs* and *avasarpiṇīs*) [2, p.187]. The life-span and duration of the living beings are discussed in detail in the text *Gatāgata* as follows:

**Life-span of the hellish being:** The life-span and duration of a hellish being is a minimum of 10,000 years and a maximum of 33 *sāgaropamas* (an innumerable large quantity of measure of time analogous with the vastness of oceans). This time scale is also used on earth. Duration of body (*kāyasthiti*) of a hellish being is the same as its life-span (*bhavasthiti*).

Life-span of the earth-bodied being is a minimum of an *antaramuhūrta* and maximum of 22000 years [2, 36/80]. Duration in the body of the earth-bodied being ranges between a minimum of an *antaramuhūrta* to a maximum of innumerable *samaya*.

Life-span of the water-bodied being is a minimum of an *antaramuhūrta* and a maximum of 7000 years [2, 36/88]. Duration in the body of the water-bodied being ranges between a minimum of one *antaramuhūrta* and a maximum of innumerable *samaya* [2, 36/89].

Life-span of the fire-bodied being is a minimum of one *antaramuhūrta* and a maximum of 3 day-nights [2, 36/113]. Duration in the body of the fire-bodied being is a minimum of *antaramuhūrta* and a maximum of innumerable *samaya*. [2, 36/114].

Life-span of air-bodied being varies between a minimum of one *antaramuhūrta* and a maximum of 3000 years [2, 36/123]. Duration in the body of the air-bodied being is a minimum of one *antaramuhūrta* and a maximum of innumerable *samaya* [2, 36/123].

Life-span of an aquatic being is a minimum of one *antaramuhūrta* and a maximum of one *pūrvakoṭi* (= 705,600,000,000,000,000 years i.e.  $7.056 \times 10^{20}$  years) [2, 36/175]. Duration in the body of the aquatic being is a minimum of one *antaramuhūrta* and a maximum of 2 to 9 *pūrvakoṭis* [2, 36/176].

Life-span of a terrestrial being is a minimum of one *antaramuhūrta* and a maximum of 3 *palyopama* (a large measure of time determined by analogy with a pit filled with pieces of hairs).

Duration in the body of the terrestrial being is minimum of an *antaramuhūrta* and a maximum of 2 to 9 crore (*koṭi*) plus 3 *palyopama* [2, 36/184-185].

Life-span of an avian being is minimum of one *antaramuhūrta* and maximum of innumerable-th part of a *palyopama*. Duration in the body of the avian being is a minimum of an *antaramuhūrta* and a maximum of 2 to 9 crore (*koṭi*) plus innumerable-th part of a *palyopama*.

Life-span of the plant-bodied being is a minimum of one

*antaramuhūrta* and a maximum of 10000 years [2, 36/102]. Duration in the body of the plant-bodied being ranges between a minimum of one *antaramuhūrta* and infinite time.

## 6. Process of Creation (Birth)

The process of birth is not the same in different types of living beings. The process of birth of a human baby is different from that of a plant. The human baby is born from the womb of the mother, while a plant is born from the earth.

### 6.1 Types of Birth

From the view-point of process, birth is of 3 types: 1) asexual (*sammūrccchana*), 2) from the womb (*garbhaja*) and 3) emergence (*upapāta*) [34].

**a) Asexual** – When the place of birth is not identified and the birth is not from the womb, it is called an asexual birth. Living beings with one to four sense organs are said to be asexually born. The living beings i.e. five-sensed human beings and animals without mental faculties born in 14 places like excreta, urine, phlegm etc. are also of asexual birth.

**b) From the Womb** – Those born by combination of semen of a male and ovum of a female are said to be born from the womb. Such process of birth is of 3 types – 1) oviparous (*aṇḍaja*), 2) from womb but without placenta (*potaja*) and 3) viviparous (*jarāyuja*).

**c) Emergence (*upapāta*)** – Those who 'emerge' in bed-like places are said to take birth by emergence. The deities and hellish beings take birth in this manner. The hellish beings are born in very hard stone-like beds in holes with small opening. The deities are born on flower beds.

### 6.2 Eight Types of Birth Processes

Two-sensed to five-sensed mobile living beings are divided into eight categories depending on their types of birth [28, 4/9]:

- 1) **Oviparous (*aṇḍaja*)**, the living beings born from egg, e.g. birds etc.

- 2) **From womb but without placenta** (*potaja*), e.g. elephant etc.
- 3) **Viviparous** (*jarāyuja*), those covered in a membrane at the time of birth, e.g. cows, human beings etc.
- 4) **Bred in fluids** (*rasaja*), such as worms born in curd etc.
- 5) **Born in sweat** (*svedaja*), e.g. louse, nit etc.
- 6) **Asexual** (*sammūcchim*), i.e. those born without copulation of a male and female, e.g. fly, ant etc.
- 7) **Born from earth** (*udbhijja*), insects born by coming out of the earth, e.g. locust (*ṭīḍḍī*) etc.
- 8) **Emergent** (*aupapātika*), living beings born not from womb but in certain specific places, e.g. deities and hellish beings.

The one to five-sensed living beings without mental faculties are sexless as a rule. Deities are never sexless. The five-sensed human beings and animals with mental faculties may be of both sexes (male or female) or sexless.

### **6.3 Procreation in Science**

Procreation is a process by which the human beings, animals and plants propagate their own species. Such propagation is of 2 types – vaginal and non-vaginal [16, 63-64].

**a) Vaginal (*yonija*) procreation** – This occurs by copulation of a male and a female. The birth occurs due to fertilization of mixing of semen of the male and ovum of the female.

**b) Non-vaginal (*ayonija*) procreation** – This type of procreation occurs by process of division of body by the being itself or by some external agency. There is no need of a male and a female for this type of procreation. Human beings and animals procreate by vaginal procreation. The lower order living beings and plants adopt the method of non-vaginal procreation.

Jainism considers vaginal procreation through womb as sexual (*garbhaja*) and non-vaginal procreation as asexual (*smmurchima*). As



regards human beings and some animals, there is agreement in Jain theory and modern science. However, science does not recognize procreation process found in deities and hellish beings.

## 7. Motion in Transmigration State (*Antarāla gati*)

How the soul moves after death and reaches its new destination, i.e. the next birth-place? For going from one realm to another, a soul moves in two ways – straight line motion (*rju gati*) or curved motion (*vakra gati*), as given in *Bhagavaī* [3, 2/82,83,88].

When the body dies, the soul leaves it and goes in a straight line like an arrow to its next destination. This straight motion takes only one *samaya* to complete the journey. A curved motion, having bends and turns, slows down the motion of the soul and it may take longer to reach the new destination. The duration of the journey in this case is a minimum of 2 *samayas* (one bend) and a maximum of 4 *samayas* (three bends). The liberated soul travels in straight line only. It does not take in any energy on the way so it remains *anāhāraka*. But the worldly soul, travelling in a straight line absorbs energy on the way and is called *āhāraka*. In the zigzag motion in straight lines of 2 *samayas* (with one turn), it does not absorb energy in the first *samaya* but absorbs it in the second *samaya*. In the straight line-zigzag motion for 3 *samayas* (with 2 turns) it absorbs energy in the third *samaya* and in zigzag straight line motion for 4 *samayas* (with 3 turns), it absorbs energy in the first and fourth *samayas* and not in the rest of the *samayas*. The cause of the straight or curved motion is the place of next birth. If the same is collinear with the place of death then the motion is in straight line. If it is not collinear, then the motion is straight but with turns [18, p.6].

## 8. Conclusion

Jain philosophy regards the existence of living beings as eternal. Thus, the life has not originated at some particular time during evolution of the universe but has been ever present. With suitable karmic conditions and at appropriate time different species of living beings emerge. The most elementary form of a living being is *nigoda*. The process of evolutionary development begins with the exit of the *jiva* from the realm of *nigoda*. The development of soul is possible only with transformation of the subtle

*nigoda* to gross *nigoda*. This can happen under proper conditions at an appropriate time (*kāla-labdhi*). Karmas are responsible for taking the soul to the higher developed level or lower, to less developed level from higher level. The five governing factors for development of soul are time (*kāla*), intrinsic nature (*svabhāva*), karma, human efforts (*puruṣārtha*) and rules (*niyati*).

The karma is the governing principle for birth and death. As long as soul binds karmas, one has to live for going through the consequences of karmas. There is an essential connection between birth and death. The birth necessarily follows death and vice versa. What is understood by birth? What are the causes of birth? How and where and in what form the birth can take place? These and other questions have been discussed in this article on the basis of Jain scriptures. A separate article will be needed for treatment of death.

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## **Glossary**

1. ***Antaramuhūrta***: All the ranges of time in between second moment (*samaya*) to one moment less than 48 minutes are called *antarmuhūrta*.
2. ***Sammūrcchima* or Asexually born**: The living beings who take birth anywhere or everywhere when they get conducive environment are called Asexual. In other words, when the place of birth is not identified and the birth is not from the womb, it is called an asexual birth.
3. ***Āhāraka***: The stuff required to start new life in the very first moment of birth is technically called *oja āhāra* or *āhāra* i.e. food and one who takes the *āhāra* is called *āhāraka*. The liberated soul does not need such *āhāra* because it does not take birth after liberation so it is always *anāhāraka*.
4. ***Karmabhūmi***: The human beings of *karmabhūmis* are those who undertake the profession of a warrior (*asi*), writer (*masi*), agriculturist (*kṛṣi*) etc. for their subsistence. There are 15 such lands in human sphere of the universe according to the Jain scriptures.
5. ***Akarmabhūmi***: The human beings of *karmabhūmis* do not need to undertake the profession of a warrior (*asi*), writer (*masi*), agriculturist (*kṛṣi*) etc. for their subsistence. Their life is completely dependent on some specific trees known as *Kalpavṛkṣa*. There are 30 such lands in human sphere of the universe according to the Jain scriptures.

## 11. Concept of Consciousness in Jainism

*Dharm Chand Jain<sup>1</sup>*

### Abstract

In Jainism, consciousness is the very nature of a soul and it is manifested through knowing activity (*upayoga*) of sense organs and mind. It can be experienced through speech, body activity, respiration, life-span, feeling of fear, sexual desire, desire of possessiveness, sorrow, happiness, enthusiasm etc. The knowing activity can express through a soul directly also. Consciousness can be experienced in meditation and alertness too. This article discusses concept of consciousness as alertness (*apramattatā*), *upayoga*, *prāṇa*, *vedanā*, *saṃjñā*, *vīrya* etc.

Philosophy is the root cause of origination and development of science, because philosophy gives ideas for inventions and experiments. But there is a basic difference between science and philosophy- that science has made its field of experiments on matter (*pudgala*) only, whereas philosophy has much wider field of knowledge which includes formless entities like soul. If we think about the concept of consciousness according to the various branches of science, then consciousness can be defined as the activity of sense-organs, mind, brain and the cells, and when consciousness is defined according to Jaina philosophy then it is an

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attribute of soul, which can not be known through the empirical or materialistic instruments.

## **1. Consciousness and Soul**

The word 'consciousness' is used mainly in two meanings – 1. Alertness (awareness) 2. Feeling of livingness (*cetanā*). In Jainism 'apramāda' word is used in the sense of alertness and 'upayoga', 'prāna', 'saṃjñā' for the feeling of livingness. In Jainism, a soul is considered as the ultimate source of consciousness. Consciousness is the very nature of the soul, with or without body.

If the soul departs from the body, sense organs and brain do not work; the body is called dead. So it is a question for the scientists to find out how the consciousness arises and how it vanishes in the body. Where does it come from and where does it go? Except the *Cārvāka* thinkers, all the branches of Indian philosophy accept the concept of soul which is the source of consciousness. *Nyāya* and *Vaiśeṣika* philosophers mention soul as omnipresent, but they accept its consciousness limited to the body. *Vedānta* philosophers propound omnipresent *brahma* and living beings as its part (*caitanyāṃśa*). Buddhist philosophers do not accept soul as eternal entity. They accept a flow of consciousness which is called *vijñāna* or *citta*.

Jain philosophy is specific in this regard. It stresses that the soul of living beings resides within the body. Every living being is having a different or independent soul. A soul is the knower; sense organs, mind and brain are the instruments for knowing the objects. This soul has the property of consciousness which manifests as consciousness in different parts of the body including brain, nervous system and every cell.

It is difficult to define a soul, but consciousness is the very nature of a soul. According to *Uttarādhyaṇa Sūtra* [2] knowledge (*jñāna*), intuition or observation (*darśana*), conduct (*cāritra*), penance (*tapa*), creative power (*vīrya*) and cognitive application (*upayoga*) are the nature of soul<sup>1</sup>. We can know a soul through its attributes or activities. Knowledge (*jñāna*) and observation (*darśana*) are the main characteristics of a soul. In *Vyākhyāprajñapti Sūtra* [3], it is stated that soul is knowledge (right or perverted) and knowledge is soul. Soul is *darśana* and *darśana* is soul<sup>2</sup>. In

this way the nature of a soul can be defined as knowledge (*jñāna*) and observation or intuition (*darśana*). Application of these two is called *upayoga*. This *upayoga* is consciousness.

There are eight types of souls: (1) A soul as a substance (*dravyātmā*) (2) A soul with passions (*kaṣāyātmā*) (3) A soul with activities of mind, speech and body (*yogātmā*) (4) A soul with cognitive activity (*upayogātmā*) (5) A soul with attribute of knowledge (*jñānātmā*) (6) A soul with attribute of perception (*darśanātmā*) (7) A soul with conduct (*cāritrātmā*), and (8) A soul with attribute of internal power (*vīryātmā*)<sup>3</sup>. Basically, a soul is a *Dravya* (substance), but when it exhibits any of the above characteristics or it enjoins passions etc. then it is addressed by the respective names.

## 2. Consciousness and its Various Levels

Consciousness can be technically termed as '*upayoga*' in Jainism. *Upayoga* is an application of cognitive and intuitive ability of a soul. Consciousness includes an attitude, vision and conduct of a living being. Cognition of happiness and sorrow also denote consciousness. There are many levels of consciousness; we can put them in the following categories.

- 1) Consciousness as *apramattatā* or alertness.
- 2) Consciousness as *upayoga* or knowing activity.
- 3) Consciousness as *prāṇa* (active ability of sense organs, mind, speech, body, respiration and life-span).
- 4) Consciousness in body.
- 5) Consciousness as *saṃjñā* (desire to eat, feeling fear, sexual desire, desire of possessiveness).
- 6) Consciousness as *vedanā*.
- 7) Consciousness expressed in *vīrya* or enthusiasm.

In this way, there are many levels or kinds of consciousness experienced by a living being. A pure and complete consciousness is found in the liberated souls (having destroyed the eight *karmas*<sup>4</sup> and in pious souls having destroyed the four *ghāti* karmas (namely *jñānāvaraṇa*, *darśanāvaraṇa*, *mohanīya* and *antarāya*).

## **2.1 Variations in Consciousness and *apramattatā***

All the living beings on Earth are having karmic bondage, hence the consciousness is not fully manifested in them. There are six categories of the living beings on the basis of variation in manifestation of the consciousness. The living beings having only one tactile sense organ are the lowest in manifestation of their consciousness. Two sensed beings can manifest more consciousness than one sensed, three sensed beings more than the two sensed beings; In this way five sensed beings are able to manifest more consciousness. The beings having mind with the five sense organs have still more manifestation of consciousness than other beings. The human beings possessing right view can express higher consciousness. The degree of consciousness increases in beings having experience of pious conduct and character. In Jainism a holy monk observing the five *mahāvratas* [(i) abstinence from violence (ii) abstinence from falsehood (iii) abstinence from theft (iv) abstinence from sexual desire (v) abstinence from possessiveness], five *samitis* or vigilances (in movement, speaking, eating, handling things and evacuation) and three *guptis* (as control of mind, speech and body) bears more vividness in consciousness. A monk having alertness in every activity expresses more consciousness. In this way living with alertness shows high level of consciousness. A laity practicing five small vows is also on the path to have higher consciousness than a lay man.

## **2.2 Consciousness as *upayoga***

'*Upayoga*' denotes the cognitive function of a living being. It includes knowing through sense organs, mind and directly through the soul.

*Upayoga* is of two kinds –

- i) Knowing in a constructive or articulate form i.e. (*jñāna*) and
- ii) Knowing in *nirvikalpaka* or inarticulate form i.e. *darśana*.

*Jñāna* and *darśana* are the key factors of *upayoga* or cognitive function. In *Nandisūtra* and other texts of Jain philosophy, five types of knowledge are mentioned as *matijñāna* (sensuous knowledge), *śrutajñāna* (scriptural or verbal knowledge), *avadhijñāna* (visual



intuition), *manahparyāva jñāna* (intuition of mental modes) and *kevalajñāna* (Omniscience; pure, perfect and complete knowledge). Among these knowledge *matijñāna* appears in a soul through sense-organs, or mind or by both. Sense organs and mind are the instruments; consciousness manifests in these organs from the soul. *Matijñāna* or *ābhinibodhika jñāna* includes recognition, thinking, reasoning, intellect and inference in it. Knowledge of previous birth (*jāti smaraṇa jñāna*) is also a kind of *matijñāna*. Four types of intellects (*autpāttikī, vainayikī, karmajā* and *pāriṇāmikī*) are also parts of *matijñāna*. All intellectual activities of a person denote consciousness. *Śrutajñāna* appears in a living being as verbal knowledge or as discriminative knowledge (*vivekajñāna*). Discriminative knowledge is a significant nature of consciousness. *Avadhijñāna, manahparyāvajñāna* and *kevalajñāna* appear directly in the soul. Through *avadhijñāna* material world can be known without the use of sense organs and mind. *Manahparyāvajñāna* is also direct knowledge, by which mental modes of others are known by a conscious monk. *Kevalajñāna* is a pure and perfect knowledge with which everything and its every mode is perceived lucidly.

Knowledge illuminates itself as well as the object. In *Niyamasāra*, *Ācārya Kundakunda* propounds the self-luminosity of knowledge. He says—

*appāṇaṃ viṇu nāṇaṃ, nāṇaṃ viṇu appaṇo na saṃdeho,*  
*tamhā saparapayāsaṃ nāṇaṃ tahā dāmsanaṃ hodi* - *Niyamasāra*, 171 [1].

(There is no knowledge without soul and soul is never without knowledge. It is doubtless, hence, knowledge itself is self and object-illuminating. *Darśana* is also self and object-illuminating like knowledge).

*Darśana* is also a significant term in Jain scriptures to denote consciousness. It is an inarticulate cognition, which is succeeded by articulate-cognition i.e. knowledge. There are four types of *darśanas*- (a) *caṅṣu-darśana* (inarticulate cognition through eyes) (b) *Acakṣu-darśana* (inarticulate cognition through mind and sense organs other than eyes) (c) *Avadhi-darśana* (inarticulate cognition directly by soul, succeeded by *avadhi-jñāna*) (d) *Kevala-darśana* (inarticulate cognition or intuition directly by a soul succeeded by *Kevalajñāna*).

Every soul has an essential attribute of inarticulate cognition and articulate cognition. Both of these cognitive attributes are manifested as consciousness in a sequence of inarticulate and articulate manner. The scientists have explored the system of knowing through sense organs and their link with the nervous system and brain, but they have not reached up to the source of consciousness.

There are four stages of knowing the material objects through sense organs i.e. *avagraha*, *īhā*, *avāya* and *dhāraṇā*. *Avagraha* is a primary sensation in which an object is known without its specific properties. *īhā* is the knowledge having inclination to know the object with its properties, and the ascertaining knowledge about the object is called *avāya*. When that *avāya* knowledge goes into retention, then it is named as *dhāraṇā*. These four stages are very important in learning process. Why children do not learn the lesson properly? Its answer lies in the Jaina principle of learning through stages of *matijñāna*. This principle is useful in the educational psychology. This is a psychological science of learning that if a learning process is up to the stage of retention, then it becomes part of the memory. Without retention, knowledge does not go into memory.

### 2.3 Consciousness as *Prāṇa*

*Prāṇa* (vitality) is another technical term in Jaina scriptures which shows consciousness in a living being. This '*prāṇa*' word has a different meaning from the meaning which is referred in Yoga philosophy. In Yoga philosophy *prāṇa* word has been used for vital airs which are of five kinds- *prāṇa* (air inhaled and exhaled), *apāna* (air goes out through anus), *vyāna* (air pervaded in the whole body), *udāna* (air in throat), *samāna* (air in the stomach). In Jainism *prāṇas* are of 10 types (1) Auditory sense, (2) Visual sense, (3) Olfactory sense, (4) Gustatory sense, (5) Tactile sense, (6) Mental force, (7) Power of speech, (8) Power of body, (9) Respiration, and (10) *Karma* related to life span (*āyusya karma*). Thus the *Prāṇas* depict the living power of the five sense organs, body, speech, mind, respiration and *āyusya karma*. Every sense organ has power to operate. If that sense organ is damaged or harmed then that does not work as an instrument of knowledge. A person can live even in the non-working state of some sense organs, but the working power of sense organs denotes consciousness. I hear a word, I see a bird, I smell a flower, I taste a candy, I touch a chair- all

these knowing activities show consciousness of sense organs and also of the knower. A knower remains the same in all the knowing processes with the help of different sense organs. We feel consciousness in the functioning of mind and speech. We also feel consciousness throughout the body. In case of any violence these *prāṇas* are affected and at the time of death these *prāṇas* are destroyed. According to Jainism, all the sense organs, body, mind and speech are made of *pudgala* or matter, but they have consciousness due to their association with the conscious soul.

In Jainism, mind is made of matter (*pudgala*), but it has a quality of thinking and desiring, hence mind also bears consciousness. A conscious mind is very useful for a real development of a human being. If it is controlled or restrained, then it is useful for spiritual development, if it is uncontrolled or wanton, it is a big cause for fall of a person. Neurologists talk about brain and accept that mind is a product of brain. According to *Śvetāmbara* Jain texts, the mind is a separate entity and pervades the whole body, whereas *Digambara* texts accept its shape as eight feathered lotus flower and it is located only in the heart. But mind is used in every knowing activity of sense organs and in its own functions. In *Vyākhyāprajñapti Sūtra* a question has been raised that mind is conscious (*sacitta*) or non-conscious (*acitta*)? Answer has been given that mind is not conscious, it is without consciousness<sup>5</sup>. Here it is to be clarified that mind is different from soul<sup>6</sup> and it is made of matter or *pudgala*<sup>7</sup>, hence it is not conscious, but is found only in living beings<sup>8</sup> and is formed only at the time of thinking<sup>9</sup>.

A sense organ is associated with an object, mind is associated with that sense organ and the soul is associated with the mind. This is the procedure of knowing the objects through sense organs. Sometimes a soul can know the objects directly through the mind. Sorrow and happiness can be known in this manner. Psychologists accept mind as a separate entity and Freud mentions three types of minds as - conscious, unconscious and sub-conscious. We are aware of the conscious mind. A big part of our mind remains unconscious, which has a store of imprints of our unfulfilled wants and *sanskāras*. Sub-conscious mind has the function to get some feelings or desires from conscious mind to unconscious mind and from unconscious mind to conscious mind.

## 2.4 Consciousness in Body

Jain scriptures enumerate five types of bodies as (1) Gross body (*audārika*) (2) Protean body (*vaikriya*) (3) Translocational body (*āhāraka*) (4) Luminous body (*taijas*) and (5) Karmic body (*kārmaṇa*). Of these five types of bodies, we are only aware of the gross body. All human beings, animals, birds, insects, plants etc. are having gross or *audārika* body. This body is made of gross material. *Vaikriya* body is found in heavenly beings (*devas*) and hellish beings (*nārakas*) by birth. In human beings, this body may enjoin the gross body after some specific spiritual achievements. This body can have different modes depending on the will of its owner. *Āhāraka* or translocational body is a subtle body which is used by monks having a vast knowledge of 14 *Pūrvas*. This body is used to get clarifications from a *Tīrthaṅkara* living at a distant place like *Mahāvīdeha*. This subtle body comes out from the gross body and after getting answers, it enters back in it. This body may be a mystery for the biologists. *Taijas* and *kārmic* bodies are more subtle and these are not obstructed by any obstacles. These two bodies are found in every non-liberated soul. Karmic body is a store house of karma bondage and luminous or *taijas* body maintains a level of energy and is helpful in the process of digestion etc. These two subtle bodies remain with the soul even after death when it is on the way of getting a new birth.

Biologists have done experiments on gross body, but they do not know about *vaikriya*, *āhārak*, *taijas* and karmic bodies. At present *vaikriya* and *āhāraka* bodies in human beings are very rare, but *taijas* and karmic bodies are subjects for investigation. If something is known about them after experiments that might constitute advancement in knowing the mystery of life.

## 2.5 Consciousness as *Samjñā*

An instinct of desire or *saṃjñā* also indicates consciousness in a living being. There are four main *saṃjñās* – (1) desire for food (*āhāra saṃjñā*) (2) feeling of fear (*bhaya saṃjñā*) (3) sexual desire (*maithuna saṃjñā*) (4) desire of possessiveness (*parigraha saṃjñā*). These four *saṃjñās* are experienced in every living being including the plants. Every living being feels hunger and wants to take food. It makes effort for obtaining food. Feeling of fear is also a characteristic of worldly living

beings. All living beings have fear from death, harm etc. This fear is found only in the worldly souls. Sexual desire is also a phenomenon of consciousness. This desire may have three forms – (1) desire of intercourse of a male with female, (2) desire of intercourse of a female with male, (3) sexual desire of hermaphrodite. This is a desire of reproduction. Possessiveness is also found in conscious beings. Human beings, insects and even plants bear this phenomenon. The non-living things do not possess these four *saṃjñās*.

## 2.6 Consciousness as *Vedanā*

*Vedanā* is another technical term of Jainism, which denotes an experience of happiness and sorrow, coldness and hotness etc. by a living being. This '*vedanā*' is felt on the level of mind and body. It may be a result of the karma-bondage. Pleasure or comfort may be felt through five sense organs and mind.

## 2.7 Consciousness as *Vīrya*

Enthusiasm (*vīrya*) is also a significant nature of consciousness. A living being feels enthusiasm for doing something. Where does this enthusiasm come from? Generally it is accepted that enthusiasm comes from the food which we eat. Vedic statement '*annam vai prāṇāḥ*' proves it. It is true that without food, body cannot run for a long time. Food is the source of energy in the body to enable it to work. Body is made of *pudgala*, so *paudgalika* food is required to sustain it. Soul has its own enthusiasm or power which is expressed in mental power and in emotional balance. Soul gives consciousness to body, but it has to leave the body, if it is not capable of sustaining the consciousness. If the body has decayed and *prāṇas* are arrested, then the soul leaves that body and takes birth in a new body accompanying the two subtle bodies namely *taijas* and *kārmaṇa*.

## 3. Conclusions

Scientific studies have been carried out on cells, genes and consciousness of the brain, and it has proved that cells of the body are changing every moment. Body cells are renewed in a short time interval and hence food is needed for this activity of change. The gross body cannot survive without food. According to Jainism, animation in gross body,

brain, genes etc. is due to consciousness of the soul. In the presence of a soul all of these work consciously.

Scientific experiments have been carried out on the matter or *pudgala* having eight touch qualities<sup>10</sup>. Gross body, blood, brain and genes are matter with eight touch qualities. Jaina scriptures propound a type of matter with four touch quality and also matter with two touch qualities. *Kārmaṇa* and *Taijas* bodies are the example of four touch quality matter. *Paramāṇu* in Jainism has been propounded with a quality of two touches i.e. smooth (positive charge) or rough (negative charge) and hotness or coldness. Matter can be the object of experiments by instruments, but the real consciousness of soul is difficult to come under the purview of experiments. Its existence can be proved by the following three sources according to Jaina philosophers:

1. **Self-perception or Self-realization**
2. **Inference:** There are many logical arguments by which an entity of soul can be proved. In *Rājaprasānīya Sūtra*, *Keśīśramaṇa* has given many arguments to king *Pradeśi* for existence of a soul which is different from the body. Sense organs and mind are only instruments; someone should be the user of these instruments and that user is the soul.
3. **Canonical Literature** - The enlightened souls have told about the independent existence of a soul, by which consciousness is felt in a body.

It is interesting to note that violence of *prāṇas*, falsehood, theft, sexual copulation, possessiveness, anger, pride, deceit, greed, attachment, aversion etc. are 18 sins appearing in a soul [11], but these are having characteristics of subtle *pudgala* having five colours, two odours, five tastes and four touches (cold, hot, smooth and hard). Scientists have done experiments on micro matter, but they have yet to do experiments on the intensity of anger, pride, deceit, greed, attachment, aversion etc. These experiments will help a human being in understanding the intensity of these passions and disorder. Knowing their intensity would help a person to reduce these sinful emotions and activities. At present the examination of blood, sonography, MRI, and CT scan are quite helpful in knowing about the physical health. The examination of anger etc. will be quite helpful for mental and spiritual health.

## End notes

1. *Nāṇaṃ ca dāmsaṇaṃ ceva carittaṃ ca tavo taḥā.*  
*vīriyaṃ uvaogo ya eyaṃ jīvassa lakkaṇaṃ – Uttarādhyayana Sūtra, 28.3.*
2. *Goyamā āyā siya nāṇe, siya annāṇe, nāṇe puṇa niyamaṃ āyā Goyama āyā niyamaṃ dāmsane, dāmsane vi niyamaṃ āyā. – Vyākhyāprajñapti Sūtra, śataka 12, Uddeśaka 10, sūtra 10-18.*
3. *Vyākhyāprajñapti Sūtra, śataka 12, Uddeśaka 10, sūtra 1.*
4. Eight karmas are – *jñānāvaraṇa, darśanāvaraṇa, vedanīya, mohanīya, āyusya, nāma, gotra and antarāya.*
5. *Sacitte bhante! maṇe? Goyama! No Sacitte maṇe, acitte maṇe. – Vyākhyāprajñapti Sūtra, śataka 13, Uddeśaka 7, sūtra 11(2).*
6. *Āyā bhante! maṇe? Aṇṇe maṇe? Goyamā! No āyā maṇe, aṇṇe maṇe – Vyākhyāprajñapti Sūtra 10.*
7. *Rūvi bhante! maṇe arūvi maṇe ? Goyamā rūvi maṇe, no arūvi maṇe – Vyākhyāprajñapti Sūtra 11(1).*
8. *Jīvāṇaṃ bhante maṇe, ajīvāṇaṃ maṇe? Goyamā! jīvāṇaṃ maṇe no ajīvāṇaṃ maṇe – Vyākhyāprajñapti Sūtra 11(4).*
9. *Puvviṃ bhante maṇe, maṇṇijjamāṇe maṇe? Maṇasamayavīkkante maṇe? Goyamā! No puvviṃ maṇe, maṇṇijjamāṇe maṇe no maṇa samaya vīkkante maṇe – Vyākhyāprajñapti Sūtra 12.*
10. Eight types of touch are – cold, hot, smooth (positive charge), rough (negative charge), light, heavy, soft and hard.
11. *Vyākhyāprajñapti Sūtra, śataka 20, Uddeśaka 3, sūtra 1.*

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## 12. Non-Physical Order of Existence

*Rudi Jansma*<sup>1</sup>

### Abstract

This article seeks to point out a few thoughts which might be helpful to ponder a deeper understanding of the spiritual principles of ancient wisdom in comparison with developments in the occidental sciences of recent centuries. This paper is put in the form of aphorisms, each of which reflects deep universal truths or sane possibilities for theoretization. The topics discussed are Truth and Consciousness. Conscious forces, or divine beings which are invisible to the unenlightened, carry out various processes in the universe, in accordance with the laws of noumenal matter, as everything in the universe is intimately connected. Various gaps that exist in our understanding are also discussed.

### 1. Truth

1. Less than 1 percent of the universe is visible. More than 99 percent is invisible.
2. Of all physical phenomena only those can be perceived visually which operate within the spectrum of wavelength in which our

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sense organs are sensitive. For example, infrared or ultraviolet light, or sounds, smells, tastes and tactile impulses that are outside our range of physical perception cannot be perceived.

3. Phenomena slightly subtler than the physical (also called 'astral') can be perceived by specifically sensitive persons, animals and other beings.
4. Physical matter is the outermost manifestation of reality with which we can consciously and physically interact at this moment in universal history. All outside this is invisible and otherwise imperceptible by our senses and their instrumental extensions in the physical realm.
5. There is only one religion, and this is Truth. There is no religion higher than Truth. Nothing exists outside Truth and Truth is non-dual.
6. All religions, philosophies and sciences are devoted to Truth.
7. Reality is the expansion or vehicle of Truth: it is how things really are, independent of mental speculation and theory.
8. There is but one Truth, though it shows itself to the reflective mind in an infinitude of aspects. There is but one true religion – and this religion has no name or external form. It is beyond all scriptures and teachings.
9. Mental speculation and theory as well as partial mystic understanding are parts of Truth, but are 'false' because they are concentrated around a mind-created ego, which may become confused in the multiplicity of possibilities.
10. All of Reality which has no direct interaction with our perception belongs to 'the invisible'. There is no reason to suppose that there is a limit to possibilities: possibility itself is infinite.
11. All aspects of consciousness, such as mental ideas, intuitions, emotional feelings and instincts are invisible to the external senses and their mechanical extensions. They can only be measured indirectly, through their external effects. Only when they have an effect on the small layer of reality that is known as 'physical matter' or 'physical reality' they can be perceived and/or measured. Even then, the awareness itself is invisible and non-physical.

12. The Sanskrit word *māyā*, derived from '*mā*' – to measure, expresses this apparent aberration from infinite Reality. What can be measured has a beginning and an end. However no reality can ever have a beginning and an end except in a relative sense. In deeper understanding there has never been a beginning to anything, nor an end. There has never been 'creation' of something out of 'nothing'. Nothing ever was not, nor will it ever cease to be.
13. There can have been no 'Big Bang' in the absolute sense of an 'absolute beginning' of existence and a beginning of space and time. Even if there have been and are an infinitude of Big Bangs in the Universe, they were mere 'remarkable points in history' – but not absolutes.
14. The One nameless religion named Truth has given rise to uncountable thought systems and individual religions. All are reflections by Mind and equally valid. However these reflections have been taken by some dull human minds as 'absolute truths' existing in their own right and independently. This has given rise to quarrels, competition and wars. Universal Truth does not change by fighting over it.
15. In and through all thought systems and religions, universal truth is present. Universal truth is the core of relative truths and even of obvious errors.
16. Nothing exists in its own right, nor is any existing thing ever independent (in origin and manifestation) of all other things, nor, of course, of Universal Truth.

## **2. Consciousness**

1. The mainstream western scientists take it for granted that consciousness is a function or arising property of physical matter – and most probably only of a complex physical nervous system as found in humans and (higher) animals. This is however disproved by phenomena like near-death experiences, out-of-the body experiences, spiritualism, reincarnation research, and multitude of 'paranormal' phenomena and reports of people having mystic experiences. Strange enough, large classes of scientists disregard such proofs and refuse to give it even the slightest attention.

2. In other thought systems consciousness is the guiding force embodying itself in many subsequent bodies. A famous Eastern saying is: First I was a stone – I died as a stone and became a plant; I died as a plant and became an animal; I died as an animal and became a man; I will die as a man and become a god.

In the Jain system, it is the *jīva* which first embodies itself in the mineral kingdom, and in that stage has only one organ of perception: touch. In that state the consciousness, which is not yet mental, *jīva* needs no complex organic organism and an organic nervous system. It can do with the simple arrangement in geometrical patterns of inorganic molecules. A crystal is an expression of the *jīva*'s expression in the mineral kingdom. Later the *jīva* will build itself more complex vehicles and methods of sense perception to interact with the environment. Consciousness was first, and is in no way the *result* of chemical complexity, but the *cause* of it, according to the purpose and will-power and developed intelligence of the *jīva*.

3. Almost all or all genuine thought systems and religions, all of which are reflections of the one universal religion or understanding of Truth, and were brought about by great preceptors aiming to help the aspirant and humanity to find Truth, have stated that Consciousness is universal, omnipresent and eternal. Sometimes they labeled it with terms like 'God' 'Creator' or 'Allah'. It had no beginning nor will it have an end. In Jainism it is very clear that *jīva* – life-consciousness itself, the core of all compound entities, has no beginning or end. Consciousness has ever been and will ever be – but has many reflections which are born, fulfill a function and then disappear.
4. Western sciences, despite their progress in technology, have found no consciousness in the universe outside or without connection with the physical brain. NASA with all its beautiful telescopes such as Hubble and space-traveling instruments studying the *physical* macrocosm, nor CERN with its Large Hadron Collider and other huge particle accelerators studying the *physical* microcosm have ever found any acceptable evidence of any conscious entity in the whole universe. No *devas*, gnomes or elfins, nor the deities of which the stars and planets are supposed to be the bodies, no beings which are far greater than humans in their

evolutionary mental and spiritual development, no organized guiding forces entertaining intelligent information exchange. Therefore most physicists and astronomers do not believe in extra-physical consciousness.

5. It may be, according to these people, that elsewhere in the gigantic universe – measuring dozens of billions of light-years across – human-like intelligences may have developed, perhaps on other physical planets with answer to a very narrow set of chemical and physical conditions (call it extreme gaia-centrism) – but so far we have failed to contact such beings, so it remains hypothetical.
6. For the rest, according to that view, when we look at the sky, even until the borders of the perceptible universe EVERYTHING IS WITHOUT CONSCIOUSNESS – we are absolutely lonely in the fact that we are aware of an environment and of ourselves. THE REST DOES NOT EVEN KNOW THAT IT EXISTS. Awareness exists only within the earthly human mind – a very small section of the universe indeed! Everything that came into being, exists and disappears out of appearance is absolutely unconscious matter. Everything exists only for our human perception.
7. In the prevailing occidental view there are no thoughts and feelings, nor is knowledge or wisdom anywhere in the universe as far as known, except in the imperfect condition of the human nervous system.
8. The greatest scientists, like Einstein and Bohr and the dozens of great quantum physicists thought only in terms of unconscious particles and waves, bent space and the automatic forces of gravity, electro-magnetism, and weak and strong nuclear forces. How can they ever expect to find consciousness and mind in the universe? They just closed off their own awareness of it. Even if they would find structures comparable to an organic nervous system elsewhere in the universe, it would still be impossible for them to perceive consciousness.
9. On the other hand, we start from the supposition that consciousness and life are the *fons et origo* of all existence, as Jainism has always done, the picture of the cosmos changes dramatically. *Jīva* itself is defined as life-consciousness. It is non-physical.

10. Let's first ask the question: What is consciousness?
11. Is consciousness universal and omnipresent, or is it a superficial and relative phenomenon?
12. According to Jainism and other great thought systems, consciousness is fundamental, has no beginning and has no end – but can manifest in many layers or strata or aspects in many ways.
13. The *jīva* has, in the Jain phrasing, the properties of right vision, right knowledge and right conduct. This is the basis of human ethics. In the cosmological sense it means that *jīva* in its pure essence is at one with the universal Truth (right insight), possesses infinite knowledge because it knows the essence of all phenomena (right knowledge) and sends out the streams of energy and force to accomplish all processes in the phenomenal universe. Thus it composes all existing entities.
14. The various dimensions of consciousness that can be recognized are:
  - universal non-dual consciousness,
  - phenomenal but undivided consciousness,
  - omniscience (i.e. direct insight in all phenomena),
  - higher mental consciousness (mind striving towards true knowledge, ethical understanding and recognition of true beauty),
  - lower mental consciousness (mind serving the attractions of isolated or egotistic desires),
  - desire consciousness (either divine, human, animals, plants, mineral or elementary) striving towards manifestation, gaining experience and helpfulness to others,
  - subtle feeling consciousness (such as perception of the refined forces and energies in nature),
  - energetic consciousness (will-power),
  - coarse feeling consciousness (such as physical and emotional feelings),
  - consciousness and knowledge of the noumenal world behind physical phenomena,
  - physical phenomenal consciousness.

15. Unconsciousness does not mean absence of consciousness. Unconsciousness is not the opposite of consciousness. It means that a specific aspect of universal consciousness is focused in one level of being while temporary withdrawing from another level (such as during sleep), but consciousness never stops – otherwise it cannot be called universal and omnipresent. It would mean the extinction of *jīva* that is impossible.
16. The fact that something is present in human consciousness proves that it is part of universal consciousness. It carries more logic that consciousness is universal and expresses in many aspects and forms, than to suppose that it exists *only* in humans and other beings with a highly developed nervous system.
17. All composed things – built of *paramāṇus* or 'ultimate *paramāṇus*' – in the universe have been brought about by *kārmic* action of the conscious *jīva*. All particles were originally brought together by specific vibrations of the *jīva*, who, being divine by nature, have a conscious free will and thus the possibility of choice. These composed things are known as *karmas*. *Karmas*, i.e. individual units of information, comprise physical, subtle ('astral') as well as emotional, mental, aspirational, ethical and sensual complexities. This applies to higher beings like plants and humans, but on a cosmological level applies – each on their own level – to any composite structure: atoms, subatomic particles, quarks, photons, Higgs bosons, dark matter particles, neutrinos, etc., etc. The fact that they can interact with other phenomena proves that they are composite – because interaction is an exchange of 'something'. An absolutely indivisible unit or particle would have nothing with it to exchange, so would be principally imperceptible forever. Interchange always presupposes the presence of a *jīva*, and is always conscious.
18. In one scientific theory, known as the 'superstring theory', the ultimate particles or rather units of matter in the physicals universe are presumed to be strings of a size, far beyond the possibility of measurement, but a mathematical necessity to explain and unify both quantum physics and Einstein's relativity theory. However even superstrings give no clue to the meaning of consciousness.

19. If consciousness is eternal and the source and origin of all phenomena, we find ourselves in a universe where everything is an expression of that universal consciousness as well as an individual, an individual expression. Like every flower has a different color and form and mood, every galaxy, solar system and molecule expresses a different mood or expression of the universal consciousness. Instead of being alone, we form part of a universal brotherhood of consciousnesses, feelings, thoughts, sorrows and happinesses of many different intensities like we ourselves have purposes, every being has a purpose – including every star, planet or *paramāṇu*. There is no loneliness in such a universe.
20. Just as we find physical units and the laws of matter everywhere in the universe, there are mental and sensitivities' units everywhere in the universe. Of many of these we may have no clear idea or feeling, or none at all, because in the vast universe there are no doubt many fields of consciousness which in humans have not yet found development – just as a human mind has not yet developed in a frog. The many gods and enlightened beings may experience states or phases of consciousness of which we humans as yet have no idea, or only vaguely so. And so *ad infinitum*.
21. This involves that not only every compound entity, even of the most humble mineral has a degree of consciousness and potentiality to develop into higher directions, but also that the physical universe itself is like a large molecular structure of a being which ensouled that total structure, like the human *jīva* ensouls the complex structure known as the human body.
22. It also involves that the universe may be full of intelligent and sentient beings which do *not* make use of a *coarse physical* body, but of vehicles of some finer, invisible matter. Jainism and all occult-based systems confirm many degrees of matter other than physical matter. Because consciousness is universal and *jīva* omnipotent, the number of expressions in vehicles of physical or other matter knows no conceivable limit.
23. Moreover there may be millions or billions of visible planets (as is now surmised by astronomy) or invisible planets which are inhabited by beings of an intelligence, possibly far higher than the humans (who was even an Einstein, after all, compared to the

intelligence that pervades organic structures in the nature that surrounds us?).

24. It also involves that there may be beings of a development far beyond (as well as below) human development in spirituality who are not hampered by the limits of physical knowledge (According to the Buddha in the *Avatamsaka Sūtra* there are universes – among many other universes – in which the inhabitants are predominantly *bodhisattvas* – i.e. 'those whose very nature is wisdom'). Of course their forms and sizes may be very different from the human form. Their gaze may penetrate vast stretches of the universe, including regions and dimension of which we have no knowledge.
25. Because of the common essence of consciousness and the common origin of all things, all things are forever connected, and, through their specific soul-vibrations and attunements interact, are entangled and eternally influencing each other. This interconnectedness exists simultaneously in all aspects of consciousness in which the specific *jīvas* are active, in other words, in all dimensions at the same time. It is much more than a mere 'network' of consciousness.

### **3. Invisible Forces**

In Jain and other literature we find that even our own sphere, i.e. that of *Jambūdvīpa* or the Earth, is filled with invisible beings – known by names like *bhavanavāsins* and *vyantaras* – of many classes and subdivided in hierarchical classes, all interworking and performing specific functions. Many work in the emotional field, causing experiences after death of humans, or can perform specific activities from the astral or non-physical realm in which they live. Many of them perform meteorological functions: winds, earthquakes, lightning, in other words the phenomena of the sea, the air, natural fire and the land. This differs from the occidental scientific view that all such forces are blind processes of matter, such as inequalities in air pressure due to local heating or cooling, a build up of electrical charges in clouds, tensions between moving continental plates, etc. In Jainism all such phenomena are headed by an *indra*, an intelligent divine being, and in accordance with the laws of noumenal matter, expressed in hierarchies of executing beings such as



'priests' performing the 'downloading' of divine intelligent information towards a workable realm, of *lokapalas* (regulators of the kārmic influences of the four directions), of servants and vehicles (the last being executors of the lowest rank) etc. These beings are powers of adjustment in the meteorological field, of disturbances originally caused in human mind and emotions. There may also be comparable beings regulating the flow and results of forces within the solar system, between stars and other heavenly bodies and between galaxies. There are scientific indications that galaxies can communicate – from their own center to periphery as well as with the intergalactic space. All these beings are invisible except for those who have the eye to see them – and they link every phenomenon on earth and larger systems with conscious activity of responsible beings (i.e., in our case, humans).

#### **4. Gaps and Bridges between Science and Spirituality**

We will briefly mention here some of the findings of occidental science mainly of the 20<sup>th</sup> and 21<sup>st</sup> centuries.

All mainstream scientific findings limit themselves to the realm of physical

phenomena only – i.e. the extreme and 'thin' surface layer of the totality of phenomenal existence. Apart from confining oneself to perceiving this physical realm only by means of often very sophisticated but equally physical instruments, explanations for these phenomena are also exclusively sought in the physical realm.

##### **4.1 Relativity Theories**

1. For example, Albert Einstein, though in a sense an intuitive mind, and perhaps the most intelligent mind which recently lived among present-day humanity, confined himself to space and time, connected them together into one dimension (named space-time). He kind of polished Newtonian physics, but did not leave the realm of coarse physical matter. Einstein, in formulating the Special Theory of Relativity, believed that the absolute maximum speed possible in the universe is that of light a mere 300,000 km per second, and motion at higher speeds is impossible. This may be true in the sphere of physical matter, but in the true universe there

can be no limits of time, nor of space. There can be no maximum speed. Interestingly the speed, with which a *divinity* in Jainism can travel, supersedes that of the speed of light by several times or even dozens of times (depending on the adopted length of a *yojana*). Of course a divinity is not bound by the properties of physical matter, because it has no physical body. It has a body of a subtler type of matter though, which has arisen 'spontaneously' (without the slow processes of gestation necessary for building a physical body) according to its character.

Then, it is said that the speed of a free soul within each *gati* (realm of existence) is almost infinite.

2. Absolute measures, such as a speed of light, a maximum or minimum size of the universe or an elementary particle of even the hypothetical superstring, a zero temperature (merely meaning that intermolecular movement would have come to a standstill, but saying nothing about intra-*paramāṇuic* movement) and other limits can have no true existence in an infinite universe except in the relative sense of a particular isolated level or *māyā* (such as the physical).
3. Einstein, in the General Theory of Relativity, postulated the existence of a bent space-time, explaining the perceived properties of gravity better than Newton's laws. This space-time was described mathematically, not as physical reality. Nevertheless space-time in the physical sense must exist of 'something'. The idea of ether (that means actually only of particular presupposed properties that this ether should possess) had been rejected (by scientists Michelson and Morley in 1897) a few years before Einstein developed his theories.
4. Space, in Sanskrit, is called *ākāśa* - usually translated as 'ether' - the term also used by Jainism. Even among Jains themselves there may be discussion whether *ākāśa* or 'space' is merely empty, providing merely the possibility of things to exist on a distance, or that 'space' is a substance with properties. Hindus and the ancient Greeks as well as modern Theosophists call it the 'fifth element' (in addition to earth, water, air and fire). In my view, space MUST be a substance; otherwise all things would be packed together against each other as in a singularity. In a singularity – the state of being of

matter at the time of the hypothetical Big Bang – empty space was not manifest, and therefore things had no distance. Nowadays science knows that 'empty space' is by far the largest entity in the universe – but is it really empty, or is it a densely packed substratum of still unperceived particles? In any case, 'empty space' is penetrated by 'fields' throughout.

5. Time- Einstein called 'the fourth dimension' but actually that is only a way of expressing the fact incorrectly. If we wish to talk of more than the three 'dimensions of space (x, y and z)' we are actually only talking of one dimension, i.e. that of physical matter. Sensually imperceptible realms of existence, i.e. other levels of materiality (more subtle or more coarse) may not answer the description of length, height and depth (x, y and z).
6. The term 'dimension' has different significances in science and spirituality respectively. The 'three dimensions' of space, nor the 'fourth dimension' of time, are true dimensions. The higher dimensions of modern science can not be spatially imagined, nor have objective existence, but can exist in mathematics into infinitude. In string theory, for example, eleven mathematical dimensions are necessary to form a mathematical theory uniting the theories of gravity and quantum physics. Whether this theory will, or even can ever, be either confirmed or proven false remains an open question at present.
7. The term 'dimension' in occultism refers to the stages of expression of consciousness and life. In an occult (spiritual) sense 'dimension' refers to levels of beings which include all phenomena of consciousness in the universe. These have been discussed above in this article. The physical dimension is at present the lowest and coarsest dimension – as far removed from the spiritual dimension as is cosmologically possible – the physical dimension is the 'other pole' or 'nether pole' of spirituality. Though all higher dimensions reflect themselves in physical reality (which is, after all, their ultimate product), it is most difficult to discover them there and enter into the higher dimensions.

## 4.2 Mathematics

8. Mathematics forms the logical framework of physical existence – and often mathematical predictions are found to actually exist in physical reality (such as the famous example of Einstein's bent-space hypothesis – confirmed by detailed measurements taken during solar eclipses). Pythagoras discovered more than 25 centuries ago that there is a relation between mathematics and our feeling, i.e. consciousness of harmony. All beautiful forms in nature as well as intelligent theories of scientists answer to mathematical regularities, and usually the most simple ones. Still it is an unsolved mystery why this relation between abstract mathematics and concrete physics actually exists.
9. Still, even the mathematical point, which is said to be of zero dimensions, or beyond dimension, cannot *actually* exist – it is an abstraction. In the mind it is kind of 'in the middle of the smallest space imaginable'. The mathematical point itself is a creation of mental imagination of which the truth can never be confirmed. Absolute mathematical zeros, even when added up indefinitely, can never leave their zero spatial dimensions: they would never form lines. Therefore spatial dimensions seem to be a product of the mental dimension of consciousness (i.e. a *māyā* or illusion) rather than true realities. The same applies to time-points – a time of zero length, which still would lead to length of time when added together. This is an actual impossibility.
10. Does space actually exist? From reports of near-death experiences, mystical experiences, and occult descriptions of states of conscious between death and rebirth, it appears that time and space has no reality. It appears that space and time are only realities in the *māyā* created by our own mind within the physical realm. It seems that our own consciousness 'created' space and time in order to explain reality for our minds on the physical plane. Elsewhere space and time do not objectively exist as real experiences. All phenomena are perceived as existing at the same time (or rather not existing in time) at the same place (or rather no place). *Ākāśa* in the sense of the fifth element or dimension of existence however *does* exist and has properties and is part of our being and the being of the universe. *Ākāśa* seems to have been

translated as 'space' only because its substance is imperceptible for the senses, and therefore *seems* empty.

### 4.3 Quantum Physics: Superposition and Entanglement

11. It seems that quantum physics has touched at some points an intuition of 'the beyond'. Relatively (from the human measure) very small particles have been found to be 'superimposed' i.e. to exist at two places at the same time, or 'entangled', i.e. maintaining their commonness in particular properties in which they have become entangled ('involved together') over distances over which information cannot travel. In other words, they seem to communicate with a speed faster than light. But how much faster? It appears to be instantly, even if separated by distances of billions or trillions of miles. This is not 'spooky' or 'weird' but refers to the next lowest dimension just above the physical where time and space do not have the meaning which they have in our physical dimension. There, a field of existence of a phenomenon may be non-local and non-temporal. What is weird or spooky is that our mind on the physical level creates such illusions as space and time. Jainism has clearly stated that the properties of space and time (or speed of travel through 'space') do not apply to higher dimensions.

### 4.4 Particle Physics

12. Science, as far as human memory goes back, seems to have been in search for an 'ultimate smallest particle' or '*paramāṇu*' which would be the building block of all composed structures in the universe. As stated above, such absolutes as 'the smallest,' 'the biggest', 'the fastest' 'the coldest', 'the densest' etc. can only exist in the relative sense, i.e. within one spiritual dimension. Black holes and singularities too are only relative. In an infinite universe there is always 'a beyond' in the small as well as in the big. Also in mathematics, absolute limits are inconceivable.

So what is a particle: is it a kind of 'absolutely smallest marble', a tiny piece of matter that cannot be further divided? Again this can only be relative. The very fact that interaction with such particles is possible, proves that they are not homogeneous and indivisible. So what is a particle?

13. As we have learned, everything in the universe that is composed (including particles) has been in contact with *jīva* (life-consciousness). This *jīva*, by its conscious mental activity, brought a number of *paramāṇus* (the relative smallest *paramāṇus* for any layer of being) together in a specific combination, thus forming a *karma*. So a particle is not 'only matter', but contains the imprint of everything a *jīva* is: life, consciousness, right insight, knowledge and energy, mind, desire, purpose and will. A particle is a manifestation on our physical plane of a conscious activity, which is concentrated into an egoity for a particular purpose. So every 'particle' as science perceives it, is either a body harboring a living *jīva*, or a 'dead and decaying body' in the case the *jīva* has left it. *Jīvas* embody and disembody themselves continuously. In the case of humans a period of embodiment may last say 80 or 90 years, and for most smaller animals like insects no more than a season or even a day, and for some germs no more than 20 minutes. But in the case of elementary particles the period of incarnation of the *jīva* may be a millionth or a billionth or a trillionth (and so on ad infinitum) of a second. The bodies (i.e. particles) come and go with enormous speed. Electrons can die and be reborn almost instantly. The same electron-*jīva* may perhaps incarnate millions of times during their existence as a part of a *paramāṇu*, and thus disappear from and reappear into physical manifestation with a very high frequency. They wave into and out of embodiment continuously. Their living activity must influence their environment or substratum of existence continuously. To conclude: a particle, however small, is a re-embodying spiritual entity as much as we ourselves are.

#### **4.5 Double-slit Experiment**

14. It was found by scientific experimentation in the early part of the twentieth century that when a photon or other very small corpuscular entity approaches two slits in a wall, it manifested in the character of a wave as well as in the character of a particle (in the sense of 'a little ball' or 'packet unit of electromagnetically energy'. When measured by an instrument (misleadingly called 'observer' – what presupposes an active consciousness) the particle is found to move through one of the two slits only (like a ball); but if not measured it produces a wave like phenomenon, like water

moving through two slits in the wall of a harbor. The water is just waves, not one localized particle. Then the interference pattern of the waves appears as a measurement further on behind the slits. So it was concluded that very small units of matter have a particle as well as a wave character at the same time. The interference pattern behind the slits suggests that it went through both slits at the same time. As it is not logically possible that a particle passes through one slit only and at the same time through both slits, it has been concluded that the waves are not real physical waves but mathematical probability waves (a mathematical function only), and that the wave 'collapses' into an actual situation (i.e. perception) by an influence of the 'observer.' The actual existence of things would then depend on the presence of an observer. This leads to the strange conclusion that nothing in the whole universe exists unless there are observers. Still, the universe is, in this view, not a mere construction of the 'minds' of observers, because the wave-particle also has properties when not observed – however only as probabilities or possibilities.

Probabilities or possibilities express ignorance, but for an omniscient consciousness working on more than, or all, dimensions there would be no need for probabilities or possibilities – but only for knowable cause and effect relationships. This points to the direction of a serious lameness of this theory.

One solution to this enigma might be that the physical manifestation (the actual 'particle') indeed moves through one slit only, but that its effect in a hypothetical medium (e.g. ether, *ākāśa*) might move through both slits, like waves in the water. Imagine a skylark, singing while flying, fly through one slit, while the song it produces goes through both.

## 4.6 Black holes

15. It has been found that most (but not all) galaxies have a black hole at their center. A black hole is a locality where matter is extremely dense and gravity extremely strong, i.e. in Einsteinian terms, that the space around it is bent into a vortex like structure, in which all that is subject to the law of gravity, even light, is sucked in. Like the

nucleus of the earth which is the core of the Earth's gravity, a black hole is the gravitational core of a galaxy and other structures in the universe.

16. It has been said that 'spirit' (*jīva*) is the opposite pole of matter. Matter attracts matter, and thus matter (*pudgala*) concentrates itself in cores of extreme density. We may pose the theory that the invisible spirit (the uncountable numbers of *jīvas*), which in its pure form is not dependent on or attracted by *pudgala*, tends to move away from matter like even an earthly flame moves upwards and away from the center of gravity of the earth.
17. Once a *jīva* has moved far enough away from this extremely material environment at the core of a galaxy, it will come to a standstill in the space around a black hole, and may attract particles (i.e. entities) of subtle or physical matter and then embody itself according to the information carried in its *kārmic* body. It is taught in Jainism that the *kārmic* body (*kārmaṇa śarīra*) has been with the *jīva* during its pilgrimage through the manifested illusionary universe since beginningless time – and will only be separated from it when it reaches ultimate liberation from illusion and bondage to illusion.

Thus, at their right place in the universe (i.e. due to their karma), *jīvas* will form stars, planets, and indeed any compound living entity around themselves according to their character.

#### **4.7 Multiverse**

18. One modern scientific speculation is that, next to our home-universe, there may be many, perhaps an infinitude of other universes. Some theorize that there may be as many actual (physical) universes as there are mathematical possibilities. From a Jain spiritual point of view there may be as many universes as there are *jīvas*, because the universes or any compound entity is brought about by the mental activity of a *jīva*.
19. Not all of them need to have physical manifestation on our level of perception – but where a non-liberated *jīva* exists; there must be a universe of thought. Even a human being lives in his own universe of thought – curtailed by inter-subjective verities and habits –



which we then take as 'absolute truths' in themselves, one's belief system and by the limitations of the senses, etc., but no two humans (or animals or other beings) live in exactly the same universe of thoughts.

#### **4.8 Dark Energy and Dark Matter**

20. The term dark in the so-called dark matter and dark energy refers only to our present ignorance about them. Dark matter exerts gravity and therefore contraction; dark energy stimulates expansion. Their balance explains the retardation or acceleration, or relative centripetal and centrifugal movement of matter in the universe. They seem to relate as a material and a spiritual pole manifested in the perceptible physical aspect of the universe.

### **5. Conclusions**

Occidental science, which limits itself almost exclusively to the thin layer of physical reality, has made amazing discoveries by means of its sophisticated instruments. However their universe is lifeless and soulless. The psychological danger is depressiveness and a sense of uselessness of life. Western science struggles with concepts like consciousness, mind and feeling because it tries in vain to seek their source of being in physical matter. However from a spiritual point of view all things happen in the inner – super-physical worlds of *jīva*, i.e. consciousness, life, knowledge and action, and the physical realm is only the 'scum', the surface layer in which our physical sense organs of today work. Spiritual understanding brings the human heart to happiness and *eternal hopeful prospective*. *Causes must be sought in the noumenal, not in the phenomenal worlds.*

## 13. Evolving Human Consciousness

*Gary Zukav<sup>1</sup>*

### **Abstract**

Human consciousness is currently in transition. It is shifting from being confined to the limitation of the five senses, from what we can see and hear and taste and touch and smell, and it is expanding into a much larger domain of perception, which allows us to visualize non-physical dynamics- the domain of matter and time and space and duality. The five senses together form a single sensory system, so we call that 'five sensory perception'. Now, we are acquiring another sensory system. We are becoming multi sensory. So we call this 'multi sensory perception'.

Multi sensory perception shows us beyond the limitations of the five senses. In other words, it allows us to see behind appearances. It allows us to see the non-physical dynamics that generate and sustain the earth school –the domain of matter and time and space and duality. These dynamics or many of them are very familiar to Jainism –the universal law of cause and effect or karma, the great universal teacher of responsibility, and the law of attraction. Energy attracts Like Energy. If you are hateful, you surround yourself with hateful people and if you are loving, you surround yourself by loving people. These dynamics and more are now becoming visible to humankind.

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*1. Short Note, based on video talk; Gary Zukav, Seat of Soul Institute, Ashland, Oregon, USA. Email: [info@seatofthesoul.com](mailto:info@seatofthesoul.com)*

A new consciousness is emerging, and with it the potential of a new world. At the heart of this new consciousness, is the perception that the universe is alive, wise and compassionate. It is very different from the perception of the five senses and so also are the experiences of individuals who are beginning to become multi-sensory. They begin to sense themselves as more than bodies and minds. They begin to sense themselves as souls. They begin to sense themselves as having an immortal aspect.

They begin to sense themselves as having the intentions of their soul's harmony, cooperation, sharing and reverence for life and they begin to thirst and to hunger for these intentions. This is not a small change in human consciousness. It is not a change in the content of human consciousness. It is a change in what humans can experience.

Now, of the little I know of Jain Philosophy, I know that Bhagawān Mahāvīra explained how the universe is spiritual in nature and not material in nature and that is exactly what expanded the human perception as it is now presenting to millions of humans. The universe is a spiritual endeavour, not a material endeavour and that is a game changer. It changes everything. Some of this knowledge, some of this information has been around for a long time, so why has not it changed the game? Why do we still have a world full of violence and brutality, a world full of suffering and lack and need? It is because, although the information is there, it has not become a part of experience. It is not housed in the heart. That is when a human life changes. That is when the world changes: I will get to that. Because a world cannot lodge anything in its heart, but the people in it can. They are so important in changing the world. They are the only way that the world can change. In other words, self-transformation is the first step in global transformation.

I want to talk about this great transformation in human consciousness, this emerging human consciousness which is multi sensory perception. This multi sensory perception is a gift. We do not have to do anything to make it happen. However, this multi sensory perception brings with it a new understanding of power. The old understanding of power, the five sensory understanding, is the ability to manipulate and to control. And humans have competed for external power, because that is what that is – power over external circumstances, including people and

things, since our origin. That pursuit has helped us to evolve by surviving, but now it has become poisonous. It is counter-productive to human evolution. This is a big change too. It has turned everything upside down. What used to be good medicine is now toxic and in order to evolve, it is necessary for us to create the new kind of power, authentic power. That is the alignment of your personality with your soul.

How do you do that? That is really what I want to share. First of all the big news – the shifted human perception that is occurring now in millions of humans and within a few generations will occur in all humans. And the second thing is – the new understanding of power and how to create it. Authentic power is the alignment of your personality with your soul. It is the alignment of your personality with the immortal aspects of You with a capital 'Y'; your personality is you with a little 'y'. And you can do that only with awareness and volition, emotional awareness and responsible choice. By emotional awareness, I am not talking about being able to say that I am happy or I am sad or I am depressed or I am exhilarated. That is emotional illiteracy. But when you become emotionally aware, when you develop emotional literacy, you are able to put your attention inside your body and each of the areas of your 7 *cakras*, which I will call energy processing centres and see how they are processing energy.

Whenever you put your attention, for example, say in your chest area and you find uncomfortable or painful physical sensations, then you know that that energy processing centre is processing energy in fear. What energy? Energy that is flowing into your body through the crown of your head, the top *cakra*, and down all the way to the bottom of your trunk and then up again and down, and as it flows through you in this manner, it is processed by each of the 7 *cakras*, and when it is processed in fear, you experience painful physical sensations in the vicinity of that *cakra*. For example, you might feel a pain in the left side of your heart or like there is an ice pick in your heart or something the size of a soft ball right in the middle of your chest, that is hard and painful, or a band constricting around your chest – these are just some examples of what everyone feels when they are processing energy in fear and doubt in this *cakra* area. When you are processing the energy that is flowing through you in love, trust, you feel very different physical sensations. Those physical sensations feel

good. They are vibrant – warm – expansive. You want more of them. That is what happens when you are processing energy in love and trust.

So as you become emotionally aware, you become able to distinguish when love is active in you and when fear is active in you, and that is very important. Why? Because creating authentic power is a matter of distinguishing within yourself when love is active and when fear is active and choosing to act in love, no matter what is going on inside of you or what is going on outside of you. That is how you create authentic power. That is how you bring the energy of your soul – the impersonal perspective of your soul – the intentions of your soul – harmony, cooperation, sharing and reverence for life to the earth, through You.

As you create authentic power, the energy of your soul begins to flow through your personality and into the earth school, like the breath of a musician through a flute. And in such a person, you cannot tell where the personality leaves off and where the soul begins. That is an authentically powerful personality and that is now our evolutionary requirement – to create authentic power. You do not create authentic power the first time you challenge a frightened part of your personality, which means choose not to act on it. For example, maybe you are feeling angry or jealous or resentful and you feel that because you put your attention into your *cakra* areas and you feel painful physical sensations there and you choose not to act on it. You choose to act instead, from loving parts of your personality, parts of your personality that experience gratitude or appreciation, caring, patience, contentment, all of the universe. The first time you do that, the fifth, the eighth time, the frightened part of your personality does not go away. It does not cease to hurt. You cannot decide what you are going to feel when you want to, but you can decide what you are going to do when you are feeling it. You can choose to respond with love instead of react with fear. That is creating authentic power. That is doing the work.

Now, the gift and the work come together – the gift is multi-sensory perception, the work is for you to do. Authentic power does not happen automatically. You have to develop emotional awareness and you have to apply what you become aware of so that you can choose responsibly. Making a responsible choice is making a choice that creates consequences for which you are willing to assume responsibility. So when you choose to act with patience when impatience is roaring through you,

you are creating authentic power in that moment. In my experience, this is hard work. Also, in my experience, it is the only work. It is not enough anymore to simply want to pursue external power, to do the things that satisfy the frightened parts of your personality, so that they will feel better about themselves and safer. Isn't that a glorious picture? It is now our evolutionary requirement. It is for us to create authentic power – or not. And the only way that you can contribute to a world that reflects the values of the soul is to live your life by choosing the energy of your soul, by choosing the intentions of your soul. At the bedrock, cannot get any deeper level –there are only 2 intentions –love and fear.

Your choice of intention is the fundamental creative act. That is what brings energy into matter that is what creates karma – that is what brings consequences into your life. It is not the words you say, it is not the things you do. There are many people doing good deeds and saying good things, but they are not creating constructive consequences for themselves or others because the intention is not loving. The intention, for example, might be to gain attention to themselves by saying wise things. I did that for a while. It doesn't work. You cannot fool the universe. You cannot get around karma. The universe knows your intentions, so if you do not know it, beware that you will be creating unconsciously, and that means creating in fear and that means creating painful consequences.

But as you begin to develop your awareness to include your internal dynamics, your emotions in terms of somatic experience, physical sensations in your body and then use your volition to choose between love and fear to consciously choose when you act, then you bring the intention of love into your actions, into your words and intention is a quality of consciousness, it is the reason for your acting and it infuses the matter in your life with energy –in this case with the energy of love. And when you are not aware what your intention is, you are infusing the matter of your life and the consequences of your life with the energy of fear and it creates only violence and destruction.

So that is the last big thought that I would like to share with you and that is that the pursuit of external power now creates only violence and destruction. It is a dead end stream. It goes nowhere. And you do not have to take my word for it. You do not have to take anyone's word for it. Even if you do not believe these things, even if you do not believe the most

beautiful aspects of Jain Philosophy, you will find out for yourself that what we are talking about is true. That you are a powerful and creative, compassionate and loving spirit and the pain in your life is a measure of the distance between your self-image and this reality. So now is the time above all to begin to act from this expanded recognition of yourself. If you do not, you create power nonetheless, but you continue to create painful consequences, and when you do, you continue to create power nonetheless, but you create constructive, beneficial, loving consequences.

I am so pleased and so gratified to be able to share these things with you and I send you all of my energy for a constructive gathering, to probe deeply into these things, which means to probe deeply into human experience and to recognize the power that each of us carries and that each of us alone must develop in ourselves—I in me and You in you—and that is how we can transform the world. I send you all my love and gratitude and appreciation.

## 14. Avenues of Scientific Research on Soul-Science and Kārmic Laws

*Paras Mal Agrawal'*

### **Abstract**

Both, modern science as well as Jainology, believe in the automatic running of the cosmos through the laws of nature. A large number of scientists including Nobel laureates support the existence of spiritual entity beyond the matter and energy recognized so far by the modern science.

With the recent discoveries of modern science, new gates have opened up for researchers of Jainology. For example, it is expected that in the near future, the computer memory and speed comparable to human brain could be achieved at an affordable price. Futurology, therefore, predicts the possibility of robots looking and talking like man or woman. Such robots would not only open the gate of the home on the arrival of the master but would be able to share what happened in the day with appropriate emotions and questions. J. Krishnamurthy once remarked that such developments would throw a big challenge to our faith in spirituality.

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It is, therefore, meaningful to pursue research on consciousness as well as *Bheda-Vijñāna*. Jainology is rich in providing spiritual knowledge regarding *Bheda-Vijñāna* which reveals the separateness of soul from the associated emotions and matter. For example, Ācārya Kundakunda writes:

*Jīvaṣṣa naṭṭhi rāgo na vi doṣo neva vijjāde moho.  
Na paccayā na kammaṃ ṇokammaṃ cāvi se naṭṭhi.*  
(*Samayasāra* - 51)

This stanza clearly says that emotions of liking and disliking, material possessions, etc. are different from the soul.

For the welfare and peace of the mankind another scientific avenue of research in Jain philosophy may be to explore *kārmic* laws. For example, one can take up the following:

*Bhūta-vratyanukampā-dāna-sarāga-saṃyamādi-yogaḥ  
kṣāntiḥ-śaucamiti sadvedyasya.*  
(*Tattvārtha Sūtra*— 6.12)

According to this *Sūtra*, compassion, charity, self-restraint, forgiveness, purity, etc. bring pleasant outcomes. The positive effect of forgiveness has already been researched by the psychologists of Stanford University in USA under the popular project known as 'Stanford Forgiveness Project'. Therefore, another project related with this *Sūtra* may be to explore scientifically positive effect of compassion in the form of sweet and polite words. In this lecture, we shall discuss some aspects of such experiment also.

## 1. Introduction

The modern science and technology have provided wonderful things to the mankind. Therefore, we love science. We respect science and we invest in science. We also realize that the science does not talk of peace, non-violence, forgiveness, love, etc. Peace is a big necessity. Therefore, we need spirituality. Spirituality described by Jain preceptors is based on the belief in eternal soul and *kārmic* laws. Some aspects of research on these areas would be discussed.

## **2. Modern Science, Jain Metaphysics and Soul**

Quantum Mechanics, a branch of Physics, discovered around 1900, is close to philosophy. Quantum Mechanics [1-3] satisfactorily explains the processes involving subatomic particles, which classical physics can not, and has become a very respectable area of Science/Physics. Nobel Prize awards for the work done during 1900 to 1930 on Quantum Mechanics shows the importance of this branch of physics. The list of such Nobel laureates includes Planck (1918), Einstein (1921), Bohr (1922), Millikan (1923), Compton (1927), de Broglie (1929), Heisenberg (1932), Schrödinger (1933), Dirac (1932), Davisson and Thomson (1937), Pauli (1945), and Born (1954).

Like the Theory of Relativity, quantum mechanics also leads to such results where our common sense fails. 'Tunneling' applicable to the emission of alpha particles from the nuclei is an example of the failure of common sense. In this process, one notes the crossing a barrier of high strength (say 50 units) by a particle of energy 10 units.

Quantum mechanics is close to philosophy because of the facts such as the acceptance of Uncertainty principle and the probabilistic nature, i.e., the same-cause-same-effect principle works only in a probabilistic way. Physicists such as Bohm [2] try to understand the Uncertainty principle through some kind of hidden variables not yet recognized by physics. Due to such phenomena in nature as perceived by quantum mechanics, we find books such as 'The Ghost in the Atom' [3]. Some scientists and philosophers have postulated a soul or soul-like or *kārmic* dust like stuff to explain all the phenomena. Many scientists tend to agree to such a notion. For example, we can consider the following:

Schrödinger (Physics Nobel Laureate-1933) writes, “Mind has erected the objective outside world of the natural philosopher out of its own stuff [4]”.

Wigner (Physics Nobel Laureate-1963) [5] remarks, “We are not machines. If man were a machine, then it should be possible to describe him in terms of atoms and molecules, and I don't think that is possible.” He [5] also mentions that consciousness is a non-physical entity.

Josephson (Physics Nobel Laureate-1973) writes, “Thus Bohm

views quantum mechanics as providing an indication that there is unobserved order in nature. This now connects back to what I was saying much earlier in my lecture, i.e., that if we want to put God into science, then we have to say there is an intelligence behind the scenes which is creating order or at least leaving things less ordered than they would have been without the intelligence being present [6]”.

George Wald (Medicine Nobel-Laureate-1967) writes, “... each of us has a share in Brahman, the *Ātman*, the essential Self, ageless, imperishable. *Tat tvam asi* – Thou art That! That is the stuff of the universe...” [7]. Albert Einstein (Physics Nobel-Laureate-1921) says, “I believe in Spinoza's God,...”[8].

An analysis made by Tihomir Dimitrov [9] reveals that there are at least 27 Nobel laureates in the field of science (physics, chemistry, and medicine) who believe in the existence of some entity (entities) beyond the matter and energy covered in physics. The bottom line of this discussion is that there are indications regarding the possibility of some real stuff not yet detected by scientific instruments. In this regard, it may also be noted that the modern science has neither proved nor disproved the existence of soul or *kārmic* laws.

There are many reasons for not arriving at any scientific inference about the existence of soul. One of the reasons is the lack of scientific funding for carrying out investigations. Another reason is revealed by Jain preceptor Ācārya Kundakunda in *Samayasāra* [10-12]. Here it would be appropriate to quote Āchārya Mahāprajna as well as Muni Mahendra Kumar to highlight the value of the scripture *Samayasāra*. Ācārya Mahāprajña writes: “He (Ācārya Kundakunda) was an author of many treatises, one of which is *Samayasāra*, which is the most outstanding one in the field of spirituality” [13]. Muni Mahendra Kumar writes, “It (*Samayasāra*) has the same value in Jain tradition as the treatises/scriptures like *Brahma Sūtra* in the *Vaidika* tradition and *Visuddhimaggo* in the Buddhist tradition. In short, we can say that for anyone to understand the essence of Jain philosophy, *Samayasāra* has to be studied [14]”.

In stanza 49 of *Samayasāra*, Ācārya Kundakunda conveys the following:

*Arasamarūvamagandham avvattam cedaṇāguṇamasaddam.  
Jāṇa alimṅaggahaṇam jīvamaṇiddiṭṭhasaṁthānam. ||49||*

“That which is without taste, form, smell, and sound, which is beyond perception, which possesses consciousness, which cannot be apprehended through a symbol or sense-organs, and which, being shapeless, cannot be shown by diagrams, must be known as the soul.” (Translation by Prof. Muni Mahendra in Ref. [11]).

Thus Ācārya Kundakunda explicitly reveals that soul cannot be comprehended through any symbol or sense-organs. It implies that soul cannot be detected by any instrument.

Further, in Jain description of *Bheda-Vijñāna* or 'knowledge of separation', the emotions are not the qualities of soul. For example, it may be noted that stanza-51 in *Samayasāra* [10-12], quoted in the beginning, says that emotions, karmic bonding, pleasure, pain, etc. do not belong to soul.

It opens an avenue of scientific research for the devotees. We need to explore and elaborate the attributes of soul and recognize the soul devoid of emotions [15,16]. It also requires an understanding of the relationship of soul with emotions and *Karma* from different perspectives (*Naya*). One may also be interested in exploring this issue that if soul and emotions are different then who gets bonded and who experiences pain and pleasure.

Here some analogies of science may be helpful: (i) Photons are emitted from H-atom but physicists know that photons neither come from the proton nor from the electron. An electron can truthfully say that "I am an electron, not a photon. The properties of photon are different from my properties". (ii) We also know that an electric bulb does not give light without electricity but light is not electricity, and (iii) Though a microphone and speaker system does not operate without electricity yet the sound from the speaker is not considered as the electricity.

Question: What is the advantage in knowing about such basics of the soul science?

**Answer:**

- (1) It is a matter of knowing the truth. The truth always brings good results.
- (2) A doctor not only recognizes 104 degree fever as a fever and gives medication, sometimes continuously and sometimes a few tablets per day, but also knows and believes that the fever is different from the physical body, and the body has ability to heal itself.
- (3) Same applies to the spiritual healing. *Prekṣā Dhyāna* or a high level of meditation requires an understanding of the soul devoid of pleasure, pain, emotions, sickness, etc.
- (4) In the technical language of Jain metaphysics, without *Bheda-Vijñāna*, living beings remain in the first *Guṇasthāna* and are considered as spiritually ignorant. The first step of spiritual progress lies in the realization of *Bheda-Vijñāna*. By such realization a living being jumps from the first *Guṇasthāna* to fourth *Guṇasthāna*. (It may be noted in this regard that while going up, the *Guṇasthāna* increases directly from first to fourth. Due to change in the realization, some living beings may come down to first from fourth also. The second and third *Guṇasthānas* are availed while coming down. It may be appropriate to add that *Guṇasthāna* is a measure of the spiritual progress. One attains liberation on attaining 14<sup>th</sup> *Guṇasthāna*) [17].
- (5) In the interest of equanimity and good emotional and spiritual health, many modern motivational speakers and psychologists also advance this point that the separation of soul from the associated physical body and emotions is to be understood. For example, let us look at the quotes from some best-selling books:

In Ref. [18], Wayne W. Dyer writes, “*Make an attempt to describe yourself without using any labels. Write a few paragraphs in which you do not mention your age, sex, position, title, accomplishments, possessions, experiences, heritage or geographic data. Simply write a statement about who you are, independent of all appearances.*”

In Ref. [19], Deepak Chopra writes, “*Your true Self, which is your*

*spirit, your soul, is completely free of those things. It is immune to criticism, it is unfearful of any challenge, and it feels beneath no one. And yet, it is also humble and feels superior to no one, because it recognizes that everyone else is the same Self, the same spirit in different disguises.”*

In Ref. [20], Eckhart Tolle writes, “*I am not my thoughts, emotions, sense perceptions, and experiences.*”

### **3. Kārmic Laws and Avenues of Scientific Research**

According to Jain metaphysics based on one's actions, one gets *kārmic* bondage which, in turn, brings circumstances of pleasure, pain, material gain, sickness, next birth, etc. The *kārmic* bondage is due to material particles known as *kārmic* dust or *Kārmaṇa Vargaṇā*. *Kārmaṇa Vargaṇā* is finer than *Taijas-Vargaṇā* which is finer than *Āhārak-vargaṇā* (*Tattvārtha Sūtra* 2.36 and 2.37). The present day technology is unable to detect *kārmic* particles due to their smallness. As discussed earlier, the Uncertainty principle of Quantum Mechanics also points out the possibility of some hidden variables. It is likely that *kārmic* particles may fall in the category of hidden variables.

What are the *kārmic* formulas or laws that show the relationship between actions and outcomes? Scriptures such as *Tattvārtha Sūtra* [21] may be helpful in seeking the answer. As an example, we can take up the *Sūtra* 6.12:

*Bhūta-vratyanukampā-dāna-sarāga-saṃyamādi-yogaḥ  
kṣāntiḥ—śaucamiti sadvedyasya.*

Meaning: Compassion towards all living beings, devotion towards the spiritually advanced persons, charity, self restraint with auspicious conduct, forgiveness, purity, etc. become the cause of bonding of pleasure feeling *karma* (*Sātā Vedanīya Karma*). (It may be noted that the meaning of '*Anukampā*' in the above mentioned *Sūtra* 6.12 is more than compassion. It includes courteous and polite behaviour).

It is possible to perform scientific studies to verify many points of this *kārmic* law. Already a scientific project named as Stanford Forgiveness Project regarding the beneficial effects of forgiveness has been successfully conducted in Stanford University, USA [22]. Therefore,

following the pattern of that study one can think of initiating a project related with this *Sūtra* by exploring the effect of compassion in the form of sweet, courteous, and polite words. For a quantitative study, one can first study the effect of the courteous and polite behaviour of retail shop keepers on their income and happiness. Before recording the data, a one-week workshop to educate and train the participating retail shop keepers is essential to let them understand various dimensions of courteous and polite behaviour.

#### 4. Conclusion

The examples of scientific studies described here are to be considered as preliminary. One can think of some other components in the future explorations. We all know that science of matter can do wonders. Both, modern science as well as Jainology, believe in the automatic running of the cosmos through the laws of nature. With this similarity, it would be very appropriate to expect and believe that the science of soul and *kārmic* laws may lead to more wonders in the form of peace, happiness, and bliss. Therefore, it may be valuable to explore and realize the significance and wonders of spiritual science.

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- [13] On the 'Blessings' page of Reference [11].
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## 15. Awakening of Higher Consciousness–Panacea for All World's Evils

*P. Sriramamurti<sup>1</sup>*

### Abstract

It is being increasingly realized that 'Awakening of Higher Consciousness' is the panacea for all evils in the world. It behooves the spiritual traditions to make a concerted effort in promoting this cause in a pronounced manner eschewing their denominational constraints. Several yoga techniques with a common base of self discipline, such as *Prāṇāyāma*, *Prekṣā*, *Vipaśyanā*, *Rāja Yoga*, *Surat Śabda Yoga*, all contribute to raising the level of spiritual consciousness. Dayalbagh, Agra (Head Qrs. of *Rādhāsoami Satsang*) is making efforts to forge a meaningful dialogue between Yoga of the East and Science of the West. Religion and Science are progressing towards actualization of the possibility of emergence of higher spiritual faculties of man. When you raise your consciousness further to the level of Highest Heavens/*Nirvāṇa*/*Kaivalya*/*Brahma*/*Satnāma*/*Rādhāsoami*, you would realize that the consciousness inside you is the same as what is there outside in nature and all living beings. The human body is the Microcosm with gateways embedded in the spine, grey matter and white matter of the brain to reach the regions of Physical World, Universal Mind and Pure Spirit in the

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**Macrocosm.** The destiny of humanity is controlled by an all-intelligent and all-merciful Spiritual Force which is leading humanity imperceptibly to it, illuminating the human heart and elevating the human soul to realize the Fatherhood of God and Brotherhood of Man. In this way all human problems get resolved and peace will be established on earth.

## **Awakening of Higher Consciousness**

1. Human civilization is in an unprecedented crisis. There is poverty in plenty,  
  
ignorance amidst explosion of knowledge, estrangement coexisting with enforced closeness, steep decline in values side by side ostentatious and exuberant religiosity, and lack of cohesiveness of love in human relations within family, community, nations, and it is much less internationally. Natural instincts are suppressed, emotions are perverted, reason is hijacked and spirituality is denied its role. Man is mechanized; finer sentiments of love, compassion and charity have lost their place in life, giving place to exploitation of environment and living beings including humans ruling the roost. Suicidal bombers have become the products of our age ready to annihilate humanity itself without concern to one's own self. What is the diagnosis of this colossal malady – self destroying epidemic? Fast spreading and far reaching malaise?
2. The wise among the spiritual traditions of the world should retrospect and act effectively coordinating with each other. Dr. M.B. Lal, the founder of Dayalbagh Educational Institute, had said: “It is not enough for us to grow in wealth and material prosperity. If there is no peace in the world today, it is not because of lack of material wealth. It is because there is lack of poise and balance of judgment in distinguishing right from wrong. We have failed to recognize our own spiritual dimensions and to kindle the spark of the Divine in us. So long as we do not accept and advocate the Fatherhood of God and Brotherhood of Man, we would neither trust each other, nor behave as dutiful children of the Supreme Father. You would, therefore, do well to discipline your mind and chasten your spirit.”
3. The inherent acquisitive impulse in man, when directed towards objects of the world, manifests as greed and avarice and this vice in

human character is the root cause of most of the present day troubles and misery. Nature in her bounty has made ample provision for sustenance of every form of life. If only men were but to apportion its gifts without greed and avarice, all men and other living beings on earth would have enough food, clothing and shelter. Otherwise these gifts would be found too few for us. Hence Sir Sahabji Maharaj, the fifth *Sant Satguru* and Founder of Dayalbagh, advises that this acquisitive impulse should be turned towards the direction of Truth. We should not lose sight of the high ideals of life set forth by all great men, we should follow them. There would then evolve a race of higher men in whom attributes of Spirit shall have the fullest expression through whom the Gracious Object of creation would be truly fulfilled. Man is endowed with instinct, intelligence, emotion, intuition and wisdom. He exercises higher order of intelligence and uses it for his own benefit and for that of all others. When he used his five senses only, he did not find full comfort. So he experimented with his hidden inner senses and discovered an inner eye which, on opening, blessed him with an experience of a different kind severally named with gradations – Heaven, *Mukti*, *Kaivalya*, *Nirvāṇa*, *Brahma Pada*, *Satt Pada*, *Rādhāsoami* by *Rishis*, *Munis*, Prophets and Saints. They gave out that transcendental knowledge to humanity which enabled people to attain internal bliss and establish peace outside in the world. Thus it becomes the prerogative of these spiritual traditions to quicken, kindle and awaken the spiritual faculties of man for establishing peace in the world. Education without spiritual awakening can make man clever, but not happy, inventions make men powerful but not self-controlled and all your possessions make you only more ambitious but not contented. So the teaching of all religions and spiritual traditions become relevant for human progress and for saving humanity from self-destruction. Religion means spiritual light that illumines and purifies human heart that elevates and expands human soul and that makes it possible for human mind to realize the Fatherhood of God and Brotherhood of Man.

4. Having accepted that the Soul, the spirit entity, animates and sustains the living beings and survives mind and body, it behooves one and all to awaken spiritual consciousness to the maximum extent.

*Ātmanāstu kāmaya sarvaṃ priyaṃ bhavati /  
Ātmā vāre dṛṣṭavyaḥ, śrotavyo mantavyo nididhyāsitavyaḥ //*

It is for the sake of one's self that everything becomes desirable. Therefore, one should find out what is that Self. One should hear about it from the *Guru*, discuss and contemplate on the Self.

5. Dayalbagh believes that the panacea for all ills and evils lies in the development of spiritual faculties. We need to rouse the latent spiritual faculty in man. We ordinarily have only physical and mental consciousness. We should awaken our spiritual consciousness and cognize the spiritual current that is giving life to man and the universe. "Providence has located within the human body a special spiritual faculty and it is the exclusive function of religion to teach man all about that faculty. When that faculty is developed in us like our other physical and mental faculties, we shall be able to perceive Truth and Ultimate Reality in the same manner as we perceive Sun with our physical eyes. And when that takes place, you will be both astonished and amused to find that Truth – the goal of Science, Ultimate Reality – the goal of Philosophy and God – the goal of Religion, are but three names of the same Supreme Essence." (8<sup>th</sup> Agra University Convocation Address by Sir Sahabji Maharaj, Founder of Dayalbagh, 1935). Religion alone can help us in this effort. Religion consists in coming into contact with the spirit-current (*Chaitanyavritti*) and moving it upwards to the source of the Spirit and inwards through physical and mental spheres to spiritual regions. All religions have spoken of different ways and means to reach spiritual regions. They analyzed the causes of human sorrow and the way to mitigate it and attain unsullied happiness. Their teachings are supplementary and complementary. They have no conflict with science, being themselves spiritual system sciences, and corroborated by all human experience and knowledge verifiable by all. Let us review below the methods adopted in Jainism, Hinduism and *Sant Mat* which have much in common in this respect.
6. Jainism teaches rigorous self discipline to enable man to develop his spiritual dimensions. Withdrawal and aloofness from the world

– *Nivṛtti Mārga* – is the life of Jainism. This helps awakening of spiritual consciousness leading to *Kaivalya*, complete dissociation of *Ātman* from Kārmic matter. The three spiritual practices of Jainism are *Samyak Darśana*, *Samyak Jñāna*, *Samyak Cāritra* – Right Perspective, Right Knowledge and Right Conduct. Rules are separately enjoined to householders (*Śrāvakas*) and mendicants (*Sādhus*). They are almost like the eight limbs of *Pātañjali Yoga*.

7. The Jain tradition too adopts the *Śabda-sāadhanā* for spiritual progress. In the *Namaskāra* (*Namukkāro*) *Mantra*, contemplation on “Om” is prescribed. The contemplation of *Praṇava* or *Omkāra* is performed independently also. This forms part of *Śukla Dhyāna* an advanced stage in spiritual progress. The *Mantras* used are: *Om Namo Arihantāṇaṃ*, *Om Namo Siddhāṇaṃ*, *Om Namo Āyariyāṇaṃ*, *Om Namo Uvajjhāyāṇaṃ*, *Om Namo Loe Savvasāhuṇaṃ*. Also the following combined *Mantra*:

“*Arhatsiddhācaryopādhyāyasarvasādhubhyo namaḥ*”//

It is believed that this fivefold *Namaskāra* wards off all sins, secures all auspiciousness and results in *Mokṣa*. This is combined with *Prāṇāyāma* too. It is also said that the place of concentration is *Nāsāgra* (tip of the nose – the seat of spirit). *Dharma Dhyāna* and *Śukla Dhyāna* are said to lead to salvation, a spiritual regeneration. Several stages of spiritual development are described in detail, which are called *Guṇasthānas*.

Kumārapālacarita of Hemacandra, Sarga 8:

“*Yati arihā-parama-manto paṃhiyyate, kirate na jīva vadho /  
Yatīsa-tatīsa jātī tato jāṇo nivvutīm yati*”//

Whosoever recites the great *Mantra*, *Pañca-Parameṣṭī-Namaskāra*, and does not injure or kill any living being, that man, to whatsoever *jāti* (caste) he may belong, attains *Mokṣa*, Liberation.

*Prekṣā Dhyāna* technique of contemplation is developed for attitudinal change which results in behavioural modification and personality development. Prof. J.P.N. Mishra formulated the

*Prekṣā Dhyāna* in terms of modern biology synthesizing ancient wisdom with scientific knowledge. Psychic energy manifests in a concentrated manner at some centres of human body. *Prekṣā*, perception of these psychic centres by focusing attention on them is meditation with concentration. Such a practice would endow the subject with faculties of clairvoyance and extra-sensory perception. The specific centres endowed with extra-sensory perception are called *Karaṇas* which get activated by concentrating on body and psychic centres. Each specialized cell is potential *Karaṇa* and it can become active on concentrating on it.

8. The relationship between the nervous system and the endocrinal system is significant. They coordinate and control all other systems. The integrated system may be called Neuroendocrine system. The endocrinal glands are scattered all over the body but related to nerve centres and *cakras*. Soul in *Ājñā Cakra* controls all bodily functions through the mind – the physiological, biological, electrochemical functions. The *Ājñā Cakra* controls the pituitary gland and the hypothalamus. The *Viśuddhi Cakra* controls endocrinal glands of thyroid and parathyroid glands. *Anāhat Cakra* controls all metabolism i.e., anabolism and catabolism and organizes the *prāṇic* currents of subtle life energy both in protection and destruction of the physical body. The *Maṇipura Cakra* controls the digestive system and the functions of pancreas. The *Swādhiṣṭhāna Cakra* controls excretion of liquid matter and gonadal endocrine glands and the *Mūlādhāra*, eliminates undesirable solid matter and controls adrenal glands. These are the explanations given by scientific investigation of the functions of the *Cakras* and their control over the glands. The six *cakras* in human body are reflection of six *kamalas* in the *Brahmāṇḍa* i.e., the Region of Universal Mind which are themselves reflections of six *Padmas* of Pure Spiritual Region, *Nirmala Cetana Deśa* of *Santa Mata*. The microcosmic centres in human body correspond to eighteen Regions in Macrocosm. Saints advise their disciples to start their spiritual practices from the *Ājñā Cakra*, the seat of spirit in human body for spiritual awakening and move on inwards and upwards to *Sahasradala Kamala*, *Trikūṭi*, *Śunna*, (the *Virāṭa*, *Hiraṇyagarbha* and *Avyākṛta* forms of *Brahma*), *Satta Lok* and

*Rādhāsoami Dham*, the Infinite Reservoir of Spirituality.

9. *Vipaśyanā* is the quintessence of Buddhist spiritual practices. It is rightly attracting the attention of all nowadays. The scientific tests are also performed on its practitioners. *Vipaśyanā* is closely looking at things which will gradually lead to enlightenment. *Ānāpānasati* (*Prāṇāpānasati*) concentration on the incoming and outgoing breath as well as concentration on *Brahmavihāras* forms part of this meditation. The four *Brahmavihāras* are *Maitrī* (friendship), *Karuṇā* (compassion), *Muditā* (altruistic joy) in the well-being of others, *Upekṣā* (sense of equality and justice towards all). These are found in *Pātañjala Yoga* also. In this way we find much in common in all yoga techniques, calling for a scientific corroboration of all the techniques in an integral way, after testing them independently in respect of different practitioners, to prove their scientific nature and efficacy for control of mind along with bodily well being and spiritual regeneration.
10. *Vajrayāna* and *Mantrayāna* of Buddhism use the formula “*Om Manipadme Hum*” accepting the efficacy of the *Omkāra*. All these uses of *Omkāra* in *Vedānta Yoga*, Jain and Buddhist traditions prove that the *Śabda Sāadhanā* is at the root of these practices. They show that the seekers and *Sādhakas* were seeking results only. The Christians speak of the Word and the Islamic Sufis speak of *Lahut* and *Hut*, which are of a high dimension of spirituality, like *Sat Nam* of Sikhs and *Rādhāsoami* of *Sants*.
11. The *Rādhāsoami* Faith teaches *Surat Śabda Yoga*, uniting the individual spirit current with unstruck spiritual sounds internally of *Om*, *Rarang*, *Soham*, *Satt* and *Rādhāsoami*, as the method for awakening the spirit and attaining complete salvation. In *Kena Upaniṣada* it is said that the waking of the spirit consists in the removal of the unconsciousness (sleep) of the spirit and the realization of its own self. It cannot be achieved through mind. It is the *Ātman* that can know itself. Besides the five *jñānendriyas*, man is endowed with subtle senses of inner perception. Their importance and that of the spiritual sound that awakens them are explained in all religions. It is *Anahāt Śabda*, unstruck sound, resounding at higher centres in human body. It is due to the spirit

force that even body and mind perform their intelligent functions. As the spirit casts off its coverings of body and mind, it becomes free and manifests itself in its eternal, all-intelligent and blissful form. The *Sūrata Śabda Abhyāsa*, consists of the practice of uniting the spirit current with sound current resonating at particular centres of our human body (*Anahāt Śabda*). This is the method taught in *Rādhāsoami* Faith for gradually freeing the spirit from all covers and getting full vision of the Supreme Spiritual Reservoir and get merged into it. This is in fact the object of human life according to all religious traditions.

12. The way of doing Science in India has been distinct from the western approach. The approach was holistic and integrative. The physical and mental dimensions of man were considered to be rooted in the spiritual and they sought answers to human problems in the higher dimension. Instinct, reason, emotion, intuition and revelation were used judiciously for the exploration of the inner worlds as well as those of the physical, physiological and psychological realms. Reason and intuition were used to investigate, organize and understand geometry, cosmos, physical universe, emotions, language, art and technology as well. Great discoveries and inventions were made. They gave us the so called Pythagoras theorem, concepts of *Tanmātras* and *Pudgalas*, classification of human species, the zero, the computational methods employed in prosody and writing a perfect meta-language for writing a descriptive and generative grammar, preparing alloys, astronomical calculations and great advances in spiritual science of Soul. In this effort, scientists affiliated to all creeds and classes participated. They openly recognized the contribution made by Greeks and other nations. The motto was:

*āno bhadraḥ kratavo yāntu viśvataḥ/*

(Let noble thoughts come from all directions)

*Yavanah: ṛṣivat te'pi puḥyante/*

(The Greeks are good at astronomy; they are also worshipped as *rishis*);

They ultimately built up such a confidence that they declared:

*Etad deśa prasutasya sakaśādāgrajanmanah: /*

*Svaṁsvaṁ caritraṁ śikṣeraṇa prthivyaṁ sarva mānavah: //*



(From the learned of this country, may all the people in the world learn how to lead their lives themselves).

13. This is echoed presently in the statement of Prof. P. S. Satsangi: "the fact that *Sant Mat* gives out the highest Revelation of the Supreme Spiritual Region of *Rādhāsoami*. *Surat Śabda Yoga* as the unique method for reaching that Region and *Param Sant Satguru* continues to remain here to work out the salvation of mankind." 'This makes us unique in our responsibility to humanity'.

Presently a better world order, making an arrangement possible under which people could lead their lives in comfort, with harmonious relations is the desideratum. There is however a condition for establishing this type of world order. The persons who are in charge of the administration of the affairs and arrangements, including those who are endowed with wisdom and foresight should join together in making efforts towards that end. Param Guru Mehtaji Maharaj, the sixth leader of *Rādhāsoami* Faith at Dayalbagh said: "Distinction and differences between high and low status should be completely obliterated. We should make no distinction between men of different colour, creed, race or religion, nor should we behave accordingly. In my opinion, there is no sensible person who would believe that there is more than one creator of this world. And when the creator of this world is one and the same, one should consider all the men in this world to be brothers and sisters". If this is agreed upon, they should ponder as to the various means they would have to adopt- they should have full freedom of thought and belief. They should have full freedom of expressing their ideas, they should be free from anxiety for their necessities of life and they should get rid of all sickness. Persons who are entrusted with making rules and regulations for the purpose- should not let their selfish ends, desires and rancor in between. They should act with a large heart-." Sir Sahabji Maharaj, founded Dayalbagh Ashram at Agra as Headquarters of *Rādhāsoami Satsaṅga* in 1915. Such efforts are continuously being made there through education, industry, agriculture, self-protection and other services, leading to evolution of a community of 'Supermen' with the chivalries of *Brāhmins*, *Kṣatriyas*, *Vaiśyas*

and *Śūdras*, all in one – a Superman is a complete man.

14. Firstly one has to adopt a way of life conducive to spiritual awakening inculcating virtues of contentment, forbearance, humility and devotion and become a seeker of Truth. Approaching an adept in Yoga techniques, he should awaken spiritual faculties. Even a glimpse of the glory of the spirit can quicken us in our journey and take us to our destination of realizing the highest level of spiritual consciousness. Stress is to be laid on having inner spiritual experiences which are elevating and make us develop into instinctive, to discursive, to intuitive beings. So long as we are enmeshed in matter and mind and on the plane of ego, we cannot have peace inside nor we can establish peace in the world. When you raise your consciousness further to the level of *Kaivalya/ Brahma/ Satnāma/ Rādhāsoami*, you would realize that the consciousness inside you is the same as what is there outside in nature and all living beings. In fact you are only an extension of the consciousness in nature. Thus we should raise our consciousness of the heart centre to that of spirit centre between the eyes and beyond to centres situated in the brain. Human body is the Microcosm with respective gateways embedded in it on the spine, grey matter and white matter of the brain to reach the regions of Physical World, Universal Mind and Pure Spirit in the Macrocosm.
15. In D.E.I., systemic experimental studies are being conducted on spiritual consciousness. It showed that there is no conflict between physical science and spiritual science i.e. Religion. Religion is only metaphysical Science, an extension of physical science. The spirit is the motive force behind mind and, at the secondary level, mind supervises the worldly functions of the brain (physical) which is at the tertiary level. Accordingly, in the primary abstract level of Universal Spirit in the Macrocosm, all spirit forces are interconnected. Similar is the case with Universal Mind and Physical Universe where net working of all minds and all brains and bodies communicate with one another. There are six sub-divisions in each of the Grand Division of Spirit, Mind and Matter. And pertaining to each individual spirit entity, there are equal numbers of sub-divisions. The individual spirit entities are spirit

forces which are parts of the all-encompassing abstract and infinite reservoir of Universal Spirit Force, Omni-Quantum-Spiritual Force Field, as it is called by Prof. P. S. Satsangi. These spirit particles are imperishable while the mind particles and particles of quantum physical force fields are ephemeral. Consciousness pertaining to spirit entity at the eighteen levels of its existence in spiritual, mental and physical levels is graded. As an investigator i.e. the practitioner of yoga of different kinds ascends to various levels, the effects are seen and measured in the electromagnetic fields by appliances such as EEG, MEG and fMRI (Electro-encephalogram, Magneto-encephalogram and functional Magneto Resonance Imaging) using these as also SQUID (Superconducting Quantum Interference Devices), Random Numbers and some established psychological tests on practitioners of *Surata Śabda Yoga* at the Yoga Centre of Dayalbagh and D.E.I. Research was also conducted on “Effect of Yoga and meditation on Consciousness and Mindfulness” using tools like Freiburg Mindfulness Inventory, Consciousness Quotient Inventory, Mind-wandering Questionnaire.

16. Of late we see great interest being shown in yoga. The lack of poise, criminal tendencies, inability to take right decisions at the right time in different walks of life, lack of harmony in human relations are motivating people to resort to several types of yoga exercises with and without religious tags. Their efficacy for restraining mind, increasing concentration and mental equilibrium, emotional equipoise and raising the levels of consciousness by creating interest in cultivating higher values of super mind and spirit is evident beyond doubt. The practitioners of these yoga techniques are also eager to demonstrate their usefulness to the public by allowing several tests being conducted on them. This has popularized their practice but mostly they are picked up from books or amateur practitioners. If they are done with meticulous care through regulated and properly trained teachers, it would really deliver immense results. It should be seen that these yoga exercises really result in raising of mental faculties, improve moral behaviour and elevate the spiritual consciousness of the people at large.

17. As has been clearly stated by Prof. P. S. Satsangi, Chairman, Advisory Committee on Education, Dayalbagh, who is the Leader of the *Rādhāsoami* Faith, Dayalbagh, as also a great Systems Scientist, a unique model of scientific methodology for investigation of consciousness is evolving. The methodology of first person investigation of consciousness by contemplation namely, *Surat Śabda Yoga*, i.e., uniting the individual spirit current with the sound current of the cosmos is being integrated with their personal methods of observation, deduction, decision making and hypothesization. Thus we build into the third person modeling frame work, the results of first person subjective experiences of inner reality, by scans of all the three levels of inner experience. Adopting the terminology of Rocco Gennaro – HOT (Higher Order Thought) which he says is what makes a mental state conscious – a new connotation is given to HOT – Consciousness, i.e., Hierarchical Order Transactions of Consciousness taking into consideration all the 18 levels of consciousness in the cosmos in all the three domains of spiritual, cognitive and neural-environmental, taking into consideration our experience of inner and outer worlds. The scientific methodology is retained, building into it phenomenology of first person inner experience.
18. The Dayalbagh Educational Institute established a Centre for Consciousness Studies which is developing in close association with the Quantum-Nano Centre established earlier. Consciousness is being investigated by scientists, both physicists and neurobiologists, moving towards a Science of Consciousness. Dayalbagh as a Centre of Spiritual Organization and DEI, established for service to humanity through education, are working in unison in the field of Consciousness Studies. We are developing a method of scientifically acceptable phenomenology. The lofty philosophy of *Rādhāsoami* Faith and inner experience are being made known to the world through interaction with top scientists by integrationist efforts organizing East-West Forums in the regularly held yearly Conferences of (Towards) The Science of Consciousness by Prof. Stuart Hameroff of University of Arizona, USA.
19. Efforts are being made at Dayalbagh to forge a meaningful

dialogue between Yoga of the East and Science of the West. Religion and Science in recent years are progressing towards actualization of the highest human possibility of emergence of higher spiritual faculties of man. "Providence has located within the human body a special spiritual faculty and it is the exclusive function of religion to teach men all about that faculty. When the spiritual faculty is developed in us like our other physical and mental faculties, we shall be able to perceive Truth and Ultimate Reality in the same manner as we perceive Sun with our physical eyes. And when that takes place, you will be both astonished and amused to find that Truth – the goal of Science, Ultimate Reality – the goal of Philosophy and God – the goal of Religion, are but three names of the same Supreme Essence." (8<sup>th</sup> Agra University Convocation Address by Sir Sahabji Maharaj, Founder of Dayalbagh, 1935). Summing up the current state of Consciousness Studies at Dayalbagh Educational Institute, Prof. Prem Saran Satsangi, observed that: "At Dayalbagh, we have the rare blend of science and spirituality, with the DEI University providing the science and Dayalbagh community the spirituality.... We are pursuing at Dayalbagh 'Mission : Science of Consciousness' promoting and practicing *Surat Śabda Yoga* - uniting the Spirit with the Sound Current which is the true yoga for the well being of not only body but mind as well as spirit."

20. The destiny of humanity is controlled by an all-intelligent and all-merciful Supreme Spiritual Power..."there is a merciful plan with which this universe is being run and there is a merciful destiny to which humanity is being led imperceptibly.....Religion means spiritual light, purifying and illuminating the human heart, elevating and expanding the human soul thus leading the human mind to realize the Fatherhood of God and the Brotherhood of Man". In this way all human problems get resolved and peace can be established in the world.

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## **16. Past Life Memory, Quantum Theory and the Jain World View**

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### **Abstract**

At first glance, the doctrine of rebirth, traditionally a matter of religious and philosophical belief, would not appear to be a topic conducive to scientific investigation. Recent studies of past life memory in young children, however, combined with developments at the cutting edge of physics, suggest that this situation may be changing, and that rebirth, a central tenet of the Jain worldview, is perhaps becoming an appropriate topic for scientific study. The claim here is not that rebirth has been proven, but that there is sufficient evidence in this regard to warrant taking this topic seriously and engaging in further research.

### **Introduction, Past Life Memory and Jain World View**

In a now famous conversation between Carl Sagan and the Dalai Lama, Sagan, a scientist, author, and renowned skeptic, asks, “Your Holiness, what if science were to prove that there is no such thing as reincarnation?” To Sagan's astonishment, the Dalai Lama replied without hesitation that if rebirth were to be disproven, then the word would need to

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be put forth that Buddhists should stop believing in it. The Dalai Lama, however, then stumped Sagan with the question, “How would one disprove reincarnation?”

How, indeed? Belief in reincarnation, or rebirth, like many other spiritual beliefs, would, at least at first glance, appear incapable of falsification—and falsifiability is the criterion by which any claim can be said to be properly scientific.

In other words, if one wants to assert a scientific claim, one must answer the question, “What would be needed to disprove this claim?” By what test could one measure the departure of consciousness at the moment of death and the continuity of the same stream of awareness in another, newly born or conceived individual? More to the point, how could one demonstrate in a conclusive fashion that such a transfer never occurs, or that it is impossible?

At first glance, this would appear to be an extremely difficult, if not impossible, task. The best candidate for such a test would seem to be the existence of memories in a person of places and events that they could not possibly have experienced in this life, and to which it could be proven that the person had no access through books, the internet, or hearsay. But how could such memories be subjected to repeatable testing? One problem is where to look. Such alleged memories are typically brought forward either by people who have experienced them or, in the case of young children, by their parents. By the time the data is brought to a scientist, it is likely already to have been corrupted through the introduction of the idea of reincarnation and whatever biases in favor of or against the idea that the person or his or her family might have. These are not laboratory conditions.

Some would argue that its apparent un-testability is a sufficient basis for rejecting the idea of rebirth: that one cannot measure or analyze a soul or stream of consciousness as it leaves the physical body because there is no such thing as a stream of consciousness independent of a living brain. If one assumes that consciousness is nothing more nor less than an effect of brain activity, then past life investigation becomes not only a difficult, or even impossible, proposition, but a nonsensical one, unworthy of scientific pursuit.



The assertion that consciousness is an effect of brain activity, however, is not a scientific conclusion, but rather a philosophical assumption. And while it is certainly not an unreasonable assumption to make, given the fact that brain death appears to result in an end to the consciousness of the person, it might also be the case that the death of the brain is analogous to the malfunctioning of a television set or radio. The fact that my TV or radio is broken does not mean television and radio stations have ceased to broadcast. What if the brain does not generate consciousness, but rather mediates it to the physical plane of reality to which science has access—the sensory, material world—from a plane that is no less real, but that is not amenable to scientific investigation, at least as science is currently configured? This, of course, is a completely unfalsifiable claim, and many would argue that it is a fanciful one: a product of wishful thinking, rather than of a clear-headed examination of the available evidence. But, as David Ray Griffin argues, it is not only believers in the survival of consciousness beyond death who engage in wishful thinking. The inclination to deny the survival of consciousness beyond death is no more innocent than the desire to affirm it. “The pervasiveness of wishful thinking becomes all the more evident when we realize that it can be negative as well as positive, as our thoughts about philosophical possibility, and our interpretations of empirical data, are sometimes guided by what we hope *not* to be true.” Scientist Hermann von Helmholtz provided an example of such negative wishful thinking when he said of telepathy, “I cannot believe it...[Not] even the evidence of my own senses would lead me to believe in the transmission of thought from one person to another...It is clearly impossible.”

Such stubborn skepticism, an *a priori* rejection of the possibility of a phenomenon even before either positive or negative evidence is proffered, would seem to be as alien to the spirit of empirical research as a stubborn insistence that the phenomenon is real. It is not that either form of insistence is necessarily wrong; but neither equates to science. Both, rather, are philosophical inclinations, to which one may be drawn for reasons having little or nothing to do with empirical evidence. A peculiarity of the discussion of the survival of consciousness after death is that one such set of assumptions—the negative set—is taken by many to equate to established science, when the reality is that a variety of possible accounts of reality are logically compatible with current scientific knowledge.

The pervasive importance of belief in the survival of consciousness beyond the death of the body in humanity's religious and philosophical traditions, including among believers who are also scientists, suggests that this is an idea that one can take seriously without running afoul of our best current science on the mechanics of consciousness: the workings of the brain, which parts of the brain are active when we experience particular mental and emotional states, and so on.

Science, in other words, is compatible with a variety of ontologies: a wide range of views about the ultimate nature of reality, beyond what science itself is able to confirm or to reject. Science tends to be widely associated with a materialist ontology: the view that the world that is visible to the senses (or their extensions, via instrumentation) is all that exists. It is logically possible, though, to affirm the findings of science while holding other views about those areas that are not amenable to scientific investigation. One may hold an idealist view of the fundamental nature of being, for example, according to which consciousness is not an epiphenomenon of physical processes, but the physical universe, rather, is an epiphenomenon of consciousness, while happily accepting the findings of the neuro-scientific community about the role the brain plays in the physical process through which consciousness manifests in the plane of experience that we call the material world. Indeed, past life investigation points in precisely such a direction.

Given the inapplicability of the scientific method to the question of rebirth, belief in this phenomenon typically belongs to the realms of religion and philosophy. Rebirth is something that people affirm not due to a rigorous examination of scientifically tested evidence, but because it plays an important role in their world view or system of values. For many, the idea of rebirth, combined with the closely connected concept of karma, a principle of cosmic justice, provides a psychologically reassuring and logically consistent answer to existential questions like, "What happens to our consciousness after physical death?" and "Why does there seem to be so much undeserved suffering in the world?" In the *Dharma* traditions, such as *Vedānta*, Buddhism, and Jainism, rebirth is also affirmed because sages, *rishis*, are believed to have experienced it directly, through refined yogic perception, and the methods through which anyone might, in principle, experience such a perception are available to all. The belief in

rebirth in these traditions is therefore, while a matter of faith, of confidence in the authoritative word of another, not a matter of faith in a unique or special revelation that goes against the ordinary observation of the world.

At the same time, a strong denial of the reality of rebirth is similarly rooted in a set of philosophical principles and not in the conclusions of science—because, again, this is not a scientific question. Although many will affirm that neuroscience has proven that consciousness is an effect of brain activity, and that there is no such thing as an afterlife in the traditional religious sense, this is not a scientific conclusion, but rather a logical leap from science to metaphysics. The scientific data in this field, while giving us a great deal of useful and important information about the function of the brain, under-determines the question of the nature and origin of consciousness. The widespread affirmation by a good many neuroscientists, therefore, that neuroscience has proven the non-existence of a consciousness that survives physical death, is an error that is based on “negative wishful thinking.” Neuroscience has proven no such thing. It has shown that a great deal about the structure of our consciousness at a given moment can be explained by brain activity. But it cannot prove the falsehood of an unfalsifiable claim.

The argument here is not that the reductionist materialism of many neuroscientists is wholly indefensible. The problem is that it is rarely ever given a proper philosophical defense. Rather, it is simply assumed that this is how an educated, enlightened person of a scientific temperament must think. When one takes into account that another possible approach to the nature of consciousness is available from within the realm of science itself—at the cutting edge of quantum physics—such reductionist assumptions appear even less justifiable. Marilynne Robinson puts the matter incisively, “Nothing can account for the reductionist tendencies among neuroscientists except a lack of rigor and consistency, a loyalty to conclusions that are prior to evidence and argument, and an indifference to science as a whole”. In the words of psychiatrist Jim Tucker, from whom we shall hear more momentarily, “What most mainstream scientists seem unaware of, or at most only vaguely aware of, is that the most fundamental findings of physics have now disproven materialism”.

From the pragmatist perspective of the philosopher William

James—who, though skeptical of such things, was, unlike Hermann von Helmholtz, at least open to the testing of paranormal phenomena—the question of rebirth, like the question of the existence of a deity or deities, is in the realm of topics on which no conclusive evidence, positive or negative, can be presented. According to James, one is free to believe in such things or not, depending on how such belief or disbelief fits into the larger worldview through which one finds meaning in life. Those who are inclined to believe in rebirth because it helps them make sense of their life experiences in a profound way are free to do so, and those who are inclined to reject this notion as a superstition are equally free to do so on the basis of its un-testability. Both may claim that their views are consistent with science, which, at least as currently configured, is not in a position either to confirm or to deny conclusively whether rebirth occurs.

The best candidate, it seems, for scientifically testable evidence for rebirth, is in accounts of past life memory, the details of which can, at least in principle, be confirmed or proven false. Few scientists, however, pursue research into this phenomenon because it is viewed—due to the pervasiveness of materialism, as well as Abrahamic religious beliefs, in the scientific community—as well outside the mainstream of acceptable science.

As has been noted by Jonathan Edelmann and William Bernet, “One reason that parapsychological studies on reincarnation in particular may often be considered outside the pale of solid academic research is that reincarnation entails an ontology that deeply contradicts contemporary scientific, philosophical, and Christian theological views of mind consciousness.” There is dogmatism, in other words, in the scientific community just as there is in the realm of religion. So many scientists are already convinced that reincarnation is impossible that it is not viewed as a worthwhile use of time and resources to pursue research suggesting that it might, in fact, occur.

The implications, though, were proof of rebirth to emerge, would be profound indeed. As Edelmann and Bernet point out, “If it were shown that a human mind or consciousness could reincarnate into another body after death, this would have a revolutionary impact on how we understand mind-body relationships, the nature of human memory, and the ontology of consciousness, as would the studies done on near-death experiences.

Moreover, reincarnation would rule out reductive materialism, and give some credibility to non-physical views of consciousness in Eastern religions such as Hinduism, Buddhism, and Jainism.”

The alleged instances of past life memory that has been investigated by the intrepid scientists who have been willing to pursue this line of research fall into two categories: hypnotic and spontaneous.

The phenomenon of apparent past life memories emerging during hypnosis is presented famously in the work of Brian L. Weiss, a Miami-based psychiatrist who documented the memories that emerged in one of his patients after he had placed her under hypnosis in a bestselling book published in 1988 and titled *Many Lives, Many Masters*. Particularly after the publication of this book, “past life regression” became an increasingly popular element in the repertoire of New Age spiritualists.

Interesting though the revelations are that occur when persons are regressed to past lives through hypnosis—a process that many have found to have therapeutic value—as far as scientific verification of reincarnation goes, they have proven to be of little value. As a tool of empirical investigation—including investigation of crimes allegedly occurring during the childhood of regressed patients—hypnosis has proven unreliable. The power of leading questions to generate entirely fanciful visions in the minds of patients makes it incapable of withstanding rigorous scrutiny. Even in cases where information given in regression could be independently verified, the possibility could never be entirely discounted that the information in question was already known, at least on an unconscious level, by either the patient or hypnotist.

Far more promising is the phenomenon of spontaneous past life memory, especially in children. An impressively large number of cases of this kind—cases numbering in the hundreds—was compiled by University of Virginia professor of psychiatry, Ian Stevenson.

The phenomenon of very young children, between the ages of three and six, claiming to remember details of their past lives is not unheard of in India. A skeptic, however, might claim that such alleged memories, particularly occurring in a culture where reincarnation is a widely accepted belief, are simply a reflection of this prevailing belief. Such stories certainly do not meet the rigorous standards of rational

inquiry that would be needed for them to be accepted as scientific proof of rebirth. Children are highly impressionable. A story that might simply begin in the imaginative mind of a child could sound to an adult who believes in reincarnation like an event from the life of a person they know who has died. Leading questions and prompting might lead the child, who wants to please adults, to craft a story that fits the details for which the adult is looking, and so thus reaffirms the adult's belief in rebirth. This is not science, but wish fulfillment.

Stevenson's work was plagued by problems of this kind, given that a large number of his cases were drawn from regions such as India and Southeast Asia, where belief in rebirth is woven into the cultural fabric. It was also argued that Stevenson's methodology failed to include cases that were not supportive of his theories—falsifiability, again, being a key component of scientific investigation. Stevenson's findings were nevertheless extremely interesting, including numerous cases in which birth defects could be traced to events that allegedly happened in previous lives—such as large moles in places where candidates said that they had been shot or stabbed in a past incarnation.

It is much more difficult, though, to discount this phenomenon when it occurs in a culture in which belief in reincarnation is widely rejected, such as that of the United States. Take the case of Ryan, a boy from Oklahoma. Ryan's parents are conservative evangelical Christians. Belief in reincarnation is strongly rejected in this religious tradition as a false doctrine, and the broader American culture in which the family lives is strongly skeptical of the concept (though not all Americans reject the idea of reincarnation, with roughly twenty percent of the population accepting this idea, according to most opinion polls).

Around the age of four, “Ryan began talking about going home to Hollywood. He would cry and plead for Cyndi (his mother) to take him home so he could see his other family”. This account is given in *Return to Life*, a book by Jim Tucker, the child psychiatrist at the University of Virginia to whom Ryan's parents took him for help. Tucker, building on the work and sharpening the methodology of his mentor, Stevenson, has continued to compile cases of apparent past life memory. Collecting Ryan's detailed accounts of his past life, and correlating them with carefully researched information, Ryan's parents and Tucker concluded

that the life Ryan was describing was that of Marty Martyn, an agent from the golden age of Hollywood, but not a person of any particular fame, and with no connection to Ryan or his family.

Importantly, the details Ryan articulated were not readily available, such as on the internet, and no one in Ryan's family, nor Tucker, had any knowledge of Martyn prior to engaging in this research. In the most striking portion of the entire story, Ryan at one point said, with some frustration, that he did not understand why God would allow someone to live for sixty-one years and then make them come back as a baby. All of Ryan's information about Martyn's life at this point had proven accurate, but on this one point of fact, he was at odds with Martyn's official death certificate, which stated that Martyn had died at the age of fifty-nine. Further research, however, proved that Martyn had in fact died at the age of sixty-one, and that the birth certificate was incorrect. Ryan therefore not only had detailed information about the life of a man no one in his family had ever met and about whom they had no prior knowledge, but his information actually led to a correction of the public record of the death of that same man.

Is Ryan's story scientific proof of rebirth? Not necessarily. The phenomenon described here is susceptible to a variety of interpretations, including a form of telepathic contact between the deceased Marty Martyn and the living Ryan. It does, however, raise serious questions about the standard materialist paradigm that is used to explain phenomena such as consciousness; for even if Ryan's declarations are not repeatable or testable under laboratory conditions, they do leave us with the fact that a young child has been walking around, as far as can be discerned, with detailed memories from the life of a deceased person whom he never met and to whom neither he nor his family had access, in his mind. Even if, under the most rigorous definition of science, this information does not count as proof of rebirth, it certainly renders problematic the standard materialist idea that consciousness is nothing but an effect of neurochemistry, incapable of surviving the death of the brain.

Again, neuroscience tells us a great deal about the mechanics of consciousness: how the interactions of chemicals and electrical activity in the various parts of the brain correlate with specific experiences. We certainly need our brains to get by in this world.

One may assume a materialist ontology and take an account of brain activity to be a comprehensive account of consciousness. But one may also accept the conclusions of neuroscience on the mechanics of consciousness without buying into a materialist view of its ultimate nature. The fact that my sensory perceptions correlate with activity in part of my brain, and that this activity can be witnessed and measured scientifically, does not mean that my perceptions are not real: that there is not actually a world I am perceiving. And the fact that my consciousness, to all appearances, is dependent upon my brain does not mean that my brain might not simply be a tool or vehicle for something beyond itself that is not reducible to it. As mentioned above, the fact that my television or radio stops working does not mean the television station or radio station has ceased broadcasting. The science, again, underdetermines the philosophical question of the ultimate nature of things. One who is wedded to a materialist ontology might be inclined simply to reject the results of Tucker's research. But this would not be a scientific attitude. It would be akin, instead, to Von Helmholtz' refusal to give credence to research in telepathy. An *a priori* decision that, regardless of empirical data, something simply cannot be true is not in accord with scientific temperament or method.

In taking the implications of his research seriously, Tucker has raised the question, "What scientific model of reality might explain phenomena of this kind better than materialism is able to do?" In response to this question, Tucker, in the final two chapters of *Return to Life*, explores some implications of recent physics, particularly quantum theory. In these chapters, Tucker makes a number of significant points, including the fact that there are interpretations of quantum theory according to which consciousness is not merely a by-product or epiphenomenon of material processes, but that it is foundational to being itself, that our experience of the material world has the character of a collective dream, and, of course, that consciousness can survive the death of the physical body to be reborn in another form.

In Tucker's work, very importantly, he does not display an extensive or in-depth knowledge of Indian philosophical traditions such as *Vedānta*, Jainism, or Buddhism. This is important because he cannot be accused of having a communal axe to grind in advancing his theory, one implication of which is that these traditions have been right about many



things in the basic account of reality that they give—though this is of course precisely why we are interested in these findings in the context of a conference on Jainism and science. Like Jainism, with its affirmations that conscious *jīvas* pervade the cosmos, Tucker hypothesizes that consciousness is fundamental to the nature of being. Certain aspects of quantum theory also fit well with Jain philosophy. The fact that the same entity can be described as both wave and particle, for example, is consistent with the Jain teaching of *anekantavāda*, the multi-faceted nature of reality, *navavāda*, the teaching that reality can be viewed from many perspectives, and *syādvāda*, the teaching that truth can be expressed in a variety of seemingly contradictory ways. The fact that consciousness is not a byproduct of material processes, but intrinsic to the nature of being itself, echoes the Jain teaching that the *jīva* does not emerge from or depend upon *ajīva*, but is entirely distinct from it. And Tucker's model of course affirms the phenomenon of rebirth itself—including rebirth across species. Interestingly, Tucker's cases even include one in which a child seems to remember a past life as a snake. This affirms not only the Jain view of consciousness as distinct from the physical body, but also the Jain view that consciousness is not limited to human beings.

What should one make of such developments? Tucker's work is of course exciting news to those of us who are drawn to ideas of this kind, and who practice one (or more) of the traditions in question. At the same time, the very fact that one would like very much to believe in rebirth is reason for caution. Just as a materialist errs in simply dismissing the evidence Tucker presents because it does not fit the materialist's preferred, preconceived metaphysical paradigm, an adherent of rebirth, and an idealist metaphysical account of consciousness, would err in exaggerating the scientific conclusiveness of the information that Tucker has collected—information that is not derived from a repeatable methodology, and which, again, is susceptible to a variety of possible interpretations.

And to the extent that rebirth plays a role in a religious or *dharmic* worldview, one should be wary about placing too much reliance on the latest science in cultivating one's worldview and way of life. Science is always subject to eventual change given further experimentation and speculation. It cannot be simply set aside, given its explanatory power; but it does have its proper limits. Ethical and metaphysical reflection must certainly be informed by science. They cannot, however, be dictated by it.

Science is important for playing the role of falsification, for ruling out what cannot be the case. But there are other foundations for knowledge - other *pramāṇas*, as such foundations for knowledge are known in the Indian philosophical tradition - as well. For those of us who accept the idea of rebirth, our belief is founded on the yogic perceptions of the ancient seers—such as the *Tīrthaṅkaras* – and, in some cases, our own *sādhana*, or spiritual practice. Such spiritual practice can provide a self-certifying experiential foundation for a worldview that includes rebirth, and it is arguably a sufficient basis for an individual to hold this belief. This is not, however, the same thing as science, which involves publicly available, testable, and repeatable knowledge. In other words, I am certainly justified in believing in rebirth if I am able to remember my own past lives through yogic practice (particularly if the knowledge I receive thereby is verifiable through other sources, and is consistent with other established knowledge). But this is not a sufficient basis for another person to hold the same belief, if that person has not had the same experience. This is a subtle, but important difference between an experiential, *dharmic* approach to knowledge and the empirical or scientific approach. These two need not be incompatible. In fact, they must ultimately be in harmony; for reality is one. But they are not identical.

Because of its many profound implications for spirituality and our understanding of who we are, research of the kind pursued by Jim Tucker clearly deserves much greater attention than it has heretofore received, and not to be simply dismissed because it does not fit with the materialist ontology fashionable among many scientists, or because it raises uncomfortable questions about the model of the afterlife held by many adherents of the Abrahamic religions. That is the plea of this paper.

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## 17. Dying and Death in Jainism: Philosophical Anthropology of *Samyaktva*

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### Abstract

Depending on the cultural and religious background, the last phase of life stipulates existential questions of meaning, soteriological directives and modes of conduct facing the collapse of the body. This presentation seeks to connect the Jaina view of the body, the soul, the load of karma, rebirth and liberation with the very consistent Jaina views of dying a good death. The textual sources for this theme are *Ārādhana*-texts, especially *Śivārya's Mūlārādhana*. The importance of faith and the great discipline required for the exemplary death by renouncing food and drink is at the core of a process of active and conscious dying. The topics of 'voluntary death', 'assisted death' and 'self-killing' will be clearly delineated and put into context.

### Dying and Death in Jainism

A book written in 2010 by the Dutch psychiatrist and sociologist B. Chabot and the German neuro-biologist C. Walther dealing with “Self directed dying by voluntary renouncing eating and drinking” was

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republished in 2015 in the fourth edition. It received a lively response from scientists as well as from the general public. The title of the book, translated into English, is: *A Way Out at the End of Life*. The age-old method of ending one's life voluntarily by consciously refusing food and fluid, as practiced, for example, by Stoics and Epicureans, has been revived in this book; numerous articles and the praxis in palliative care comment on it rather positively. This revival comes at a time when the so-called ethic commissions all over Europe discuss the political, juridical, theological, philosophical and medical standpoints regarding euthanasia and find themselves in extremely difficult controversies. The method of renouncing food and drink seems to be seen by many patients, by their families and by palliative workers to be a relieving resort in the jungle of juridical dilemmas and restrictive rules. It is a way out, it is not illegal, it is feasible, it is a kind of soft way of passing in comparison to taking a lethal dose of barbiturates. Research surveys report that the dying process is usually not too difficult to endure, provided some care is taken against the dryness of the mouth and eventual pain. This method of dying is presented as a possible way for those who want to take their end in their own hands, in order to die in dignity, which is understood as a self-determination and avoidance of pain, invalidity and dependency; it is a possible escape from physical and mental horrors — a way out at the end of life.

I would like to juxtapose this “way out” with the Jaina way and view by considering some salient points of difference as gathered from a pertinent text. The investigation will thus be based on textual evidences. The specific phenomenon, namely faith as the basis of decision and acts, which I hope to delineate below, is concerned with human nature and is thus a topic of philosophical anthropology.

The Jaina mode of dying by renouncing food and drink, *bhaktapratyākhyāna*, by taking the vow of *sallekhanā*, is one of the age-old methods of ending one's life voluntarily. Much has been written about it especially recently since it was in the news due to the notorious court verdict and its suspension. However, few critical studies have been done on the old texts whose theme is exactly the science or the art of dying and its contextual and intertextual features.

This paper tries to spin a thread of interconnected tenets as found in old basic Jaina texts on dying the death of the wise. It seeks to show that at

the core of the topic of ending life are the concepts of *darśana*/faith, *jñāna*/knowledge and *cāritra*/conduct, the three jewels and the prominent feature of Jaina asceticism, *tapas*/penance. The interrelation and the impact of these concepts, will be depicted on a textual basis. An attempt is made to show that the celebrated modes of dying an active, disciplined death in *sāmāyika*, *ahimsā* and *śuddha dhyāna*, are entirely linked with the human phenomenon of having absolute faith in a doctrine. *Ārādhana* and *samyaktva* are the concepts which discern this mode of dying.

First, a short remark about the term *Ārādhana* and the *Ārādhana* texts: They are dogmatic and ethico-religious texts, systematically expounding *samyaktva*, the rightness, regarding *darśana*, *jñāna*, *cāritra* and *tapas*. They are concerned with attaining final spiritual purification.

The focal literature of my research is Śivārya's *Mūlārādhana*, also called *Bhagavatī Ārādhana*. Śivārya's dates are not known. A.N. Upadhye suggests that the work belongs to the earliest stratum of the pro-canon of the *Digambaras* and scholars give reasons to place the author around the 1<sup>st</sup> century of our era. It is written in a *Prakrit* which the eminent Prakritist Richard Pischel calls Jaina-Śaurasenī. The *Mūlārādhana* offers in more than two thousand verses a compendium of the entire Jaina doctrine; and one has to add the *Digambara* doctrine, although the text is far from being sectarian. The *Mūlārādhana* is a book on dying and death, in that it explains step by step the perfect purification in the most decisive last phase of life.

The prominent theme is dying a salvific death, i.e. a process which enables an ascent on the ladder to liberation, be it a good rebirth or, in the best case, liberation from the cycle of rebirths. The ultimate characteristic of a salvific death, that is one of the three types which have the attribute *pañḍita*, (*bāla-pañḍita maraṇa*, *pañḍita maraṇa* and *pañḍita-pañḍita maraṇa*), is dying with complete control over the senses, free from passions and in pure meditation. It is also called *samādhi-maraṇa*. Such a death is well prepared and the dying itself is an active process. It is based on a decision of the person who may be a lay-person or a monk or a nun. One should note, that the *Mūlārādhana* includes laymen as well as women. *Ārādhakas* attempting the active process of dying get a *dikṣā*, an initiation into the monastic status or a re-initiation in the case of a monk or a nun, since they would have to leave their order and enter another. The

path consists of forty detailed steps, covering several phases, like leading an ideal ascetic life, studying the scriptures (*śikṣā/svādhyāya*) (no.3), reaching the inclination (*parīṇāma*) (no.7) for liberation, etc. A prominent step is the vow of *sallekhanā* (no.11), which is a gradual abstention from food and drink and an eradication of the passions. At a later stage food and drink are entirely abandoned and this is called *pratyākhyāna* (no. 30).

The process of dying can be performed as a public dying with members of the religious group and the assistance of a *susthita*, a highly qualified teacher. He supports the “destroyer of karmas”, the *kṣapaka*, with the protective religious instruction, the *kavaca* (no.35). The public dying is called the *bhakta-pratyākhyāna*-rite. When dying is performed without any assistance, then it is in solitude, as *inḡinūmarāṇa*, which allows some restricted movements, or in the most non-violent way it is *prāyopagamana marāṇa*, dying alone on the bare ground, not moving the body at all.

The *Mūlārāadhanā*, one has to note, explicitly affirms the possibility to end one's life by killing oneself in an abrupt way, namely by hanging oneself, exposing oneself to vultures and even using a weapon, if circumstances are compelling. These deliberate self-killings are also performed according to the rules and with equilibrium of mind.

I have dealt with the complexity of the modes of dying in other papers and now I am turning to an analysis of *ārāadhanā*, which I regard as the condition of the possibility of dying by fasting or, as already mentioned, by killing oneself. Obviously the highest degree of penance is reached in this last act; the controlled endurance of physical and mental pains while renouncing the body certainly requires the firm conviction that this is the right path to take. Dying becomes the touchstone for authentic and true faith.

*Śivārya* elaborates in a systematic way that the decisive features of *Ārāadhanā* are just these two: rightness (*sammatta/samyaktva*) and right conduct (*cāritra*).

The text says in verse 3:

*duvihā puṇa jīṇa-vayaṇe bhaṇiyā ārāhāṇā samāseṇa /  
sammattammi ya paḍhamā bidiyā ya have caritammi // 3*

“Concisely the *ārādhana* in the Jaina teaching is said to be twofold: firstly with regard to *sammatta* (rightness) and secondly with regard to *cāritra* (right conduct)” (3).

In subsequent verses *Śivārya* establishes the relationship of the terms *darśana*, *jñāna* and *cāritra*. These concepts are by no means used un-equivocally in the Jaina scriptures, neither in the canonical nor in the commentarial literature. The *Uttarādhyayana*, for example, in 28-14 says that *samyaktva* is belief in the 9 *tattvas* but 16–27 says that faith is produced by the 10 *rucis*, like *nisarga*/nature, *upadeśa*/instruction, *ājñā*/command etc. The function and role of *jñāna* and *darśana* especially are seen variously and it is therefore also difficult to translate the terms. Apart from the problems faced within the Jaina tradition itself, I think, here one touches upon a bundle of principal problems of cognition, volition and agency. However, to be clear about issues of faith and knowledge and the related prescription of conduct is exactly what matters in the end-of-life-decisions and the way of performing a good death.

*Śivārya* seems to have found a standpoint and puts the relation between *darśana* and *jñāna* in proper perspective. He says in verse 4:

*daṃsaṇam ārahanteṇa nāṇam ārahidam bhavaṇīyamā /*  
*nāṇam ārahanteṇa daṃsaṇam hoi bhayaṇijjam //4*

“The one who gains *darśana* will undoubtedly attain *jñāna*. (But) the one who gains *jñāna* is not necessarily granted *darśana*” (4).

He then consistently restricts *jñāna* to those who have the right faith. The *jñāna* of the others is merely ignorance. This is expressed in the next verse:

*suddha-nayā puṇaṇāṇam micchādiṭṭhissa benti aṇṇaṇam /*  
*tamhā micchādiṭṭhī nāṇass' ārahavo ṇ' eva //5*

“Those who have *śuddha naya* (in the sense of a pure standpoint) call the *jñāna* of the one who has the wrong faith, ignorance. Therefore such a one does not even gain *jñāna*” (5).

What looks puzzling here at first sight is the use of the word *naya* which one tends to associate with the Jaina *naya-vāda*, the seven standpoints. But here the *śuddha naya* is the *niścaya-naya*, the ultimate

standpoint, in contrast to the *vyavahāra naya*, the common everyday - *vyavahāra*-standpoint (cf. Kundakunda, *Samayasāra* 13).

*Śivārya*'s deliberation turns now to the distinction of self-discipline (*saṃyama*) and self-mortification (*tapas*) and he states in verse 6:

*saṃjamam ārāhanteṇa tavo ārāhio have ṇiyamā /*  
*ārāhanteṇa tavaṃ carittam hoi bhayaṇijjam //6*

“Whoever achieves self-discipline (*saṃyama*) will certainly attain *tapas*; but whoever realises *tapas*, might or might NOT get *saṃyama*, self-discipline.” (6) And further in the next verse 7 he says:

*sammādiṭṭissa vi aviradassa na tavo mahāguṇo hoi /*  
*hodi hu hatthi-ṇhāṇam cundacchudagam va tam tassa //7*

“To the one who lacks discipline (*avirada*) the *tapas* are not of much use, even if he has the right views; it is for him like the bath of an elephant or the drilling-thread”(7).

He concludes in verse 8:

*ahavā cāritt'-ārāhaṇāe ārāhiyam havai savvam /*  
*ārāhaṇāe sesassa cāritt-ārāhaṇā bhajjā //8*

“In other words by achieving *cāritra*, right conduct, everything is gained. But by achieving the others, right conduct is not necessarily granted”(8).

The next verse is succinct as an aphorism. *Śivārya* states:

*kāyavvam iṇam akāyavvayam ti ṇāūṇa hoi parihāro /*  
*taṃceva havai ṇāṇam, tam ceva ya hoi sammattam //9*

“To know the dos and don'ts, that is mindfulness (*parihāra*) (cf. Kundakunda *Mokkapāhuḍa* 37, 32), and this is verily *jñāna*, this is verily *sammata/samyaktva*”(9).

Thus it becomes clear that right conduct is crucial for the preparation of *Ārādhana*. But right conduct is embedded in and



interconnected with *darśana* and *jñāna*. *Darśana* is based on the *jñāna* of the teaching, but it is by the synthetic view of *darśana* that *jñāna* becomes the right *jñāna*. Only then this right *jñāna* enables right conduct, which is the precondition for the disassociation of karma, and thereby enabling liberation.

What is essential for liberation is that this *ārāadhanā* take place at the end of life. In the crucial hour of death the *ārāadhanā*, i.e. the ensemble of *samyaktva* has to be upheld (see Verses 15 and 17):

*suciram avi niradicāraṃ viharittā nāṇa-daṃsaṇa-caritte/  
maraṇe virādhayittā aṇanata-saṃsārio diṭṭho//15*  
*diṭṭhā aṇādi-micchādiṭṭhī jamhā khaṇeṇa siddhā ya/  
ārāhayā carittassa tena ārāhaṇā sāro//17*

“Even though transgressions with respect to knowledge, faith and conduct have been avoided for many years, if the *ārāadhanā* (at death) is failed then *saṃsāra* is regarded as endless (15).

On the other hand it happened that primarily wrong believers gained final perfection in an instant when they observed the *ārāadhanā* of right conduct; therefore this *ārāadhanā* is the highest”(17).

*Samyaktva* has eight supportive auxiliaries; these are the eight *aṅgas* of *samyaktva*. Of these the first is freedom from the obstacles of doubt/*niḥśaṅkitā*. It connotes the absolute trust in the teaching. *Sammā-diṭṭhī jīvo uvaiṭṭhaṃ pavayaṇaṃ tu saddahai /... //32*. The one who has right faith believes in the proclaimed doctrine; ... (32).

To this point regarding absolute faithfulness, I would like to briefly relate a *dharma-kathā* from *Harīṣeṇa's Bṛhatkathākośa* (No. 4), the earliest of the *Ārāadhanākośas* based on the *Mulārāadhanā*.

The story is named after the protagonist, *Vidyuc-caura*, the thief as quick as lightning. It clearly demonstrates the defect of fear and doubt over - against the quality of confidence with regard to right faith. I am going to summarise the rather lengthy story briefly.

The wealthy merchant *Jinadāsa* was a knowledgeable and pious Jaina layman. A wandering deity bestowed upon him a magic formula,

which enabled him to move through the air. He used this skill to travel to temples and images of the *Jinas* in all the continents and to pray there.

His adopted son, the well behaved Brahmin Somadatta became curious about what his father did twice a month on auspicious nights. The father, aware of his son's pure-mindedness, explained to him that he flew to the splendid Mt. Meru at the centre of the Middle World for worship in the temples there. Somadatta was eager to go to these holy places as well and he prevailed upon his father to impart the knowledge of the procedure to obtain this supernatural skill.

Joyfully Somadatta started out following his father's instructions. These entailed going to the cremation ground in the night of the new-moon and finding a big Banyan-tree on a high hill. Using the aerial roots he had to tie a basket hanging on 108 strings on the upper branch of the tree. On the ground, right below the basket, he had to place darts, spears and sharp knives with their tips pointing upwards. Then he prepared an oblation with grains, incense, plant shoots and lit lamps. Taking a small knife with blazing sharp edges and uttering the five homages, the *pañcanamaskāra*, he started climbing up into the basket. There he was supposed to cut the strings one by one reciting the *pañcanamaskāra* 108 times and with the last stroke he was supposed be able to move into the air.

However, when he looked down onto the ground and perceived the terrifying sharp blades reflecting in the light of the lamps, he froze with fear thinking: If I cut the strings of the basket I will certainly fall directly onto the blades down below and when I fall on them, that will certainly be the end of me; if I am so frightened, will the magic knowledge lead to the supernatural power or not? With this thought the fearful fellow climbed down and again, confused, he climbed up and down.

Meanwhile a thief called *Vidyuc-caura*, of radiant appearance, who was staying nearby, noticed him and asked him what he was doing. Somadatta told him about his attempts and his predicament and then said: When all the strings are cut one after the other then — not having fallen down to the earth, one quickly flies up into the sky. But I am here in this deserted forest and I am overcome by doubt (*samśaya*) and for people who doubt there are no fruits.

The thief became desirous of this magic knowledge for himself, so

he inquired of Somadatta, from whom he had obtained this precious knowledge, which granted truth, consciousness and bliss for beings. When he learnt that it was told by the trustworthy, pious and compassionate father of Somadatta, he was convinced about its truth. He escorted the dejected Somadatta home, went back to the tree and performed the act with the required precision and with proper devotion to the *Jinas*. While cutting the strings of the basket his body stood out against the sky and, at last, the thief flew through the air to the splendid Mt. Meru. Now, omitting some details, I come to the end of the story.

On Mt. Meru the thief worshipped the images of the *Jinas*, received peace of mind and total joy. He asked for initiation into the order, and since the thief was recognized as capable of liberation (*bhavya*), he obtained the karma destroying consecration, practiced penance, accomplished his death in the proper way and became a great god.

The story ends with the words:

“The magic knowledge did not lead the brahmin who was possessed by fear and doubt to supernatural power. But the fearless and confident thief obtained it directly.”

The story clearly enacts the first of the auxiliaries of rightness/*samyaktva*, namely the freedom from the obstacles of doubt/*niḥśaṅkitā*. What matters in the conditioning of the soul and in the progress of purification, is the state of ripeness of the soul. Here in the story the well-behaved *brāhmin* Somadatta was not capable of performing the liberating act because he was not completely filled with trust in his father's instruction. The thief, despite his status as a thief, could progress immensely on his path to liberation by virtue of his firm and clear faith.

In extending the metaphor of upward movement in the story—climbing up the hill, the tree and into the basket, cutting off the bonds and taking off into the air—may be said to hint at the first four stages of the ascent through 14 stages of purification (*guṇasthānas*). The Jainas compare a soul's gradual progress from delusion to liberation to that of climbing up the rungs of a ladder. In the case of right faith (*samyag-darśana*) the thief left behind false faith (*mithyā-darśana*) and proceeded beyond the next two stages of unstable faith to the fourth rung of *samyag-*

*darśana* or right faith. This stage is associated with the mental disposition and behaviour entailing extraordinary bliss (*sukha*) because the soul experiences itself (*ātmānubhava*).

The concept of 'rightness' or 'trueness' (*samyaktva*) is a central term not only in Jaina philosophy but especially in all aspects of their teaching when it concerns faith, knowledge and conduct. In fact, Umāsvāti's (c. fifth-century) *Tattvārtha-Sūtra* (TS), begins with the word *samyak* (also: *samyag*). The very first *sūtra* or basic teaching says: *samyag-darśana-jñāna-cāritrāṇi mokṣa-mārgaḥ* (TS 1, 1). The commentaries apply that the word *samyak* (*samyag*) to each term in the compound and hence we can translate the *sūtra* as: 'Right faith, right knowledge and right conduct (together) constitute the path to liberation'.

Since the concept of 'rightness' forms the basis of the whole of Jaina philosophy, its fundamental significance cannot be overemphasized. It is important to note that the word *darśana* here is the first in the list and that it is used in a technical sense in Jainism to mean faith. The idea is that *darśana* as 'faith' is concerned with 'belief'. What is it that the one who has the right faith believes in? What is the object of belief (*śraddhānam*)? That is clearly expressed in TS 1, 2 when it says: *tattvārtha-śraddhānam samyag-darśanam*: 'true faith is belief in the *tattvas*', namely belief in the seven basic truths. The belief that is required is belief in the substances which are the so-called seven basic truths and which constitute the basics of Jaina ontology and metaphysics. (These are enumerated in TS 1, 4: 1. the sentient entity (*jīva*), 2. the non-sentient-entities which constitutes five categories (of which matter, *pudgala*, including karma particles, is the foremost), namely the *ajīva* categories, 3. the influx (*āsrava*) of fine, subtle particles of *karma* into *jīva*, 4. the bondage (*bandha*) which *karma* causes, 5. the possibility of stopping (*saṃvara*) further influx of *karma* particles by suppression of activities and mental weaknesses, 6. the destruction (*nirjarā*) of *karma* particles that have been accumulated and 7. the resultant liberation (*mokṣa*) from the malign influence of *karma*). The faithful Jaina accepts these basic truths, he believes them. He has *śraddhā*. And this fact is *samyag-darśana*. See also *Mūlārādhana* verse 38.

The seven *tattvas* in their interconnectedness cover indeed, so to say in a nutshell, an entire philosophical system. It states the entanglement of the *jīva* with karmic matter, the chances of embodiment, when the right

path is taken, makes stoppage and destruction of karma possible.

The role of the body as an instrument of purification is acknowledged in a small incident in the context of a lengthy *dharmakathā* (*Bhadrabāhu*), related in the *Vaḍārādhane*, an *Ārāadhanā-kathakośa* in Old-Kannada (B.K. Khadbadi, 1979, p. 52). A young monk had died in *prāyopagamana* and was reborn as a god. This god knew through *avadhi-jñāna* his former existence and wished to adore the body which acquired for him the divine body. He came down together with gods and goddesses in all pomp just when his body was carried in the funeral procession. He danced with joy in front of the car, related his story, prayed homage to his guru and returned to heaven.

Thus the body, which is the locus of suffering and failing, is recognised as the only means of removing suffering. Placing this body in the final phase on a bare rock and remaining immobile in *kāyotsarga* is the epitome of *samyaktva*, fulfilling the faith, the knowledge, and the conduct and being the height of *tapas*.

With all due brevity I would like to end by referring to the classical Kantian questions: What can we know, what may we believe and what should we do? And by pointing out that Jaina soteriology answers them with the teaching of the *Nirgranthas*. This is a matter of faith. It implies an affirmative attitude to the doctrine taught by the omniscient ones. This affirmative attitude is said to be a state of ripeness of the *jīva* which is the result of a specific karmic constellation of relative purity. This might allow some human beings to die at the right time, at the right place and in the right way. The *Prakīrṇaka Candāvejjhaya* got his title from the *candrakavedhyaka* that refers to the skill of an archer, who hits the pupil of the eye of a peacock feather or a fish circling fast in the air. The telos of dying is to be in intensive concentration and to be vigilant, like such a master-archer.

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## 18. A Bird's Eye View on what *Sallekhanā* IS and IS NOT

*Raksha J. Shah<sup>1</sup>*

### Abstract

The purpose of the paper is to put forth the deep science that lies behind this essential Jain rite and reveal the essence attached to it as also to clarify the concepts and remove the misconception regarding *Sallekhanā*. In this presentation, I wish to talk about Jainism - that has mentioned not only the purpose of life, the purpose of acquiring the human body, the subtle aspects of non-violence, but also about the peaceful systematic scientifically designed process of departing with this instrument of body with utmost care and concern.

*Sallekhanā* is one of the highest types of *Vrata* and *Tapa*. It is an essential rite based on the principle of non-violence, an act taken up willingly by the aspirant who takes utmost care to carry it out with love, friendliness, care, concern and compassion towards all living beings. It is a non-violent, eco-friendly way of welcoming death as understood in common parlance or in simple words taking leave of the acquired body respectfully in order to attain maximum *nirjarā* and get closest to *mokṣa*. UTMOST care is taken to see that no act of his is a hindrance, a burden to the society, to the near and far off relationships, to the environment and the economy as well.

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The paper will highlight the science entailed with this act and describes the difference between *Sallekhanā* and Suicide. Clarification on the prevailing misconceptions will be discussed - and the process of exiting this world in a peaceful, undisturbing manner, will be highlighted with references from *Ācārāṅga Sūtra*, *Tattvārtha Sūtra*, and *Ratnakaraṇḍa Śrāvakācāra*.

I would also like to emphasize that this rite of *Sallekhanā* can offer a solution to the grave problems that the world is facing today and help to resolve the issues related to death.

## **1. Introduction**

Of late, a lot of debate has arisen regarding *Sallekhanā* – the Jain way of exiting this world respectfully. People have misunderstood and misinterpreted this highly significant rite and many a scholars have criticized it at various levels. Is *Sallekhanā* an act of starvation as understood by many scholars and writers? Is it an act of suicide? An act that leads to *mokṣa*? Or, is it a thoughtfully designed scientific act, a bioethical boon, an act that takes you to the reality and true essence of life?

The sole purpose of presenting this paper is to put forth the deep science that lies behind this essential rite and to reveal the essence attached to it. What is the need to renounce food and passions? Why does one take up to severe austerities and recitation of mantras? What is the explicit need to meditate? Together with this, I would like to clarify the misunderstanding and certain important misconceptions that prevail, and highlight what exactly the science of *Sallekhanā* is and what it is not.

The prevalence of several misunderstandings and misconceptions regarding the terminologies, phrases, principles, and the process of *Sallekhanā* has created a lot of confusion. This is not surprising though, because for a layperson it is rather difficult to get it right given they are not conversant with the basic fundamentals of Jainism, the essence of its several rites and rituals, the in depth science behind its advocacy and the benefits accrued by following them. And until the basics of Jainism are not understood in the right context, misunderstandings are bound to occur.



## 2. The Science of *Sallekhanā*

Interestingly, Jainism has talked not only about the purpose of life, the purpose of acquiring the human body and the subtle aspects of non-violence, love, friendliness and compassion, but also about the peaceful, systematic, scientifically designed process of departing with this instrument (the human body) with care and concern.

According to the Jain metaphysics, the Universe is divided into two main categories that eternally coexist, but are independent of each other viz. the *Jīva* or Soul and the *Ajīva* or non-soul. The soul is a permanent entity that transmigrates as it is maligned with karma particles. The very purpose of life and getting birth in the human realm is to find ways and means to eradicate these particles in order to attain self-emancipation - a state of eternal peace and bliss. The body is the non-soul which is temporarily acquired and has a very specific purpose. It is a vehicle that assists in attaining *nirjarā* and as long as it assists in this endeavor, it needs to be taken care of in the right perspective. However, when the body is almost completely incapacitated its purpose is marred, and then the body is no more in a position to help the soul in shedding karmas. It is then that the rite of *Sallekhanā* comes into the picture. It is as if the function of the body comes to an end in this realm and it is time for one to leave all attachments to the body and plan to return it with grace and honor. It is returning what was received with honor and without causing even the least bit of trouble to anyone or anything.

Why is it that birth in the human realm alone can assist in getting *mokṣa*? What is so unique about this birth? Why do heavenly beings too crave to get birth in the human realm?

The answer is simple - the molecules of the body that the *jīva* attains in each realm differ. The molecules of the body in the human realm are such that they can endure the so called pain and hardships, like thirst, hunger, heat, cold and rain. They have the capacity to bear insult, be tolerant and compassionate, put in all the required efforts in observing austerities, performing meditation - the essential components for purging of the long laden karmas.

What are austerities and why have they been strongly advocated?

Etymologically austerities or '*tapa*' means self-mortification" or *Ichchhānirodha*.

According to the *Tattvārtha Sūtra*:

*Tapasā nirjarā ca*

Which means that *tapa* is:

- a. Renunciation and denunciation of desires.
- b. It helps shed off and inhibit karmas.

All of the *Tīrthaṅkaras* and *Kevalajñānīs* of the past have therefore observed severe internal and external austerities and have meditated on the real nature of the soul to achieve self-emancipation. Just as crude gold available in the ore is in the impure form and needs to be heated strongly to be purified in order to get the 100% pure metal, the shedding of karmas that have been entangled with the soul since times immemorial also need energy for their elimination. The more the amount of energy one puts in, the more eradication or purging of karmas takes place. All of the austerities are a means to attain immense karma *nirjarā*.

As long as one has attachment, desires and expectations naturally follow, and the cycle of bondage continues. Only when the aspirant truly realizes that all these cravings and ties are temporary, he decides to do away with them. And it is this attitude of non-attachment as seen in the definition that helps him to detach himself from the body. As soon as he realizes that its purpose is over, his whole outlook changes. The same body which was nourished, looked after with care is now of no use as its purpose of assisting in karma *nirjarā* being over is now to be done away with dignity. The nourishment that was the need for survival of the body therefore is now gracefully withdrawn so as to leave it to wear away gradually, taking care together with this to be aware, to have no malice, jealousy, hatred, dislike i.e. to gradually reduce and keep away from all passions and negative thoughts. The body is as though to be left clean taking care to leave no waste behind that could be harmful to the future generations.

The science behind refraining from food when nourishment is no longer required is to keep away from violence and to not allow any energy

to be wasted unnecessarily for any other purpose whatsoever except using it for shedding of karmas via meditation. The passions too keep one engaged consciously or unconsciously into various thought processes which again divert one's attention away from meditation and the energy is utilized in analyzing and preparing to react in the normal course, leading to misuse or waste of energy.

Ācārya Mahāprajña in his book "The Science of Living" has described the science of depletion of energy very well by giving a very apt example. He says, when we speak, thinking gets created in the brain which is transformed into a sentence according to the rules of grammar and language. This is transformed into the form of sound with the help of muscles of larynx. In order to transmit the sound waves the necessary quantity of air is controlled. Over and above similar directions are given to muscles of tongue, back and face. For all these activities many small muscles are employed. And to activate these muscles thousands of motor nerves are used as means of conductor of electricity for which a certain definite quantity of energy is necessary. In a similar way all of the activities that are carried out in mind, body or speech end up in waste of energy which can be thoughtfully gathered and directed towards eliminating karmas.

### 3. Why Meditate?

We know that the karmic body (*kārmaṇa śarīra*) is a carrier of past reminiscences/impressions of earlier births. These impressions are hindrances and come in the way of meditation. Hence, Lord Mahāvīra said, "vibrate the karmic body, weaken it". Eliminating it alone will help achieve the goal. This can be achieved by meditation.

In order to meditate, the purification of the body and the mind is essential. Taking up to renounce food gradually on the one hand assists in purifying the body, while the mind is purified by meditation. However, the main problem that comes in the way of meditation is the wandering or fickleness of the mind, and therefore the mind needs to be calmed down – for if the mind is not quiet, past memories and imaginations will not subside and the thought process will continue. This will prove to be a hurdle in meditation. To calm the mind one needs to keep away from all activities and observe silence.

The true aspirant who meditates as such gets so engrossed that he is unaware of the happenings around him. He allows all that is happening to happen, without getting distracted by anything whatsoever. He tolerates everything, bears all the odds. When tolerance is attained, the person gets free from anxiety and becomes steady and fearless.

According to Ācārya Mahāprajña, when there is steadiness in the gross body, the karmic body or the subtle body gets a shock, thereby breaking its vicious cycle. This leads to the disintegration and dissolution of karmic body, and the karmas start shedding.

That is the reason why austerities both internal and external are so significant.

#### **4. The Contentions against the Misconceptions**

Is *Sallekhanā* suicide or an act of starvation or an act that leads to *Mokṣa*?

Let us get to the bottom of the truth regarding these misbeliefs.

##### **Is *Sallekhanā* suicide?**

Let us describe in brief the scriptural definitions of both *Sallekhanā* and suicide. Finally comparing the two will make it clear if *Sallekhanā* is Suicide.

The simplest definition goes like this: *Samyak Kāya Kaṣāya Lekhaneti Sallekhanā*.

The gradual wearing away of the body and the passions in the right or rational way is *Sallekhanā*.

Shri Samantabhadra in *Ratnakaraṇḍa Śrāvakācāra* describes it as a religious duty observed during calamities or old age and that the person who takes up the vow, needs to give up friendship, enmity, possessiveness, forgiving relatives and friends - not forgetting to forgive and ask for forgiveness from servants too.

The word, 'Suicide', has not been defined by any legal body in the

world. However the Jain scriptures describe suicide as: “Killing oneself by means employed by oneself”.

The *Puruṣārthasiddhyupāya*” defines “*ātma-vadha*” (self-killing) as an act of severing one's *prāṇa* (life force) under the influence of internal passions and through acts such as consuming poison, drowning etc.

According to commentary on *Tattvārtha Sūtra* of Pujyapāda: “He who kills himself by (i) poison, (ii) weapon, (iii) due to desire, (iv) attachment, (v) avarice or infatuation, is suicide.”

The very definitions of *Sallekhanā* and Suicide, as described above, make the picture very clear and reveal that *Sallekhanā* is not suicide. Let us discuss it further. Recently a Public Interest Litigation in a court asserted that the rite of *Sallekhanā* is a social evil and should be considered akin to suicide under Indian Penal Code Section 309 and Article 21 of the Indian Constitution. The legal petition also added that all of the people who would assist and support such individuals taking the vow of *Sallekhanā* will also be held responsible for aiding and abetting the act of suicide.

#### 4.1 Why *Sallekhanā* is not Suicide?

Justice T. K. Tukol, in his book, *Sallekhanā* is not Suicide, writes that “my studies of Jurisprudence, the Indian penal code and of criminal cases decided by me had convinced me that the vow of *Sallekhanā* as propounded in the Jain scriptures is not suicide”. However since this view was contrary to the one held by many foreign and Indian scholars, he decided to write a paper showing that *Sallekhanā* is not suicide.

In the book, in a very holistic way, he has defined and described both *Sallekhanā* and Suicide with definitions from Jain *Āgamas*. He has given an elaborate account of the historical records, found in the inscriptions of the *Basadis* and the *Niṣadis* sanctified by the *samādhi* deaths of many Jain ascetics like Ācārya *Bhadrabāhu Svāmī*, rulers like Candragupta Maurya as well as several contemporary examples of people of royal patronage, ministers, ascetics and laypeople who have undertaken this rite. Why talk about the distant past, three and a half decades back, in the year 1979, Shri Vinoba Bhave, a non-Jain, had taken up the vow of *Sallekhanā* and met with the end of life peacefully.

These examples themselves suffice to make one thing clear that people of such stature and stable mindset will definitely not take up a rite, and an act that is unethical, unthoughtful, illegal, or a crime! Even Lord Mahāvīra's parents and the *Tīrthaṅkaras* themselves had taken up *Sallekhanā* and attained *Nirvāṇa*.

Ācārya Vidyānanda has wonderfully written, "Try and live life fully till the last moment. But when you feel that death is near, you must leave all else and turn inwards". He adds, every creature instinctively knows the time of its death. Even a tiger, for that matter, when he knows that he is going to die, he lies down quietly and refuses to eat.

Would anyone call such natural instincts seen in animals and birds as also in human beings, or the practices taken up since very distant past where even proof of such sacred deaths exist on the inscriptions as an act of suicide?

## **5. What then is *Sallekhanā*?**

*Sallekhanā* is one of the highest kinds of *tapa* and *vrata* taken up voluntarily without any coercion, with the permission of the family and the spiritual master for a specific purpose of self-emancipation. It is neither an illegal nor a criminal act but a very ancient religious practice or rite, observed by many pious aspirants. It is a gradual, well designed process undertaken with complete awareness, utmost care in a non-violent way with non-attachment, calmness and contentment for the purpose of spiritual elevation.

The aspirant keeps away not only from gradual renunciation of food and passions, but medicines and medical and palliative care, pathological tests as well as hospitalization. Here no tools or weapons are utilized to violently cease bodily function, nor is it done in secrecy or shame. Rather, it is an auspicious act witnessed and appreciated by the community who support the individual's spiritual goals, honor his courage and determination and sing songs and prayers in order to encourage him fulfill his purpose. The difference in attitude, mindset, causes, intention, thought process, outcome is totally different in the case of suicide and *Sallekhanā*.

It encompasses a slow process of penance and meditation for the sole purpose of purification and purgation, leaving no waste that could prove to be harmful to the society and the environment. The best part behind this act is the parting away from all relations. It is a matter of pride to the family who support and assist him/her in this endeavor till the last moment.

Above all, this form of sacred death is also thought to purify the environment through the wholly positive spiritual vibrations at the time of the final merging, and the blessings of the departed soul. It is indeed a step towards rational preparation to end this life.

Suicide on the other hand, is a sudden and impulsive termination of life, a self-destructive act often committed by use of external violent means like weapons, poison, or decision to jump, strangle oneself or the like. One goes ahead to act thus when life becomes a burden, or when one is in a depressed or disturbed emotional state, full of guilt and shame. This could be due to frustration or unfulfilled desires and attachment to worldly affairs, or death of near and dear ones. The person is a victim of mental agony, which is the result of either disappointment in personal or social life, unbearable economic loss, disgrace, fear, disgust, hatred, agony, punishment, failure or shock, social stigma or could be in order to escape from the consequences of the committed wrong acts or events unable to face the world due to fear of the consequences of social status, or defamation.

### 5.1 Is *Sallekhanā* an Act of Starvation?

Dr. Whitney Braun in her paper '*Sallekhanā: The Ethicality and Legality of Religious Suicide by Starvation in the Jain Religious Community*', and many other writers have called *Sallekhanā* an act of Starvation. How far is this true? Let us examine the definitions of both the terms.

**Starvation:** The dictionary meaning of starvation is death caused due to lack of food or not having enough food at ones disposal. A beggar who does not get food is said to starve but a person who abstains from food willingly in spite of having abundant food at his disposal is said to perform '*Tapa*' or '*Penance*'.

**Fasting:** The dictionary meaning of Fasting is willing abstinence from food, drink, or both for a period of time. The fasts that are taken up after taking the vow of *Sallekhanā* cannot be called as act of starvation as emphasized and criticized by many a scholars as they are austerities taken up willingly and voluntarily with the intention of giving up the desires of one's senses that have been responsible for our transmigration, diverting all the energy that is otherwise utilized in the digestive and other processes of the body to only ONE goal and that is of purging out the dust of *karmas*.

Lord Mahāvīra did penance for twelve and a half years and attained *Kevalajñāna* (omniscience). It is a matter of pride to see the aspirants taking up the vow of *Sallekhanā* inspite of knowing that they will not be able to attain either *Kevalajñāna* or *mokṣa*. Yet, with full awareness and with full zeal they take this vow, in order to get closer to *mokṣa*.

Thus we can say that *Sallekhanā* is neither an act of starvation nor suicide nor is it taken up for getting *mokṣa* in this very life. The reason for taking it up is to get closer to *Mokṣa*.

## **6. Solution to Today's Problems**

The Jain seers visualized the truth and scientifically designed the way to live life peacefully, without causing harm to anyone. They also developed the science of accepting the inevitable death, which is to come someday to everyone, be it kings and ministers, the rich or the poor. Once the truth is understood in the right context, death will not be feared and will be accepted with a smile!

All of the patients or even ordinary people may not be able to take to gradual abstinence of food and water or even deny medicines or medical care for that matter. Alternatively, I would like to suggest that these patients need not take the complete vow of *Sallekhanā* but instead, be assisted and made to understand the true meaning of life and death, the inevitability of death, with the help of stories and anecdotes. They can be taught to recite *mantras* like *Bhaktāmara Stotra*, *Namaskāra Mahāmantra*, which have been experimented on several patients - some who have got cured, others who have got relief and experienced peace of mind. They should be requested to forgive and ask for forgiveness of all the creatures of the Universe, keeping no ill feelings towards anybody,



forgetting all past instances, not worrying about the future. Such a practice will definitely inspire them and motivate them to lead the remaining part of their lives peacefully and perhaps have a happy end! It is clear thereby that this vow is looked upon as the reliever of pain of the family, and society, needing no burden of expenses or palliative care.

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# SECTION IV: Meditation & Health

## 19. Meditation and Brain: An Overview

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### Abstract

Effects of meditation on brain are not yet well characterized, although this topic has received considerable attention. Recent studies have challenged the traditionally held view that learning changes only the way the brain functions and instead showed that structural changes at the macroscopic level are possible. From a neuroscience perspective, meditation can be conceived as the interaction of diverse and distinct attentional mechanisms. Recent reports have begun to focus on well-characterized neural measures of attentional engagement during (state) and from (trait) meditation, which delineate specific effects of these ancient practices on brain activity and its subsequent influence on cognitive and emotional processing.

### 1. Introduction

Meditation is an ancient Indian spiritual practice that aims to quieten the mind and has shown significant promise as a tool to promote

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health and combat diseases. Though such practices are millennia old, little is known about their neurobiological concomitants. For centuries, scientists and philosophers have been fascinated by the brain but until recently, they viewed it as nearly incomprehensible. In earlier period, heart was considered as the seat of emotion or consciousness.

Now it is well established that brain is the essence of mind and soul and also the seat of intelligence, creativity, emotions and memories. All of our conscious and unconscious perceptions are filtered, altered, analyzed and organized by a gigantic symphony of neuronal players and then distributed to other body organs via nerve impulses and biochemical messengers. Because of the accelerating pace of research in neurological and behavioural science and the development of new research techniques, scientists have learned more about the brain in the last 50 years than in all previous centuries.

According to the Eastern spiritual tradition, meditation is a technique for spiritual development, where the aim is to attain inner peace, concentration and positive emotions. It comprises a heterogeneous group of practices. Two principal types of meditations are *Mindfulness* and *Concentration*. Various practices of meditation e.g. transcendental meditation, *Prekṣā* meditation, Zen meditation (*Zazen*), *Vipaśyanā* ("Insight") meditation, Compassion meditation (loving kindness), *Chakra* meditation, *Qi gong* meditation, *mantra* meditation, Christian meditation, yoga meditation, Chinese meditation, Japanese meditation and Jewish meditation etc. are examples of different techniques. *Prekṣā Dhyāna* is a popular meditation technique of Jain (*Terapanth*) *Dharma* formulated by its tenth spiritual leader, Acharya Mahaprajna in the middle of the 20th century. The main aim of practicing *prekṣā* meditation is purification of soul, psyche and consciousness.

Meditation can be conceptualized as a family of complex emotional and attentional regulatory training practices. By simple definition, it is engagement in contemplation, especially of a spiritual or devotional nature. To elaborate further, meditation is an attempt to concentrate mind on a single form or an idea or an aspect of divinity at the exclusion of all other forms, thoughts and ideas. The mind is focused inwards and this effort of concentration acts as a stimulus to gain access to knowledge of 'object of meditation'. The aspirant makes an attempt to minimize perceptions through senses like touch, sight, hearing, etc. This

helps in controlling restlessness of mind and directs it towards inner contemplation by which the mind, as if, becomes still.

Cognitive and neuroscience research for the past several years has shed new light on the influences that meditative traditions have on the meditation practice. Although meditation research is in its infancy, a number of studies have investigated changes in brain activation (at rest and during specific tasks) that are associated with the practice of, or that follow, training in mindfulness meditation (Tang *et al.*, 2015). The therapeutic potential of meditation for physical and mental well-being is now well documented. Though this article is technical, we have attempted to simplify it for better assimilation by scientific community at large.

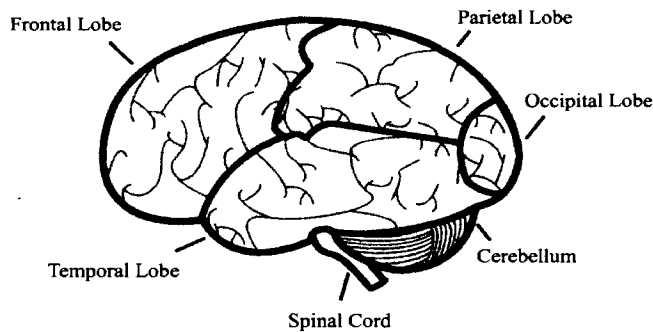
## **2. Nervous System**

Regular commentary on human nervous system is beyond the scope of this chapter and we will briefly describe few relevant structures only.

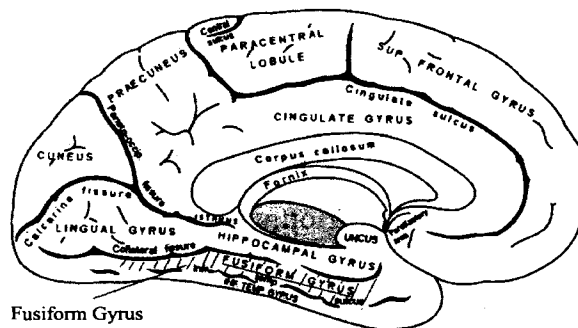
The human brain has unlimited power of functioning and controls all functions of the body. It is an organ of 1300-1400 gm containing more than one hundred billion neurons. These nerve cells communicate with one another by a hundred trillion interconnections, also known as synapses. It receives and interprets information from the outside world and inner self, interpret and stores them and direct and coordinate required actions. Electrochemical impulses of the nervous system make it possible to obtain information about the external or internal environment and do whatever is necessary to maintain homeostasis. The fundamental purpose of the nervous system is (1) to receive information from receptors cells and organs specialized to detect changes inside the body and its external environment; (2) to process and store this information and determine the appropriate responses; and (3) to issue commands to effectors, cells and organs (mainly muscle and gland cells) (Saladin, 2004).

### **Prefrontal Cortex System**

The Prefrontal Cortex System (PFC) is the most evolved part of the human brain and often termed as 'executive control centre'. It occupies the front third of the brain. It has extensive connections with the limbic system. It modulates by sending inhibitory signals to the limbic and sensory parts of the brain to reduce distraction.

**The Human Brain**

**Fig. 1. Brain seen from side** ([http://www.gender.org.uk/about/07neur/74\\_brain.htm](http://www.gender.org.uk/about/07neur/74_brain.htm)).



**Fig. 2. Brain seen from medial side showing limbic lobe and other structures.** (<http://guerrillagroup.com/tag/orvel-ray-wilson/>)

It is divided into three sections i.e. dorsal lateral (on the outside surface), inferior orbital (on the front under surface) and the cingulate gyrus (which runs through the middle of the frontal lobes). While the dorsal-lateral portion of PFC is mainly involved in sustaining attention span and selection of behaviour based on short term memory, the inferior orbital portion of PFC is responsible for impulse control, mood control, behaviour and social skills.

The capacity of the individual to generate goals, to achieve them and to learn from mistakes is considered an essential aspect of a mature and effective personality. PFC controls “executive functions,” such as capacity to formulate goals, time management, to change course and improvise in the face of obstacles, attention span, perseverance, self-monitoring, forward thinking, ability to feel and express emotions, influences the limbic system, empathy, judgment, behaviour, impulse control, planning, organization and critical thinking.

## **Parietal Lobe**

It supports perception of the body and its surrounding in space. Anterior or front portion of this lobe receives and processes sensory information about temperature, taste, touch and movement coming from the body. There is a large association area that controls fine sensation (judgment of texture, weight, size, shape). Current scientific evidences suggest that meditation results in suppression of parietal lobe functions and individuals attain a state of 'No time and No Place'.

## **Diencephalon**

It is located beneath the cerebral hemispheres and consists of thalamus and hypothalamus. Thalamus is a large cluster of nuclei that serves as a synaptic relay station and important integrating centre for most inputs to the cortex. It plays a role in interpretation of sensory impulses, such as pain, temperature, light, touch and pressure. Hypothalamus lies below the thalamus. It is a tiny region whose volume is only 5 to 6 cm<sup>3</sup>. It controls mind-over-body phenomenon and is essential to the survival of the individual and the species. It is the most primitive part of the limbic system and is the source of raw, powerful, undirected feelings emotions. It plays a major role in regulating hormones, the pituitary gland, body temperature, and many other vital activities. It plays a role in controlling behaviour such as hunger, thirst, ability to feel extreme pain or pleasure, sleep, and sexual response. It controls and integrates the autonomic nervous system and is responsible for translating our emotional state into physical feelings of relaxation or tension. It is the principal intermediary between the nervous system and the endocrine system.

## **Limbic System**

It is a group of structures located on the medial aspect of each cerebral hemisphere and diencephalon (Fig. 2). It is a functional system that mediates emotional responses and memory processing. Along the lower edge at the tip of each of the temporal lobes is the amygdale which is the centre for basic feelings, particularly fear and sexual responses, and receives inputs from the visual, auditory and sensory parts of the cortex, with numerous further connections to the frontal lobes. It has crucial role in the mediation and control of major emotions like friendship, love, rage and aggression (Chalabi, 2005).

## **Hippocampus**

A part of temporal lobe, it is an important constituent of limbic lobe. Its function is to convert short-term memory into long-term memory. The hippocampus in the right hemisphere is concerned with visual, emotional, tactile and nonverbal memories while that of the left side stores verbal and mathematical memories.

## **Autonomic Nervous System**

It is involved with the self-governing (automatic) regulation of three aspects of the body: smooth muscle, cardiac muscle and the glands. It controls the functions and involuntary muscles of the respiratory, circulatory, digestive, and urogenital systems. Two antagonistic and anatomically separate systems comprise the autonomic nervous system i.e. sympathetic division and parasympathetic division.

The sympathetic division stimulates the heart, dilates the bronchi, contracts the arteries and inhibits the digestive system. This system serves to prepare the organism for fighting in order to ensure survival in face of an environmental threat. This division has wider connection to the eyes, salivary gland, sweat glands and blood vessels in the skin, heart, lungs, stomach, kidneys, adrenals, pancreas, intestines, external genitalia, and bladder.

The parasympathetic nervous system arises above and below the sympathetic nervous system in the brain and from the lower part of the spinal cord. It produces the opposite effect of the sympathetic division. Parasympathetic division prepares the organism for feeding, digestion and rest.

**Pituitary gland:** It is also known as “master gland” or master of orchestra” as it controls other endocrine glands in the body. It is connected to the hypothalamus by the pituitary stalk. It secretes hormones that control sexual development, promote bone and muscle growth, respond to stress and fight disease.

**Pineal gland:** It is located deep in the brain in the middle. It helps in regulating the body's internal clock and circadian rhythms by secreting

melatonin. It has some role in sexual development. It involutes with advancement of age. Though religious literature puts pineal gland as the highest seat of spiritual gain, scientific evidences are lacking.

## **Physiology**

Brain is made up of two types of cells i.e. nerve cells (neurons) and glia cells. Neurons possess a very high rate of metabolism requiring a constant supply of nutrients and oxygen. Till recently it was believed that numbers of neurons are fixed at birth and they cannot be regenerated in adult life. However, recent evidences have contradicted this view. This has provided a great boost to meditation and other techniques which aim at rejuvenating brain. Glia (Greek, meaning glue) is the cell of the brain that provides neurons with nourishment, protection and structural support. They are about 10 to 50 times more than the nerve cells.

## **Evolutionary Aspect**

The evolutionary process adds higher centre to the primitive nervous system. The higher centre has inhibitory influence; in other words it suppresses the functions of lower centre. Thus, the brain stem is controlled by the higher limbic system and the limbic system in turn is controlled by still higher neo-cortex. The neuromodulators with their influence on various neurotransmitters effectively bring about this inhibitory modifications and inter-relations among various brain centres (hierarchy).

Neo-cortex keeps all the involuntary movements, hyper-reflexivity, rage, aggression, and similar animal tendencies under check so that it can effectively pursue its own highly developed activities of logic, memory, reason, language, calculations, judgment, and concepts etc. Conscious, willful and imaginative functions are therefore normal state of awareness of the human beings.

When meditation acts as a constant repetitive stimulus, certain qualitative and quantitative permanent changes develop in the nervous system. The neurotransmitters and neuromodulators may stimulate growth of dormant or latent neurons to develop a centre (or centres). The



brain develops new connections and plasticity resulting in the capacity to think, to rationalize and react in a different way to the sensory input than what is expected. The new developed higher centre will exert inhibitory control over the present day neo-cortex, and thereby, over the mind as a whole. The consciousness and all mental activities will hence be suppressed. The person will reach a state beyond mind itself, which can be called transcendental awareness.

### **3. Assessment of Changes in Brain with Meditation**

Effects on brain can be studied with psycho-cognitive tests, electrophysiological assessment (EEG, Magnetoencephalography, evoked potentials, skin resistance etc.), functional neuroimaging (fMRI, PET, SPECTS, Doppler blood flow study etc.), hormonal and biochemical changes, and epigenetic studies etc. To maintain brevity, we will touch upon only EEG and fMRI in this article.

All brain imaging techniques are indirect in some manner as they do not provide a direct way of “seeing” the brain. Techniques for measuring electrical and magnetic fields that excite the brain have a very high temporal (time-based) resolution but do not tell us about the brain structures where the activity is occurring. Neuroimaging techniques, particularly fMRI, can plot *what* activity is occurring *where*.

#### **Brain Waves and Meditation**

Electroencephalogram (EEG) waves: Neurons communicate with each other by electrical changes. We can record these electrical changes in the form of EEG waves. These brain waves are described in terms of frequency bands. There are five frequency bands i.e. alpha, beta, theta, delta and gamma brain waves. Our overall brain activity is a mix of all the frequencies at the same time in different combinations guided by the situation.

Alpha waves (8-12 Hz) are associated with relaxation, non-arousal state of brain and the lack of active cognitive processes.

Beta waves (13-30 Hz) are associated with active thinking, active attention, focused on the outside world or solving concrete problems.

Theta waves (4-8 Hz) are associated with dreaming and drowsiness. They are of two types i.e. that which is associated with lower levels of alertness and the other that is associated with alertness, attention and processing of cognitive tasks. Theta brain waves in meditation are said to open the “third eye” for practitioners. In practical terms, theta waves invoke a deep sense of relaxation and also encourage creativity and make problem solving and memorization easier.

Delta waves (1-4 Hz) are associated with deep sleep but may also be present in the waking state. Delta waves are said to occur during meditation in experienced practitioners as they access the unconscious mind.

Gamma waves (above 30 Hz up to 70 Hz) are associated with processing of meaningful activity and integration of stimuli into a coherent whole. It is seen in expert meditators.

Most of the studies have noted an increase in alpha waves, particularly in novices (Kasamatsu and Hiraim, 1966; Khare and Nigam, 2000; Shreyash Prajna and Sanchetee, 2014). EEG in Yogis showed changes of calmness in the form of "alpha rhythm" during both eyes closed and eyes open recordings. A few other studies have shown theta wave prominence which is possibly related to duration of meditation practice (Lagopoulos 2009; Vijayalakshmi *et al.*, 2011).

Travis (2001) studied effect of transcendental meditation and observed (1) significantly lower breath rates; (2) higher respiratory sinus arrhythmia amplitudes; (3) higher EEG alpha amplitude; and (4) higher alpha coherence. Lagopoulos (2009) examined EEG changes during nondirective meditation. They found significantly increased theta power when averaged across all regions but greater in the frontal and temporal–central regions. There was also a significant increase in alpha power in the meditation condition compared to the rest condition, when averaged across all brain regions, and it was found that alpha was significantly greater in the posterior region as compared to the frontal region.

Qin (2009), carried out a follow-up EEG study on a subject with 50 years of experience in Qigong. Resting EEG showed frontally dominant

alpha-1 as compared to occipital dominant alpha-2 observed in 1962. During the Qigong practice, alpha-1 enhanced quickly and became far more prominent than 50 years ago. Compared with baseline, these activities remained higher at rest after the Qigong practice. Cahn et al. (2010) observed decrease in frontal delta power, especially in those participants not reporting drowsiness during meditation and relative increase in frontal theta power during meditation, as well as significantly increased parieto-occipital gamma (35–45 Hz) power, but no changes were observed for the theta (4–8 Hz), alpha (8–12 Hz), or beta (12–25 Hz) bands. Their findings suggest that long-term *Vipaśyanā* meditation contributes to increased occipital gamma power related to long-term meditational expertise and enhanced sensory awareness. Vijayalakshmi *et al.* (2011) observed that mean value of alpha and theta waves showed an increase after meditation. The increase in the alpha and theta parameters suggests relaxation after meditation.

Thus major finding indicates that theta and alpha powers are related to proficiency of practice. However, the alteration in the dynamics of these rhythms with extended meditative practice is non-linear and topographically specific. These observations imply that increases in alpha power as a state effect of meditation may be related to learning meditation in the early stages for some subjects, but long-term practitioners demonstrate little enhancement of alpha state effects (Cahn et al., 2010). Theta band activity increase seems to be a marker of meditation across a number of different practice types, although it appears more specifically related to the focused attention on meditative forms (Lutz et al., 2009; Bajjal and Srinivasan, 2010; Cahn et al., 2010). In general five patterns of changes have been observed i.e. high-amplitude alpha, slow alpha + theta, theta + delta, delta, amplitude suppressed ("silent and almost flat"). In addition, alpha blocking phenomena was also observed, characterized by no change in alpha rhythm with external stimuli. In addition, growing evidence indicates that increased gamma band fast amplitude activity can be observed in advanced practitioners, which supports the interpretation that many meditative practices involve active up-regulation of attentional capacities (Lutz et al., 2004, Cahn et al., 2010). Long-term meditation practitioners have also shown to have a higher tolerance for pain. This effect has been correlated to altered function and structure in somatosensory cortices and an increased ability to decouple regions in the

brain associated with the cognitive appraisal of pain (anterior cingulate cortex and dorsolateral prefrontal cortex).

## **Brain Imaging**

Recent neuroscientific evidences suggest that meditation alters the function and structure of distributed neural processes underlying attention and emotion (Brefczynski-Lewis et al., 2007; Pagnoni and Cekic, 2007; Lutz et al., 2009).

Meditators show greater gray matter concentration in regions that are activated during meditation e.g. right anterior insula which is involved in interoceptive and visceral awareness, left inferior temporal gyrus, mid-temporal area, left posterior intraparietal sulcus and right hippocampus (Lazar *et al.*, 2005). The mean value of gray matter concentration in the left inferior temporal gyrus is predictable of the amount of meditation training.

Activity as well as thickness of anterior parts of the brain such as orbitofrontal cortex (OFC) and temporal areas is often enhanced in meditators (Lazar et al., 2005; Pagnoni and Cekic, 2007; Vestergaard-Poulsen et al., 2009). There is reduced activity with thinning of cortex in the regions of the brain, located in the parietal and occipital areas including the postcentral cortex, inferior parietal cortex, middle occipital cortex and posterior cingulate (Kang *et al.*, 2013). Functional neuroimaging studies using PET and fMRI have shown enhanced activity or larger volume of the hippocampus in meditators. Recent research suggests that such enhancement of hippocampus could lead to the reactivation of memories and exaggerated self-esteem (Lazar *et al.*, 2005).

The core components of meditation practice are attention control, emotion regulation and self-awareness. Each of these components has been identified to involve specific structures in the brain (Fig. 3 and Table 1). During the processing of aversive and self-referential stimuli, mindful awareness is associated with reduced medial prefrontal cortex (MPFC) activity, a central default mode network (DMN) component. Other components of DMN are dorso-medial PFC (DMPFC), ventro-medial PFC (VMPFC), inferior parietal lobule (IPL), precuneus (PC), posterior cingulate cortex (PCC) and inferolateral temporal cortex (ITC). Relative to beginners, experienced meditators had weaker functional connectivity

between DMN regions involved in self-referential processing and emotional appraisal. In addition, experienced meditators had increased connectivity between certain DMN regions (e.g. DMPFC and right inferior parietal lobule) compared to beginner meditators. Luders et al. (2009) investigated 22 active practitioners of meditation and found larger gray matter (GM) density in the orbitofrontal cortex which is related to emotional regulation processing.

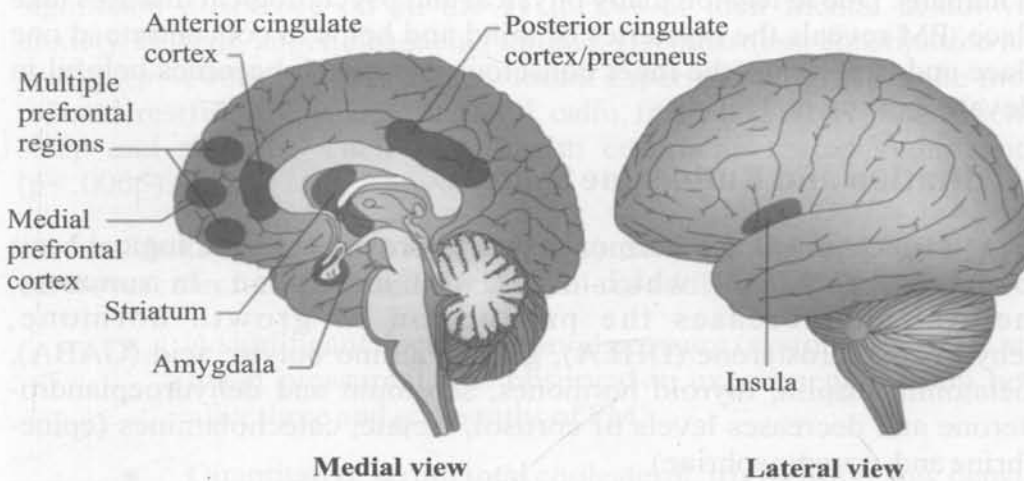


Fig. 3. Brain regions involved in components of mindfulness meditation (Tang *et al.*, 2015).

Table 1. Brain regions involved in the components of mindfulness meditation.

Region	Self regulation of Attention	Emotion	Self awareness
Anterior cingulate cortex	Yes	Yes	-
Posterior cingulate cortex	-	-	Yes
Prefrontal Cortex	Yes	Emotion	-
Frontopolar cortex & sensory cortex	-	-	Yes
Insula	Yes	Yes	Yes
Corpus Striatum	Yes	Yes	-
Amygdala & Limbic System	-	Yes	-

#### **4. Effect of *Prekṣā* Meditation (PM) on Different Systems**

On physical level: Exertion, more than the stored energy in body, reduces the working efficiency of the inner organs of our body. PM assists each body cell to revitalize itself. It makes respiration more efficient and improves circulation and quality of life.

On mental level: It is an age of competition which creates tension in humans. Due to tension many physical and psychological diseases take place. PM reveals the mysteries of mind and helps to concentrate at one place and experience the inner consciousness which becomes helpful in elevating the mental level.

#### **Meditation and Endocrine System**

Biochemical and hormonal studies provide a physiological basis to document changes which occur with meditation. In summary, meditation increases the production of growth hormone, dehydroepiandrosterone (DHEA), gamma amino butyric acid (GABA), melatonin, insulin, thyroid hormones, serotonin and dehydroepiandrosterone and decreases levels of cortisol, lactate, catecholamines (epinephrine and norepinephrine).

Melatonin is a hormone produced by the pineal gland. It has circadian rhythm and is an important determinant for good sleep. It is a potent anti-oxidant and has important role in mood changes, aging, sexual maturation, reproduction, cancer, immune system response and many diseases. Meditation is associated with increase in level of melatonin by 75% to 300%.

Betal and Gaur (1998) studied effect of PM on drug abuser's personality and observed that regular practice decreases drug abuse. They also found that, besides this improvement in psychological health, the subjects reduced the tendency of taking drugs.

Gaur and Saini (2002) concluded reduction in anxiety and hassles of prisoners who performed PM. They revealed that the prisoners significantly reduced ( $p < .001$ ) their anxiety and hassles, in several areas i.e., health, family, society, occupation, economy etc.

Gaur and Shah (2007) studied effect of PM on delinquent behaviour and CNS and ANS functions and observed that EEG activity in the occipital areas and frontal area slowed down significantly ( $p < .0005$ ) in experimental group. Similarly, heart rate and respiration rate also slowed down in the experimental group.

Sharma and Gaur (2008) studied effect of PM on mental health, reactions to frustration and personality variables of prisoners and found significant difference on all the 11 factors of their mental health viz; anxiety, despair, anger, headache, fatigue, sleeplessness, constipation and acidity ( $p < .0005$ ). Moreover they found experimental group to be more relaxed, restful, enthusiastic, hopeful, calm, fresh, and active having better sleep and appetite. Their total health criteria increased significantly ( $p < .0005$ ).

Shekhawat and Mishra (2011) studied efficacy of PM on cardiovascular functions and blood profile of adults and found that:

- A significant decline in blood pressure (systolic, diastolic and mean pressures) was observed in experimental group both after three and six months of PM.
- Quantitative serum total cholesterol, triglyceride, low density lipoprotein and very low density lipoprotein in experimental group were significantly reduced after six months practice of PM.
- The quantitative blood glucose in experimental group decreased significantly after practice of PM.
- The six month PM intervention has also resulted in significantly increased hemoglobin level in experimental group.

Kapoor and Mishra (2011) found that meditation can remove academic pressure and anxiety, eliminates conflicts, enhances emotional stability and vitalizes an individual for satisfactory performance in the area of student's work and relationships.

## **4.1 Other Electrophysiological Changes with Meditation**

1) Yogis could slow both heart rate and rate of respiration. 2) Yogis could slow the rate of metabolism as confirmed by decreased oxygen consumption and carbon dioxide output. 3) Skin resistance to electric stimulation was increased (indicating increased tolerance to external stimuli).

Our usual 'alarm' reaction to emotional and physical stress is in the form of "fright, flight, and fight" mediated through over-secretion of certain neuro-transmitters and neuro-modulators by way of stimulation of sympathetic nervous system. Under the influence of these chemicals and hormones, we reflexively become panicky or aggressive, our blood pressure rises. Thus stress and anxiety is the end result if we allow our natural age-old sympathetic reactions to act and to come to surface. But today these 'alarm' reactions have no place in our lives. Rather, they should be replaced by more calm and serene reactions of equanimity and fearlessness. Such desirable reactions of non-aggression and peaceful attitude are generated by yoga and meditation.

## **5. Philosophical Basis of *Prekṣā* Meditation**

There are two broad branches of philosophy—i.e. spiritualist and non-spiritualist. According to non-spiritualist philosophy, a living organism is understood in terms of gross body sense-organs and brain. On the other hand, the spiritualist philosophy goes beyond gross body and adds subtle *taijas śarīra*, *kārmaṇa śarīra*, conscious mind, psychical expression (*Adhyavasāya*) and finally the psyche or the soul itself as the constituents of the living organisms. Soul forms the nucleus of the organism transcendently and it is pure in nature. Proceeding towards the physical body, they pass through the domain of *leśyā* and convert into urges and impulses, which are the forerunners of emotions, passions and feelings produced in the gross body. These compulsive forces first affect the endocrine system and encourage them to secrete and distribute the chemical messengers (hormones), suitable and corresponding to the nature and intensity of the impulses. These hormones circulate through blood and goes to the brain and nervous system - this creates the neuroendocrine system. This system controls and regulates not only every bodily function but also profoundly influences mental states, emotions,



thought, speech and behavioral patterns of an individual.

## 6. Research Potentials

1. To study evolution of human brain from foetus to adult to address to the relevance of its functions at each stage and to find out if the evolution is longitudinal or parallel.
2. To compare brain size, area and structure in different species in animal kingdom including humans and correlate them with their functional efficiency.
3. Changes in different areas of brain with meditation.
4. Role of different types as well as components of meditation.
5. Role and relevance of pineal gland in meditation.
6. Role and relevance of spinal cord in arousing *Kuṇḍalinī*.
7. To identify role of different areas or part of brain in conscious awareness.
8. To scrutinize Jain literature concerning physiological subjects to find confirmation of statements made in this article.
9. Why does brain have two hemispheres and what are their independent functions?

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## 20. Art and Science of Meditation: From Theory to Practice

*Vimla Vyas<sup>1</sup>*

*“The more modern science and the ancient science of mind come together, the more our knowledge will be expanded. Then eventually we can educate humanity on the importance of our inner world, our mind, in order to promote peaceful families, a peaceful society, and a peaceful world.”*

**H.H. the Dalai Lama**

### **Abstract**

A common essential feature of eastern and western spiritual traditions is the intuitive knowledge of close connection between mind and the body, which is possibly achieved by exercising the techniques like meditation, yoga etc. Meditation is basically a family of many techniques, each of which is involved in the conscious and voluntary efforts, to focus the attention of the meditator. It is an activity that keeps the attention pleasantly anchored in the present moment. Although achieving the peak experience of thoughtless awareness is the goal of the meditator, it is the long-term trait effects of meditation, achieved after years of training that are thought to be therapeutic and have attracted the interest of Western science.

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The use of meditation for healing and enlightenment is not new. The practice of meditation has been prevailing throughout the human history among diverse cultures. In fact, all religious traditions practice some forms of meditation. After its introduction to the western world by Indian spiritualist Paramahansa Yogananda in 1920, the nature of scientific investigation of spiritual beliefs and practices underwent a drastic change.

However, it was only during the 1960s that scientific studies started focusing on the clinical effects of meditation on health after the reports of extraordinary feats of bodily control and altered states of consciousness by eastern yogis reached the west. These reports captured the interest of many western behavioural scientists. With the scientific advancement and refinement in instrumentation, scientific study of effects of meditative practices became possible. A formal acknowledgement of the academic curiosity within psychology came in 1977, when the American Psychological Association issued a statement on meditation stating that “meditation may facilitate the psychotherapeutic process”. They also encouraged research “to evaluate its possible usefulness” [1]. As a result, both health care professionals and lay people embraced meditation as a valuable tool for stress reduction and a device for healing both mental and physical disorders.

## **1. Mental Health through Meditation**

Meditation is thinking deeply or spiritually about a subject; as per dictionary definition. It's a complex cognitive task. It is more than relaxation, concentration, contemplation or posturing. Through it one achieves enlightenment and illumination. It's a state of altered consciousness, 4th stage, according to some neuroscientists. It's a spiritual ecstasy with neurological manifestations. Scientifically, meditation is essentially a physiological state of demonstrated reduced metabolic activity – different from sleep – that elicits physical and mental relaxation and is reported to enhance psychological balance and emotional stability [2, 3]. In Western psychology, three states of consciousness are described: *sleep, dream and wakefulness*. In Eastern philosophy and in several Western religious and mystical traditions, an additional and probably “higher” state of consciousness has been described, the so-called “fourth

state of consciousness", the state of "*thoughtless awareness*" [4]. In thoughtless awareness the incessant thinking processes of the mind are eliminated and the practitioner experiences a state of deep mental silence. This state can be achieved by the practice of meditation. According to the *Yoga Sūtras* of Pātañjali, one of the oldest recorded scriptures on meditation, "*Yoga is the suppression of the modifications of the mind*" [5]. Whatever one calls it, basically it is hard work. It demands highest form of discipline which comes through constant awareness, not only of the things about you outwardly, but also inwardly. According to J. Krishnamurthy, It's an effortless, choiceless, constant neutral awareness.

Although today a large variety of meditation practices have emerged, some of them not aiming to achieve anything beyond relaxation, the original goal of meditation is the reduction or elimination of thought processes, the cessation or slowing of the internal dialogue of the mind, the "mental clutter". This elimination of the thinking process has been reported to lead to a deep sense of physical and mental calm while at the same time enhancing pure awareness, untainted by thoughts, and perceptual clarity. Meditative experiences of thoughtless awareness furthermore seem to trigger feelings of positive emotions which can range from detached serenity to ecstatic bliss.

A common experience of meditation is a metacognitive shift where thoughts and feelings, rather than occupying full attention, can be observed from a detached witnessing awareness from which they can be dealt with in a more efficient manner. Achieving this mystical peak experience of complete thoughtless awareness is the ultimate goal of many traditional meditation techniques. Although meditation techniques differ widely, a common characteristic of most techniques is the training of concentrative attention skills in order to achieve thoughtless state of mind. The majority of meditation techniques are therefore, in essence, an attention training by which thoughts are consciously manipulated. This involves either the narrowing or focusing of the attention on internal events such as breathing, an object, one point in space, or a mantra (several Buddhist practices, *Yoga Nidrā* & *Sahaja Yoga*) or expanding the attention non-judgmentally on the moment to moment experience and observing thoughts and feelings from a meta-cognitive awareness state (Mindfulness meditation, *Vipassyanā* and Zen Buddhist practices) [6].

## 2. Basic Approaches and Different Forms of Meditative Practices

Many meditation techniques are being practiced presently. However, all of them can be grouped into two basic approaches - concentrative meditations and mindfulness/insight meditations. Concentration meditation aims at single pointed focus on some sound, image or sensation to still the mind and achieve greater awareness. Most popular form of this meditation is “transcendental meditation”(TM) developed by Maharshi Mahesh Yogi in 1958. TM is generally done by focusing the mind on some *mantra* (sound) to achieve transcendental state of consciousness.

Mindfulness meditation on the other hand involves opening up or becoming more alert to the continuous passing stream of thoughts, images, emotions and sensations without identifying oneself with them. Such a practice helps in developing non-reactive state of mind, which is the foundation for calm and peaceful state of consciousness. Here, instead of narrowing the focus (concentration), the practitioner becomes alert to the entire field of consciousness. *Vipaśyanā* and Zen meditations belong to this category.

Mikulas [7] propounded the classification of meditative practice into four components - form, object, attitude, and behaviours of the mind. *Form* refers to the setting of meditation and the activity of body during the meditation, whereas *object* refers to object of one's attention during the meditation. *Attitude* is the mental set with which one approaches meditation. *Behaviours of mind* connotes whether the meditation is based on concentration or mindfulness.

Classic distinction suggests as many as 14 different forms of meditation [8]. However recently, University of Alberta Evidence-based Practice Center, Canada, conducted an exhaustive review of studies on meditation and its effects on health. This review was conducted on studies up to 2005. They identified five categories of meditation practices:

- (1) *Mantra meditation* (Comprising TM, relaxation response, and clinically standardized meditation).

- (2) *Mindfulness meditation* (comprising *Vipaśyanā*, Zen Buddhist meditation, mindfulness based stress reduction, and mindfulness based cognitive therapy).
- (3) *Yoga* (This is based on Indian Yogic tradition developed by Patañjali. It incorporates various techniques like body postures, breath control and meditation).
- (4) *Tai Chi* (This is a Chinese martial art that incorporates various slow rhythmic movements that emphasize force and complete relaxation. It has been also called “meditation in motion”).
- (5) *Qi Gong* (This is an ancient Chinese practice that combines breathing patterns with various physical postures, bodily movements, and meditation).

### **3. Beneficial Effects of Meditation**

The reported long-term trait effects of meditation include:

- (1) at a physical level: feelings of deep relaxation and stress relief;
- (2) at a cognitive level: enhanced concentrative attention skills, improved self-control and self-monitoring and better ability to inhibit irrelevant interfering external and internal activity;
- (3) at the emotional level: positive mood, emotional stability and resilience to stress and negative life events (detachment);
- (4) at a psychological level: personality changes such as enhanced overall psycho-emotional balance.

These long-term effects of meditation practices are subjective in nature.

#### **3.1 Physiological Changes during Meditation**

Studies comparing experienced meditators compared to controls or short-term meditators have demonstrated physiological changes during meditation, suggestive of a wakeful hypo-metabolic state that is



characterized by decreased sympathetic nervous activity, important for fight and flight mechanisms, and increased parasympathetic activity, important for relaxation and rest [9].

This wakeful hypo-metabolic state with parasympathetic dominance has been shown to be qualitatively and quantitatively different from simple rest or sleep. *Sahaja Yoga* meditation, for example, a technique that evokes thoughtless awareness on a daily basis, presumably via activation of parasympathetic–limbic pathways [10], has been shown to reduce autonomic activity in short- and long-term practitioners compared to controls. This included a reduction in heart, respiratory and pulse rates, of systolic blood pressure and oxygen metabolism, and of urinary vanilly mandelic acid (VMA), and increase of skin resistance. These physiological alterations are indicators of deep parasympathetic activation and therefore physiological relaxation that have been related to stress relief and may have a role in the prevention of stress-related illness, such as respiratory, hypertensive or cardiovascular diseases.

In fact, the same physiological effects achieved with *Sahaja Yoga* meditation in healthy individuals, could also be achieved in patients with asthma and hypertension after 4 weeks of meditation training, which furthermore were related to the significant reduction of asthma attacks [11]. Studies using other meditation techniques such as mindfulness or Buddhist meditation have reported similar changes indicative of increased parasympathetic activity, suggesting that this is a characteristic feature of meditation.

### 3.2 Neurophysiological Effects during Meditation

As mentioned before, the key subjective experiences in meditation, apart from a general relaxation response, are the reduction of mental activity and the generation of positivity. Functional neuroimaging studies have, in fact, been able to corroborate these subjective experiences by demonstrating the up-regulation in brain regions of internalized attention and processing of emotion with meditation.

Many electrophysiological studies have examined the brain activation during a variety of concentrative meditation techniques. A common finding has been increased low frequency activation of theta and

alpha bands that has been suggested to reflect enhanced sustained attention to internal events [9]. Very few studies, however, have directly investigated the neural correlates of the peak experience of thoughtless awareness. *Sahaja Yoga* is one of the meditation techniques that aim to eliminate thought processes in the practitioner. Electrophysiological (EEG) studies comparing the brain activation of 16 long-term *Sahaja Yoga* practitioners between 3 and 7 years of practice to short-term meditators with up to 6 months of practice have been able to find specific brain activation patterns corresponding to the subjective feelings of thoughtless awareness and happiness [12]. During the meditation, compared to the state of rest, the long-term meditators showed more feelings of happiness and less mental activity than the short-term meditators. In their EEG measures, the long-term meditators showed increased power in low band frequency EEG activity of theta and alpha, which was particularly pronounced over the left frontal regions.

The intensity of the feelings of happiness was positively correlated with the theta activity over left frontal regions. This is in line with the evidence for a role of the left frontal lobe in positive emotions whereas the right prefrontal lobe plays a greater role in negative ones. Frontal theta activity is thought to originate from limbic and frontal brain regions such as the anterior cingulate and prefrontal cortex and has been shown to be increased during both affective and attentional states such as emotion processing and sustained attention [13]. There was also increased activation in the alpha power range over the same regions, which is thought to reflect a reduction in brain regions that mediate mental effort and external attention. Increased activation in alpha activity has commonly been observed in meditators of different traditions and has been found to correlate with reduced levels of anxiety. This pattern of increased fronto-parietal theta activity has also been observed during other concentrative meditation techniques and seems to be a correlate of internalized attention [9].

In conclusion, these pioneering studies show that the subjective experiences of mental silence and positive emotions during meditation have very specific neurophysiological correlates in the activation and connectivity of regions that mediate internalized attention and positive effects. Most modern functional imaging studies have typically been

conducted in very small subject numbers and without the use of control conditions. Nevertheless, the findings so far seem to support the evidence that meditation leads to increased activation in frontal and subcortical brain regions that are important for sustained attention and emotion regulation. Ideally, future imaging studies of meditation should be conducted longitudinally to measure changes in brain structure and brain function before and after the meditation experience in subjects.

### **3.3 Clinical Effects of Meditation**

Growing evidence for short and long term effects of meditation on physiological indicators of stress, on personality and cognitive functions, and on functional and structural plasticity of brain regions that are important for attention and emotion regulation, mental disorders, typically characterized by effective and cognitive-attentional problems, are obvious targets to study the clinical effects of meditation.

Research of the clinical application of meditation effects is still in its infancy, but there is some emerging evidence that meditation has positive effects on stress-related diseases and on some neuropsychiatric disorders. Another key target group could be disorders of attention, given that several meditation techniques are associated with enhanced attention skills in long-term meditation practitioners and with functional and structural effects on fronto-parietal networks of sustaining attention.

### **3.4 Depression and Anxiety Disorders**

Depression is the most common form of mental illness, with an escalating prevalence in ever younger populations. It is one of the main causes for disability and has a high burden of disease. The relapse rates of conventional treatment are high [14]. Furthermore, a recent meta-analysis on antidepressant medication has raised serious concerns about its clinical efficacy [15]. Finding non-pharmacological treatment options is therefore desirable, particularly in teenagers, where antidepressant pharmacological medication has been controversial due to side effects and suicide risk. Several clinical trials have shown positive effects of several weeks of Mindfulness meditation based stress-reduction interventions in patients with major depression and anxiety on symptoms of depression, anxiety, panic and rumination.

*Sahaja Yoga* meditation over 6 weeks showed a significant reduction in the symptoms of anxiety, depression and general mental health in 24 patients with major depression compared to a control group and a group receiving CBT [16]. Another Yoga technique, called *Sudarśana Kriyā Yoga*, has shown effectiveness in patients with depression on symptoms of anxiety and depression in a randomized controlled trial. *Sudarśana Kriyā Yoga* is based on a specific breathing technique (*Prāṇāyāma*) based on ancient Vedic tradition. The efficacy of the same meditation technique has also been tested in 60 persons with drug abuse, randomized to either meditation or control conditions. The meditation group improved significantly more in their depression symptoms and also in physiological measures of the stress hormone levels of cortisol and acetylcholine with large effect sizes [17].

A couple of meditation studies have been conducted in obsessive-compulsive disorder (OCD). The first study was an open trial of 12 months *Kuṇḍalinī Yoga* practice, consisting of posture and breathing exercises, in five medicated patients. There was a significant reduction in OCD symptoms and severity of about 50% [18].

#### **4. Mechanisms of Therapeutic Effects of Meditation**

Helminiak [19] described six possible mechanisms through which meditation works. These six mechanisms capture most of the explanations found in the existing literature. They are:

**(1) Relaxation:** Relaxation is one of the primary components of all kinds of meditation which induce a pleasant and deep relaxed state of body and mind. Herbert Benson (1976) developed a therapeutic technique called “relaxation response” which is a form of meditation. His whole concern with meditation was to reduce stress and hypertension by inducing a state of deep relaxation. Benson (1976) measured series of physiological parameters in response to relaxation response. Various effects include decrease in the rate of metabolism, decrease in the rate of heart beat, muscle relaxation, slow and rhythmic breathing, decrease in blood pressure, and so on. All this effects help in balancing physiological abnormalities and promotes healing.

**(2) Systematic Desensitization:** Joseph Wolpe's behavioural

therapy is especially instrumental in reducing anxiety [20]. This therapy involves three steps. First, the client is thought to induce a deep state of muscle relaxation. This is followed by preparing a hierarchical list of stimuli inducing anxiety. Finally, in a deep relaxed state, the client confronts (either by imagination or by presentation of actual stimuli) each of the anxiety producing stimuli progressing in hierarchy. This therapy is based on the principle of reciprocal inhibition. Since anxiety and relaxation are incompatible to each other, the stimuli lose their anxiety provoking quality. The Client continues this process until he is desensitized to the highest item in the hierarchy.

In meditation also a practitioner undergoes similar steps. Every meditation involves induction of a relaxed state. In meditation, the practitioner first enters deep relaxation state and suspends conscious thoughts by either detached observation or concentration. As a result, many anxiety provoking repressed memories, thoughts, and feelings arise in the mind. When one confronts them in a deeply relaxed state, these factors lose their power to induce anxiety and finally get eliminated.

**(3) Release of Repressed Psychic Material:** This is related to systematic desensitization. With regular practice of meditation, most of the practitioners encounter release of repressed unconscious thoughts, emotions, and images. This is very similar to the release of unconscious phenomenon during free association in psychoanalysis. This could be initially disturbing, but with constant practice, unconscious mind gets cleaned of such memories and healthy mind is achieved. During meditation, the practitioner remains under low arousal and sensory deprivation for a long time and under such a condition repressed feelings and thoughts arise (Benson, 1976).

**(4) Unstressing:** Parallel to release of repressed memories, many practitioners report several physical reactions during intense meditation. This could be involuntary muscular-skeletal movements such as repeated twitches, spasms, gasps, tingling, tics, jerking, swaying, pains, shaking, aches, internal pressures, headaches, weeping, and laughter. The experience covers the range from extreme pleasure to acute distress. TM practitioner calls this "*unstressing*". Goleman (1971) interprets this phenomenon on the basis of psycho-physiological principle, contemplating that all psychic and emotional phenomena have parallel physiological processes.

**(5) Dissolution of Habitual Patterns of Perception:** Human beings are mostly governed by rigid and fixed patterns of thinking, feeling, and reactions. Many of these patterns are unhealthy and cause neurotic and psychotic problems. Most of the unhealthy habitual patterns are due to our identification with emotions that we are not able to control and regulate. With detached observation, emotions and thoughts lose their power and practitioner is able to identify the unhealthy patterns of behaviour and remove them with healthy ones.

**(6) Cosmic Consciousness:** Attainment of cosmic consciousness is a mystical concept and not subject to scientific investigation. Many terms are used to represent cosmic consciousness such as *samādhi*, *nirvāna*, *satori*, and *mokṣa*. It is the highest goal achieved by meditation in esoteric traditions where a person transcends his personal ego. In the state of cosmic consciousness a person realizes that he/ she is one with the whole cosmos and is not separate from others. As a result, a tremendous sense of love and compassion arises in him and it is the highest state a human can achieve.

## **5. Effects of Meditation on Health**

Effects of meditation on health are based on the principle of mind-body connection. Meditation practices are generally accepted as mind-body treatments for health related problems and overall well-being. There is a growing body of literature showing the efficacy of meditation on various health related problems. Meditation is reported to be effective in pain management and enhancing immune system. Studies on the long-term mental benefits of meditation show that meditation reduces stress and increases levels of happiness, self-confidence, and general effectiveness. Meditative interventions have been found to be beneficial in treating various clinical conditions. These include hypertension, cardiovascular disorders, pain syndromes and musculoskeletal diseases, respiratory disorders such as asthma, congestive obstructive pulmonary disease, dermatological problems such as psoriasis, allergies, immunological disorders and treatment-related symptoms of breast and prostate cancer. Several Indian researchers have also made significant contributions. Their study ranges from anxiety, psychosomatic disorders, neurotic disorders and stress. Various studies also reported the benefits of TM meditation in de-addiction from chemical substances and smoking.

## 6. Future Directions for Effective Meditation Research

The new frontier in meditation research is to discover the mechanisms of action of different meditative practices. Mechanisms of action are mediators that play a causal role in the practice of interest. Identifying the mechanisms of action of various meditative practices is an important step in providing theoretical structure to the wide-ranging field of research on meditation, which encompasses a variety of meditative practices most often studied in isolation. A number of theoretical models have been published that propose various psychological and neural mechanisms of action for specific meditative practices, and require practical testing [21].

More large scale and well-controlled neurobiological and clinical research studies are needed to understand more thoroughly the neurophysiological mechanisms of action and the clinical effectiveness of these different meditation practices. So far, hardly any studies have compared different meditation techniques. Future studies are needed to investigate the specificity of the cognitive, behavioural, physiological and neurophysiological effects of these different meditation techniques by directly comparing them. However, there is scope for the use of some of these meditation techniques as a promising health intervention for specific disorders, either alone or as an adjunct to existing conventional treatment.

Scientists and scholars studying meditation and also the promising results of early meditation research have created a climate of lively growth and potential for researchers interested in pursuing the scientific study of meditation. Studying meditation can be challenging, requiring a combination of intensive assessment of potential mechanisms during meditation training and tightly-designed follow-up studies that manipulate these mechanisms. Social and personality psychologists, however, are uniquely well-situated to meet the needs of this new and interesting field of research; in return, they will gain an unparalleled opportunity to illuminate the intricate relationship between mind and body.

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## 21. Psycho-Biological and Spiritual Aspects in the Evolution of Supreme Forgiveness

*Viney Jain<sup>1</sup>*

### **Abstract**

In the interconnected and highly interdependent universe of living-beings, conflicts invariably arise and result in injuries and hurts. Negative feelings of resentment, anger and revenge against the offenders often initiate a vicious cycle of violence and counter-violence causing more harm. In contrast, practice of forgiveness is a positive and beneficial response.

Queries about the what, why and how of the manifold dimensions of forgiveness have been answered in numerous ways. The diverse perspectives on the definitions of forgiveness and its underlying motivations, identification of the various categories and stages of forgiveness have become hot topics of current research. Starting from ancient religious traditions to the modern secular philosophies and empirical scientific investigations, the concept and practice of forgiveness have evolved as complex multi-faceted issues of great personal and social relevance in the modern times.

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Transitions from the categories of non-forgiveness to conditional- and unconditional-forgiveness have been of special interest. The unique Jain concept of *Uttama Kṣamā* (Supreme Forgiveness) based on spirituality has, however, remained largely unexplored. We shall discuss the evolution of forgiveness holistically from the perspectives of psychobiology to spirituality.

From the evolutionary psycho-biology perspective, forgiveness evolved through the mechanisms of environmental adaptedness during the processes of natural selection – to act as deterrent against aggressive behaviour induced by constant and intense intra- and inter-species competitions, since aggression became disadvantageous by disrupting cooperation in species living in interdependent social groups. Forgiveness evolved to moderate competition and encourage co-operation for greater survival advantage. Furthermore, non-forgiveness is often marked by hyper-arousal of the chronic stress response due to persistent rumination leading to ill health and poor survival. Conditional forgiveness facilitating interpersonal cooperation becomes feasible after the expression of apology and repentance by the offender. Seeking and giving of an apology is, however, dependent on attachment to the self (ego) and may not be always forthcoming.

In contrast, unconditional forgiveness is grounded in the intrinsic value of all life, objectivity and equanimity. It does not condone wrongdoing. Unconditional forgiveness is essential for sustainable peaceful coexistence. Critics have argued, that to forgive without conditions is immoral since it tends to inhibit justice and encourage evil. However, if morality depends on the impact of actions of a person on others, unconditional forgiveness would be a supreme moral virtue.

Supreme Forgiveness is discussed in Jain philosophy from the real and pragmatic view-points. *From the real view-point forgiveness is an intrinsic attribute of the Jīva, which is fully expressed in a purified Soul.* Arising from a passionless, non-attached (*Vītarāga*) state of purified consciousness, Supreme Forgiveness is characterized by non-conditionality, spontaneity, unilaterality and universality. In the state of *vītarāgatā*, feeling of hurt is completely eliminated. Pragmatically capacity to forgive, essential for personal development, social harmony, peace and wellness, is restricted to various degrees in mundane living-

beings. Dispositions to forgive evolve with the grades of purity of the embodied soul. Spiritual practices, such as *Kāyotsarga* meditation help in evolving forgiveness by reducing attachment to the body, depleting the body-ego and advancing spiritual purity.

## **1. Introduction**

Seeking and granting forgiveness have played crucial roles since ancient times in resolution of conflicts and promoting social harmony and wellness. Historically, forgiveness has been closely associated with religious beliefs and doctrines. All major religious traditions, theistic and non-theistic, have strongly supported forgiveness as a moral virtue and divine gift, as illustrated by the common saying “*to err is human, to forgive is divine*”. However, during recent decades, especially after World War II, multi-disciplinary studies involving modern philosophy, psychological and social sciences, spirituality, ethics and biomedicine have witnessed exponential growth. A number of different concepts of forgiveness, differing in their interpretations, practices and significance, have evolved in the religious and secular domains and are subjects of intense discussions and debates in the modern era.

Feelings of anger, resentment, revenge, fear, hatred or avoidance are common responses to the perception of injury or insult/hurt inflicted on a victim by an offender. These negative emotional responses may trigger aggression, resulting in a vicious cycle of violence and counter-violence between the victim and the offender with further harmful consequences. In contrast, the alternative option of non-violent responses, based on the victim's capacity to forgive, is positive and universally beneficial.

Religious and secular philosophers, humanists and scientists define forgiveness in many diverse ways. The common underlying core element is a change in feelings and behaviors from negative to positive pro-social responses by the victim towards the offender, eschewing the negative emotions of anger, resentment and revenge. Forgiveness is an intrapsychic process involving emotional, cognitive, behavioural and spiritual components and resulting in great personal and social benefit.

In recent times, there has been an explosion of empirical and

theoretical studies to explore the psycho-biological and psycho-social processes associated with the various categories and types of forgiveness. Diverse perspectives on motivations, categories and stages of forgiveness have been presented and discussed.

Evolution of forgiveness in terms of transitions between different categories of forgiveness is of special interest for understanding the multiple processes involved in the complex manifestations of the various forms of forgiveness. In this context, most of the studies have been concerned with the roles of non-forgiveness, conditional-, and unconditional-forgiveness. The unique Jain concept of *Uttama Kṣamā* (Supreme Forgiveness) based on spiritual purification (Jain, 2014) has remained largely unexplored in the scientific literature.

The practice of forgiveness is difficult and uncommon. Forgiveness needs to be cultivated so that it eventually emerges as a personality trait. From the perspective of science, the psycho-biological processes such as cognitions and emotions with their associated material substrates, in the ultimate analysis, are considered as products of evolutionary forces and mechanisms. Evolutionary adaptation to meet the challenges of inter- and intra-species competitions for survival and natural selection in changing environments seems to have played a key role in the beginning. However, during the course of evolutionary time, multiple psychological processes along with the associated biological mechanisms developed to effectively meet the challenges of changing physical and social environments. Cooperation, empathy and altruism offering universal benefits, became more advantageous for survival and development compared to competition, especially in species which live in social groups and colonies. Finally spirituality evolves to enable crossing the restrictions and limits imposed by the body.

### **Competition, Cooperation, Empathy, Altruism, Spirituality**

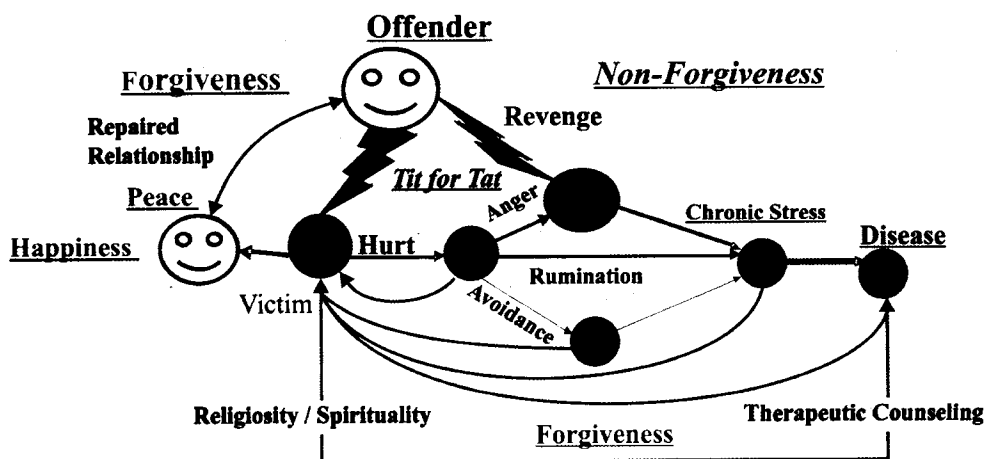
Transcending the mundane psycho-biology, spirituality aims to experience the true self, the essence of being - a domain beyond the constraints of the physical body and ego. Eliminating the feelings of suffering and pain, spiritual practices lead to enlightenment, liberation and bliss - the pinnacle in human evolution. Essentially personal, spiritual experiences extend the conscious horizons beyond the victims and the offenders to encompass the wellness of the whole biosphere.

In the present paper, we attempt to analyze the evolution of various categories and phases of forgiveness from the perspectives of psychology and spirituality.

## 2. Psycho-biological Aspects

### 2.1 Dynamics of Responses to Perceived Hurt/Injury

The dynamics of the psycho-biological processes (feelings, thoughts and actions) underlying the various responses to the feeling of hurt, perceived by the victim, are complex. To facilitate understanding the interactions and relationships between various processes, they are presented in a simple model (Fig. 1).



**Fig. 1. A Simple Model depicting Dynamics of Responses to Perceived Hurt and Prevention and Repair of Harm by Forgiveness.**

Emotion of anger is the most common impulsive reaction to an offence. Anger may induce the desire for revenge against the offender after a transgression has been committed. Revenge is a common tit for tat strategy employed by humans and higher animals. Revengeful behaviour, which generally results in violence, could have evolved, possibly, as a deterrent to future transgressions (McCullough et al., 2014). Anger and revenge, however, have negative consequences for social harmony, mental and physical health. Anger, for example, has been shown to be

detrimental to cardio-vascular health (Williams et al., 2000; Sulls, 2013; May et al., 2014). Desire for revenge is even considered as a state of psychological dysfunction. Compared to this tit for tat strategy, which may initiate a vicious cycle of violence and counter-violence, the act of forgiveness offers a better solution for conflict resolution resulting in repair of harm and an advantage for survival.

## **2.2 Feeling of Hurt as a Function of the Development of Ego**

Why and how a person feels hurt, insulted or injured?

Feeling of hurt has its origin in the relationships and interactions of the Embodied-Self with the Universe (non-self, others). These are profoundly influenced by one's perceived self-image (the Ego) and core beliefs about the universe (the world-view) which includes the physical and social environments.

Sigmund Freud, the father of psycho-analysis, believed that the roots of the Ego, lie in the sensations, perception and feeling of our own body (Freud, 1923). The ego begins and develops from the identification of the Embodied-Self with the body and its sensations (the body-ego). After birth, the most important environmental stimuli consist of the biological sensations and experiences of touch between the infant and the mother (or the primary care-giver). These experiences induce the feelings of attachment, which gradually extend the self-image from the body-ego to psychological domains of inner experience and relatedness (I, me, mine). From the evolutionary biology perspective, development of ego strengthens the survival instinct and is, therefore, a vital protection mechanism in the struggle for existence. Any perceived threat to the ego creates a state of stress and induces a feeling of hurt or injury. Anger and aggression are the initial impulsive emotional responses that occur to cope with the perceived stress and hurt.

The physiological mechanisms underlying the emotional responses of anger and aggression are not yet precisely known. It is generally believed that the temporary imbalances in the autonomic nervous system (ANS) activities, specifically the increased stimulation of the sympathetic (SNS) and depression of the parasympathetic (PNS) pathway, play a vital role in the emotional responses. The activities of the ANS may be modulated by the central nervous system (CNS) especially

the Hypothalamus-Pituitary-Axis (HPA). Importantly, levels of central neurotransmitters are also known to be involved in the regulation of emotions and behaviour (Coccaro et al., 1997). High dopamine and low serotonin (5-Hydroxytryptamine, 5-HT), for example, correlate with the aggressive behaviour and also influence the activities of ANS. Deficiencies in the synthesis, transport and receptors of serotonin have been shown in a number of recent studies on humans and animals, to be related to anger and aggression.

### **2.3 Revenge, Rumination and Non-Forgiveness**

Taking revenge (eye for an eye, blood for blood) is a common pathway to quickly resolve conflicts. However, this is neither very effective nor a desirable way, since vengeance often initiates a never-ending vicious cycle of violence and counter-violence causing immense harm and misery to all, including the so called victims and offenders.

If revenge is not possible, the victim may choose to avoid the offender by breaking the relationships and blocking all further communications. This option of avoidance is also not very fruitful because the conflicts remain unresolved and suspended. Generally, the victim returns to the normal psycho-physiological states after the initial impulse of anger, after the perceived feeling of hurt subsides. If, however, the anger persists and the burden of grudges continue for a long time due to non-forgiveness and rumination, the victim gets stuck in a state of negative emotions causing chronic stress, which adversely affects physical and mental health. Disorders such as deregulations of the autonomic nervous system, cardio-vascular disturbances, mental depression, and immune suppression have been reported in several empirical studies (Besharat and Pourbohloul, 2012; Lawler-Row et al., 2008). Thus, through non-forgiveness, the victim inflicts further harm to him/her-self, besides to others.

### **2.4 Apology and Conditional Forgiveness**

In interdependent social groups, conflicts and non-fulfillment of commitments occur, which cause hurt. Realizing the advantages of cooperation for success and survival, conditional forgiveness evolved as a strategy to resolve conflicts peacefully and facilitate maintenance of harmonious relations between partners.



Conditional forgiveness requires some kind of atonement (repentance, apology, reparation, penance) for the wrong-doing from the side of the offender. According to some religious traditions, for examples, Judaism and Islam, forgiveness is justified only after the offender has expressed remorse and offered an apology. This is based on the belief that even a terrible wrong-doer is not permanently evil, yet atonement is necessary since the capacity for moral change and reform can manifest only through repentance. It is noteworthy, however, that for majority of young persons in the present day western culture, the motivations for apology and forgiveness have been reported as self-oriented, health benefits or repair of valued relationships (Younger et al., 2004).

Conditional forgiveness is also termed as state-forgiveness since it is situation and offence specific, depending on the circumstances, nature and intensity of the offence. For heinous crimes, forgiveness may not be extended in spite of apologies.

Conditional forgiveness, however, is of limited value and not always the best strategy to resolve conflicts. It shows severe limitations in practice when forgiveness becomes dependent on the offender's behaviour. Realizing the mistakes committed, the offender must communicate a sincere expression of remorse and apologize to the victim with a promise not to repeat the offence in future. Such an unambiguous communication from the offender may be delayed or sometimes may not be even forthcoming because of egoistic considerations. Both, the victim and offender, in the mean time, continue to suffer from hostile negative emotions and remain burdened with the unresolved conflicts, broken relationships and ill health. Under such situations, non-forgiveness prevails and the vicious cycle of violence and counter-violence is resumed, increasing risks for survival. Thus, conditional forgiveness is considered as a plausible social contract and not as real forgiveness. It does not offer an optimal solution in all circumstances for conflict resolution.

## **2.5 Unconditional Forgiveness**

Unconditional forgiveness is extended without any conditions and is given unilaterally, without any self-interest. Flowing from the goodness and free-will of the victim, independent of the offender's behaviour, unconditional forgiveness is the genuine forgiveness (Cowley, 2010).

Though very difficult to practice, unconditional forgiveness can be cultivated through conscious and constant efforts, based on empathy, altruistic behaviour (behaviour that benefits others at the cost of self-interest) and equanimity – the realization of the intrinsic equal potential and value of all life.

Unconditional forgiveness has evolved as a unique pathway to break the vicious cycle of violence and counter-violence, repair and maintain close bonds, promote reconciliation and peaceful co-existence. Unconditional forgiveness does not condone wrong-doing and is fully compatible with maintaining self-respect and with justice, which is a function of the legal system.

Disposition to forgive is a personality trait which differs widely among individuals. Willingness to forgive an offender may also be modulated by social and cultural factors such as individualistic or collectivistic way of life and religiosity/spiritualistic values. Recent empirical studies suggest that extending forgiveness is positively correlated with the closeness of the relationship between the victims and offenders. This is especially true in individualistic cultures, where individuals favor and value a small number of close relationships. Forgiving offenders with strong attachments to the self is in self-interest and comes automatically. In collectivist cultures, in contrast, the individual becomes relatively less dependent on close relations and greater importance is often given to an extended group, community or the society as a whole, which shifts the emphasis towards maintaining good relations with others beyond the circle of close relations.

Unconditional forgiveness evolved, possibly, from the capacity to feel and share the pain/distress of others (empathy), and behaviour that benefits others at the cost of self-interest (altruism). Empathy and altruistic behaviours have been observed in humans, non-human mammals and birds and are well documented. Evolution of empathy can be traced to parental care and social attachment (Decety, 2011). Empathy plays a vital part in the developments of cooperation and altruistic behaviour (de Waal, 2008) providing thus the basis for forgiveness and inhibition of aggression. Physiologically, empathy could be mediated by the embodied simulation of emotional states, involving the system of mirror neurons as part of complex neural processes and pathways (Gonzalez-Liencrea et al., 2013).

An important social evolutionary advantage offered by unconditional forgiveness is in the breaking of the vicious cycle of violence and counter-violence.

### 3. Spiritual Aspects

Empirical studies have shown that religiosity/spirituality positively influence the disposition of forgiveness.

The relationship between religions and forgiveness has played a crucial role in cultural evolution, since all religions attach great value to forgiveness. The exact conceptualizations and practices, however, differ considerably across various religions. Most theistic ancient religious traditions associate and attribute forgiveness to divine mercy and grace. Since humans have been created in God's own image, all believers are expected to imitate Him. In Judaism and Islam, feeling of remorse and repentance on the part of the wrong-doer is an obligatory condition for forgiveness to be granted. Christian theology, on the other hand, recommends that genuine forgiveness should be offered unconditionally. In Buddhism the concept of forgiveness is associated with compassion (*metta*). In Hinduism it is a moral virtue and duty (*dharma*) necessary for survival and peace. Jain scriptures describe forgiveness as a natural attribute of the Soul. The disposition to forgive emerges and evolves with the growth of spiritual purity to the highest category termed Supreme Forgiveness, which is expressed unconditionally, unilaterally and universally.

#### 3.1 Supreme Forgiveness

“*Uttama Kṣamā*” or Supreme Forgiveness rests on the Jain concepts regarding the structure and functions of the living-beings operating according to the doctrine of *Karma* (the principle of causality). Jain philosophy assumes that the living-beings (including humans, animals, insects, plants and microbes) are composed of two independent substances (i) the soul called *Ātman/Jīva*, a formless, unobservable entity, bonded with (ii) matter (*pudgala* in Jain terminology) constituting the subtle-psychic (karmic)- and the visible gross-physical bodies. The major characteristic of soul is consciousness or awareness. Bonding with matter pollutes, restricts and distorts the functioning of the soul, rendering it

impure which results in the expression of toxic emotions (*kaṣāya*) such as anger, pride, deception, and greed. Stoppage and dissolution of the bondage with karmic matter by spiritual practices facilitate the soul to evolve to a more purified state which allows unrestricted expression of its natural attributes.

Supreme Forgiveness is discussed in Jain philosophy from the real and pragmatic perspectives (Jain V., 2014). *From the real view-point, forgiveness is an intrinsic natural attribute of the Jīva (living-being) which is fully expressed by a purified Soul.* Emerging from a passionless, non-attached (*Vītarāga*) state of purified consciousness, characterized by equanimity and objectivity, Supreme Forgiveness is expressed non-conditionally, spontaneously, unilaterally and universally. It is noteworthy that in the non-attached, passionless state of *vītarāgatā*, feeling of hurt gets completely eliminated.

From the pragmatic point of view, capacity to forgive, essential for personal development, social harmony, peace and wellness, is restricted in mundane living-beings (*jīva*) and, therefore, needs to be further developed by special efforts (*puruṣārtha*). Spiritual practices recommended in Jain scriptures to be essential parts of Jain way of life are helpful. For example, every follower of Jainism is expected to perform six essential duties (*ṣaṭ āvaśyakas*) every day, *Pratikramaṇa* and *Kāyotsarga*, being of special importance in the present context.

### **(1) *Pratikramaṇa* (Introspection)**

*Pratikramaṇa*, literal meaning to go back, signifies introspection to review any ethical violations committed, to feel remorse and ask for forgiveness for the same. *Pratikramaṇa* should ideally be practiced every morning and evening, but if that is not feasible, it should be practiced at frequent intervals, at least once a year.

### **(2) Forgiveness Day (*Kṣamā-vāṇi Divasa*)**

Recognizing the significance of enhancing forgiveness in the worldly life, Jains celebrate Forgiveness Day (*Kṣamā-vāṇi Divasa*) devoted to introspection, seeking and granting unconditional forgiveness. The forgiveness day is observed every year (August/ September) at the conclusion of the great spiritual festival of *Dasa Lakṣaṇa Dharma Mahā*

*Parva*, also known as *Paryuṣaṇa Parva*, dedicated to self-purification. The festival continues for ten days, each day is assigned especially for the observance of one of the ten inherent attributes/virtues (*dharma*) of the soul. Celebration of Forgiveness Day after the conclusion of the ten day festival, getting rid of all toxic emotions of anger, pride, deceit and greed, following the path of truth and self-restraint, is an appropriate occasion to seek and grant forgiveness to all living creatures of the world, who might have been hurt, knowingly or unknowingly, by one's actions, words or thoughts.

The practice of celebrating Forgiveness Day in this manner provides an excellent opportunity to renew friendships, eschew feelings of revenge, reduce social tensions and violence to gain mental peace. Furthermore, it is a step forward towards spiritual upliftment.

### (3) *Kāyotsarga* Meditation

The various levels of dispositions to forgive evolve in direct proportion to the degree of purity of the embodied soul. Practice of *Kāyotsarga* (literal meaning: renunciation of the body) meditation, an integral part of Jain yoga, aims to transcend the limitations of the body-ego. Practice of *Kāyotsarga* involves: (i) resting the body in a comfortable posture, (such as *siddhāsana*, *śavāsana* or *khadgāsana*) without any movement in a complete relaxed state and (ii) contemplating on the true nature of the inner Self - the pure Soul, the *Ātman*. The Self is identified with pure consciousness and not the physical body. The body-ego is abandoned and reducing the karmic-load the living-being is transformed into a spiritual-being. In the absence of the body-ego, feeling of pain and hurt is completely eliminated. *Kāyotsarga* meditation, thus, helps in evolution of supreme forgiveness by reducing attachment to the body, depleting the body-ego, reducing the karmic-bondage thereby transforming consciousness to higher levels to advance spiritual purity. Empirical psycho-biological studies on the effects of *Prekṣā* meditation on forgiveness indicate that the disposition to forgive is enhanced by the practice of meditation (Samani Amal Prajna, 2016). Interestingly, recent measurements show that the sympathetic nervous system (SNS) activity, associated with degree of stress, drops to a very low level during the practice of *Kāyotsarga* (Jain et al., unpublished). Further research in this field promises to provide new insight and avenues to enhance forgiveness.

#### 4. Conclusion

Struggle for existence causes conflicts resulting in harms, injuries and feelings of hurt among living-beings, which often elicit responses of anger and aggression resulting in further harm. Different forms of seeking and extending forgiveness evolved as non-violent responses to limit further harm, to heal damaged relationships and enhance cooperation. Understanding the psycho-biological and spiritual processes underlying the expression of unconditional forgiveness will be helpful in developing effective strategies to cultivate disposition to forgive as a personality trait in lay persons. Spiritual practices, such as *Pratikramaṇa* and *Kāyotsarga* have been shown to be effective in reducing the toxic emotions (*kaṣāya*), in depleting ego and developing the rational attitudes of objectivity and equanimity (*vītarāgatā*) thereby enabling the emergence of supreme forgiveness that is extended unilaterally, spontaneously and universally. Hopefully, integration of science and spirituality would be of great value in providing a comprehensive understanding of the various categories of forgiveness and appreciation of their roles in meeting the present challenges of promoting *ahiṃsā*, peaceful co-existence and wellness.

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## 22. *Vītarāga Vijñāna: A Holistic Science*

*Shailesh Mehta<sup>1</sup>*

### **Abstract**

Today progress in various disciplines of science has gifted us with abundance of luxuries and comforts. Advances in information, communication, nano technology, genetics, stem cells etc.- as if we are ready to conquer the universe. But if we look within, do we not have inner unrest, lack of harmony, clashes, stress and so many inner issues? Despite plenty do we not feel empty within? Can science make humans happy in all respects within and without, especially from within?

Moreover we may have many unanswered questions like, but not limited to, why to me? What is in my realm and what is not? For this reason there is the need for *Vītarāga Vijñāna* or Holistic Inner Science.

Lord Mahāvīra had gone within for all the research and experiencing the Truth. As all covering veils vanished, infinite absolute pure knowing and perceiving power opened up, into which everything of the universe got reflected. Though he revealed science of everything, the main emphasis was on our own self and that too in such a simple way that common people could understand.

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Hence, we will try to look at the essence of *Vītarāga Vijñāna* pertaining to our own Self and life and describe a simple approach to have benefits of this unique science.

## 1. Human Life: A Unique Live Experiment

Our life is a unique ongoing experiment of the universe. Mind, speech, body, inner and outer happenings along with natural regulatory system constitute the experiment whereas the living 'I am' is the experimenter. In any experiment if one has correct knowledge of fundamentals and methods then only results would be favorable. If it is incorrect, despite all efforts, desired results cannot be attained and complications or problems would increase. It is also true for our life and way of living. Understanding, beliefs or visions, if incorrect, would lead to unhappiness, stress, *Ārta*, *Raudra dhyāna* or heavy binding of *karmas*. If understanding, beliefs or visions are correct then one will have happiness, resolution of all puzzles, *Dharma dhyāna*, light *karmas* and even freedom from it. Only thing needed is correct understanding and right vision.

## 2. Results

*Vijñāna*, knowledge, *Dharma* or philosophy is considered working correctly when it gives good results. How to measure results?□

1. It should reduce clash, stress and lead to happy, harmonious, meaningful and positive living. Along with increase in IQ, EQ and SQ (Intelligent Quotient, Emotional Quotient and Spiritual Quotient) the mind, body, conscious health would be taken care of.
2. It should gradually reduce and eventually stop *ārta* and *raudra dhyāna*, and lead to *Dharma dhyāna* and ultimately even *Śukla dhyāna*.
3. One who minimises and ultimately controls inner weaknesses, makes oneself free of them. Anger, pride, greed, deceit, attachments and aversions are inner weaknesses.
4. *Dharma* is innate nature of an element. *Ātmā Dharma* is to know and stay in the original nature of *Ātmā* or pure self.

### 3. *Vītarāga Vijñāna or Holistic Inner Science*

*Vītarāga Vijñāna* is the understanding and associating of 'I', the real self, with mind, speech, body, inner and outer happenings, natural regulatory system and universe as a whole. It deals with relative self- the real self, pure consciousness and matter. It discovers the world within. Who drives us? It is the inner self machinery in the form of mind, reflective consciousness, intellect and ego. It works under the influence of one's opinions, beliefs and inner weaknesses as described above. Positive and negative forces keep working and depending on understanding, awareness and one's choice, the inner state of being manifests. In present times, *Ārta* and *Raudra dhyāna* are more common. With correct understanding and awareness, one can have *Dharma* and *Śukla dhyāna*, which can be attained if one is blessed with self realization. Light is thrown on all aspects like subtle processes of *kārmic* charge and discharge, what is in my realm and what is not, Who am I and others?

Understanding each area like mind, reflective consciousness, ego, beliefs or inner weaknesses is a vast subject by itself. How does mind function? How is it formed? What is meant by mind control? How can we control mind or deal with mind? How to purify reflective consciousness? How does ego function and can one become free of it? All these are research areas but here let us touch upon relevant functional aspects only. Inputs going through the 5 senses are processed through and response or reaction given, mainly based on beliefs or visions one has. If beliefs or visions can be changed, the very experience of happiness-unhappiness, *dhyāna*, *kārmic* bondages and everything else changes. Hence, beliefs or visions form the basis of entire being. Scientist Bruce H. Lipton has studied beliefs and its effects on body and life (Biology of Beliefs).

***Dhyāna* ( ध्यान ) - *Dhyāna*** as explained by *Vītarāga* is state of being. Each moment every human being may be in one of the 4 states- *ārta*, *raudra*, *dharma* or *śukla dhyāna*.

***Ārta Dhyāna***- is getting disturbed or painful by one's own self. One is affected and becomes sorrowful within by some loss or adverse behaviour from someone and is not expressing or retaliating outside. Worries of future also is *ārta dhyāna*.

**Raudra Dhyāna-** is getting disturbed or painful by other's rage reaction, scolding, hurting, inner weaknesses. It may be at level of mind also. Dishonesty, cheating by intellect are hard varieties of *raudra dhyāna*.

**Dharma Dhyāna-** Wherein, by way of correct understanding, one remains equipoised, balanced and harmonious from within even in situations liable to cause conditions of *ārta* or *raudra dhyana*. Even when one is insulted or humiliated by some one, he gives his blessings to him/her and does not see the other person guilty but just as an instrument for such an event.

**Śukla Dhyāna-** When one has the right vision (*samyak darśana*) or self-realization and has functioning awareness of pure self even amongst all types of dealings.

*Incorrect understanding leads to ārta and raudra dhyana whereas correct understanding leads to dharma dhyāna.*

**Action (Kriyā) and intent, bhāva or dhyāna-** People doing similar activity may not have the same intent, same *bhāva* and hence may not have similar *dhyāna*, same experience or *kārmic* bonds. One doctor may be practicing for earning money as much and as fast as he can while the other may be doing it for helping people. Even in a temple people may have different motives and different *dhyānas*. There are many examples in scriptures emphasising importance of intent, *bhāva* or *dhyāna*.

To be aware of *Bhāva* (inner projection) and *Dhyāna* and rectify as needed is one of the main essence of '*Vītarāga vijñāna*'.

**Some Scientific Correlations:** Positive and negative attitudes or inner states do affect body and play role in causation or cure of disease. The effects are mediated through autonomic nervous system, endocrinal system and its effects on all cells of the body. Bruce H. Lipton proved that beliefs shape our relative personality. Change your beliefs and you can change your life. Beliefs even affect cell membrane permeability and genes are also affected by environment and beliefs. Epigenetics is a recent development in our understanding of human evolution. Even aura pictures and functional MRI study show corresponding changes in different states like anger, love-hatred, revenge or forgiveness. Inner states of *ārta* and *raudra Dhyāna* would cause stress and negative effects all throughout.

Happy, harmonious and positive states would be reflected by good changes all around.

#### **4. A Few Simple Insights**

**Happiness** - Is it in abundance? If it were so, there would be no tension on faces of rich people. Is it due to competition and comparison? No, it is normal and natural living. Temperature above normal is fever, below normal is also fever. In nature, does a beautiful rose flower or a mango fruit become so due to competition or comparison to some one? Key to happiness is obliging nature. Lord Mahāvīra said "*Yoga, Upyogo paropakārya.*" Use your mind, speech, body, time and intellect to oblige others. Actually whenever we decide to help some one, make some one happy, we become happy first. Before obliging others, one is obliged first. Contrary to that, if we decide to scold or fire staff or someone who spoke ill of us, we get disturbed first. ***Each action of mind, speech and body will affect us in the same vein, positively or negatively before affecting others.*** Thus inner effect of every act of mind, speech and body will give us reward or penalty. In this manner world is 'me' only and there is nobody else in the world. When one is nice, loving, caring, sharing for some one, one is really good to one's own self and vice versa. This is the most fundamental lesson, "learn to look within". *Realizing this our first resolve and prayer in the morning would be 'Let my mind, speech and body make one and all happy and let my mind, speech and body not hurt any living being even to the slightest extent.'*

#### **Golden Keys for Harmonious Living**

**Avoid Clashes** -Correct understanding is one which can free us of clashes. As long as there are clashes one can not be said to have correct understanding, Clashes lead to lack of harmony, loss of inner energy, stress and if too many, then even diseases. Why do clashes occur? One feels 'He or she is right, others do not understand.' One can express with love, care and persuasion. But insistence and adamancy lead to clashes. One needs to decide to resolve situation amicably with equanimity. Everyone may be right from his or her own view point. Inner clashes are resolved by correct understanding of this science and natural laws.

**Adjust Everywhere**- In present times problems are usually not due

to scarcity but they are due to lack of harmony. One finds it difficult to get along or adjust with others be it in the family, at work place or otherwise. Why so? In present times, there are gardens at home or at work place. In previous times there were farms. In a garden all trees or plants are different but none without a fruit or a flower. Similarly at home or at work place all personalities may be different. Find out what are positives and make best use of them and never complain about shortcomings. Adjustment should be internal; one who does not learn this may get disturbed.

**Home** - a heaven on earth: Win your own home, world need not be conquered. In fact home is a place to get rid of karmas. It is a testing laboratory. Husband-wife should live as best friends. Do not keep attitude of 'I-You' or 'mine-yours' but think in terms of 'we-ours.'

Be vigilant in dealings. Take care to wipe off negative notes and opinions thinking only of positive side of the mind otherwise negativities keep on increasing. Regular self *alocanā*, *pratikramaṇa*, and *pratyā-khyāna* are keys to reduce kārmic bonds.

**Parents-children** - Character of parents and atmosphere at home play vital role in overall upbringing of children. Minds of children are to be handled with care. Children seek love. Love is really one which is free of expectations and conditions. As children, we also have responsibility to take care of parents. Service of parents and teachers lead to worldly happiness. To neglect them is inhuman.

**Interconnected Living** – “*Parasparopagraho jīvānāma*” All living beings by broader view are interconnected. When one starts loving others, his/her heart will always remain blissful irrespective of reciprocation.

**Positive Vision** - Do circumstances make us happy or unhappy? No, mainly it is vision of looking at them which does so. Lord Mahāvīra used to teach monks or nuns, "If you go seeking food and you are not given anything, how would you feel?" Disciples - "Does not matter, at least we are not insulted." "If insulted then?" "Does not matter, at least we are not beaten up." "If beaten up then?" "No problem at least limbs are intact." "If one limb is fractured?" "No matter, others are intact and at the end we are immortal souls." In summary in any situation see what is left with you and

not what is lost.

One who insults or criticizes is really obliging us as it gives opportunity to introspect and improve. It washes away our inflated ego and keeps us equanimous, gives us energy and makes us free of *kārmic* bondage.

Even in critical illness one should remain steady and positive from within.

Is it compulsory to endure or suffer the effects from *kārmic* bonds?  
- Due to *kārmic* bonds natural system brings us to various types of circumstances. One may or may not be able to change the circumstances but certainly has a choice of vision and the way it has to be faced. *So inner effect depends on our vision and is our choice.*

## **5. Who am I?**

I am a name bearer and I am the doer is almost universal belief. But when one says, my name, my mind, my speech, my body, my feelings, my karmas then who is 'I' there? Everything labeled mine is continuously changing and is transient whereas real 'I' is permanent and never changing. Who is the knower and perceiver of all things even within? Know the knower and you have known everything. Even Einstein when asked, said, "Now I want to know the observer through which I have observed everything". Lord Mahāvīra used to give right vision as “एगो मे साससो अप्पा” Only my soul or real self is permanent, can be known; all the rest is external and is circumstantial. By mine-ness and belief in external circumstances, living beings go through a chain of sufferings. One should surrender this ignorance. Once self realized with conviction and initiation of experience, all puzzles are resolved. The world itself is a puzzle. There are two view points to solve this puzzle. One is relative and the other is Real. In scriptures this has been explained as '*Vyavahāra*' and '*Niścaya*'. In the present era, one needs help and grace of experienced, self realized enlightened *Jñānī Puruṣa* to distinguish between them.

What is in my realm and what is not?

When things go as per our expectations, we say "I did it." But when

outcome is adverse, then? We may attribute it to circumstances, our partner or our stars. For anything to happen it needs so many circumstances - gross to subtle, to come together in a harmonious sequence. Even if one of them is missing, the event would not occur. Are we able to control all the required circumstances? There is no one in the world who can claim to have total control or command over all the circumstances. So in part of happenings, we are instrumental doer but not an independent one. We need to try our best and leave the rest to nature. After it happens, we just need to understand that whatever has happened is just and correct. It will save us from many after-effects, stress and karmas.

Where is our independence? It is in part of *bhāva*, decision making or in projection. It is independent of circumstances and depends on our understanding and resolve. That is why the Lord said:

“भावे भावना भाविए, भावे दीजे दान,  
भावे जिनवर भजिए, भावे केवलज्ञान ”

If we can understand this relative free will, then we can make best use of it.

One should resolve and pray in the morning as follows:

1. Let my mind, speech and body not hurt any living being even to the slightest extent and let my mind, speech, and body make one and all happy.
2. I aspire to know who I am. For that I earnestly wish to see an experienced, enlightened *Jñānī Puruṣa* ' with whose grace and guidance I can attain it.
3. Other *Bhāvanā* or projections as we feel.
4. Cleansing process through confession, apology and resolution.

**Forgiveness** - It is a much discussed subject. How to forgive our own self and others?

Suppose I have hurt my mother then it will continue to bug me. I will have guilty feeling and will lose my happiness and harmony. Here immediately I should do as follows:

"In witness of the lord, I bow unto pure self within my mother, who is free of her mind, speech, body, name, and all *kārmic* bonds. O pure self! I confess my misdeed/mistake, apologize for it and resolve not to repeat it again. Please give me inner strength not to repeat such mistakes." This is a precious technique shown by Lord or *Vītarāga paramātmā*. Here, first I become free of inner burden and these vibrations are transmitted to the other person and his/her mind also becomes clear. It can be done within our heart and is preferably to be done immediately.

**Forgiving Others** - At times, merely trying to forgive may not be successful. But understanding of natural laws help. In fact no one has any independent power to harass or help us. They are just deliveryman/woman (*nimitta*), like postman in the scheme of nature. In case of Lord Mahāvīra, the Shepherd was just a delivery man who hammered nails in the Lord's ear. It is due to our own account, molecular configuration etc. that a particular person becomes instrumental for a particular event through natural regulatory system. In nature there is no injustice at any time. So the 'One who suffers is at fault.' The person himself is the cause for his own suffering and others are not to be blamed for it.

**Charge-Discharge of *kārmic* Bonds**--*kārmic* bonds are conglomerates of molecules which get attached to one's soul depending on his '*bhāva*' i.e. inner state/intention. Later on, they arise due to the natural system. While passing through various phases, one continuously has *bhāvabhāva* i.e. inner positive and negative intention. The karma bondage occurs due to our own actions or thoughts and the causal body is formed. It then gets linked to natural regulatory system which, at appropriate time, yields corresponding result.

What is basis of new *kārmic* bonding? - As long as one has wrong belief "I am name bearer and I am doer" new bondage keeps on getting generated. The cycle of cause and effect or charge and discharge governs us. Once wrong beliefs are rectified, there is hope of minimizing or arresting new charges and new bondages.

छूटे देहाध्यास तो नहीं कर्ता तू कर्मनो, नहीं भोक्ता तू तेहनो, ए छे महाभजननो मर्म।

As long as wrong belief persists, new matter or '*pudgala*' gets attached through *vibhāva* (विभाव) or as a special property of Pure soul.



**Science of Pure Soul and Matter**—As enlightened ones experienced, Pure or conscious Soul is one element and Matter is another element. Both elements exist and have innate attributes and functions or phases. Basic essence and basic properties do not change but as they come together, a third extra special property gets generated as explained in the figure.

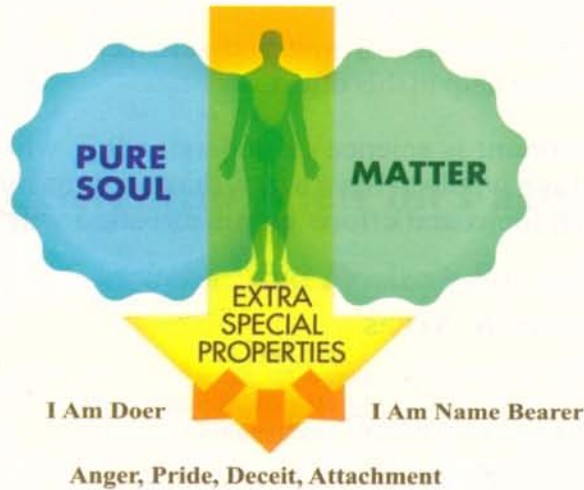


Fig. 1. Arising of Anger, Pride, Deceit and Attachment due to Relationship of Pure Soul and Matter.

Figure 1 is an attempt to explain that 'I am' and 'I am doer' leads to anger, pride, greed and deceit. These are neither the property of pure soul nor that of matter. They are extra special properties and hence the Holistic Scientist or *Vītarāga* knowing these processes well can help Pure self to come to its natural state and become free of bondages.

This may be taken as a hypothesis. Whatever is being studied is through tools developed by the five senses and intellect. But who is illuminating these 5 senses and intellect? Part of the science is through inner observations of the self and inner vision but certainly one can experience it.

## 6. Summary

In present times, many things which were highlighted by the

Enlightened ones are being studied and confirmed by modern scientific tools. It has reached up to metaphysical levels like aura, energy body, functional MRI, intention experiment and thought related researches. Scientists are now trying to understand sentience, consciousness, awareness, experience, bliss etc. In fact science includes a whole spectrum-inner science and outer science. *Vītarāga Vijñāna* includes all these aspects. When it comes to sciences of living beings and consciousness, then theories of material science may not be adequate. *Vītarāga Vijñāna* can help in this effort.

Most important is science or understanding which can help one and all, mankind as a whole to have happy, harmonious living. My humble submission is that focus and efforts in this direction will be more fruitful and appropriate.

### Suggested Research Areas

1. Study, research, develop and spread an easy, effective, scientific path based on principles of *Vītarāga Vijñāna* or Holistic Science which can help one and all to have a happy, harmonious, positive and meaningful living.
2. Psychological and Physiological Effects of various techniques like- Forgiveness, Positive and negative emotions, *ārta*, *raudra dhyāna*, anger etc.
3. How Holistic Science can help people to pass through challenging situations like critical illness, death of near and dear ones etc.
4. Diet and health- Vegetarianism, Vegan, fasting, Ayambil etc.
5. Teaching and understanding of Holistic Science in schools, colleges, universities etc.

## 23. Scientific View on Fasting

*Pratap Sanchetee<sup>1</sup> and Prakash Sanchetee<sup>2</sup>*

### Abstract

The issue of healthy eating has long been an important concern to individuals and cultures. Fasting, dieting, and vegetarianism are various techniques used to increase longevity and improving health. Fasting is certainly not bad for health, as is generally thought, if it is observed properly.

The principles of Jainism are most compatible and relevant for reinstating total physical and mental health as well as for spiritual development. Long-term calorie restriction causes many physiological changes that alter life-history traits such as growth, reproduction and lifespan. Studies have shown that reducing typical calorie consumption by 30-40% extends life span in many animals. Controlled studies in animals and humans have confirmed that fasting protects against diabetes, cancers, heart diseases, and neuro-degeneration. Some studies in humans have found that fasting helps reduce obesity, hypertension, asthma, and

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rheumatoid arthritis. Fasting is a cost-effective and non-invasive technique, has minimal risk of adverse effects or drug interactions, and does not require medical supervision in most cases.

Studies of physiological basis and consequences of prolonged fasting are limited. In a landmark study on 110 healthy volunteers, we have observed widespread benefit in body weight, BMI and systolic BP. Metabolic changes of stress have been observed in blood glucose, proteins and lipid levels. The results are presented here.

### **1. Introduction**

Food is a basic foundational necessity for all forms of life. The world over, animals and plants rely on feeding of some sort. Eating is a sensorial experience and a normal part of human experience. The issue of healthy eating has long been an important concern to individuals and cultures. Among other practices, fasting, dieting, and vegetarianism are various techniques employed by individuals and encouraged by societies to increase longevity and health. Contrary to popular belief, fasting is not dangerous or unhealthy if it is done properly; it is actually healthy and beneficial.

Long-term calorie restriction (CR) causes many physiological changes that alter life-history traits such as growth, reproduction and lifespan. Studies have shown that reducing typical calorie consumption by 30-40% extends life span by a third or more in many animals, including nematodes, fruit flies and rodents (Stipp, 2013). Even if CR does not help anyone live longer, a large portion of the data supports the idea that limiting food intake reduces the risks of diseases common in old age and lengthens the period of life spent in good health.

### **2. Fasting as a Spiritual Practice**

From an evolutionary perspective, three meals a day is a strange modern invention. Fasting has long been associated with religious rituals, diets, and political protests. It has been practiced for thousands of years by various cultures all over the world. Religions have long maintained that fasting is good for the soul, but its bodily benefits were not widely recognized until the early 1900's. For most faiths, the sacrifice of food and

water - for hours, days, or weeks at a time - is understood to be an intensely spiritual practice that allows for reflection and asceticism. While religious fasts are partaken primarily for spiritual purposes, they also have the potential to greatly improve one's physical health.

*“Fasting will bring spiritual rebirth to those of you who cleanse and purify your bodies. The light of the world will illuminate within you when you fast and purify yourself. What the eyes are for the outer world, fasts are for the inner.” – Mahatma Gandhi*

## Definition

*Shrink the “eating window”; expand the “fasting window”*

Now-a-days, fasting is considered to be taking place if one does not eat for a period of at least 8-12 hours. So technically, most of us are fasting every night when we sleep. In the morning, we break our fast; this is where the term breakfast comes from.

Fasting is primarily an act of voluntary abstinence or reduction from certain or all food, drink, or both, for a period of time to focus on health and/or spiritual upliftment (Wikipedia). An absolute fast is defined as abstinence from all food and liquid for a predefined period, usually a day (24 hours), or several days. In the traditional sense, fasting is the total and absolute abstinence from food and other liquids except water. Though a metabolic event, it is different from starvation in that it is voluntary and is done for enhancing physical and mind health.

Fasting may also be done by abstaining from other pleasurable activities like sleep, sex, and vices. As religious philosophy and customs evolved, the term has become more liberal and loose in its application. Some fasts may be only partially restrictive, limiting particular foods or substances. Some of the popular kinds of fasting are meat fasting, sweets fasting, juice fasting, 'Lent' fasting, a liquid fasting diet, and water fasting. Apart from total fast, the three most commonly studied fasts are caloric restriction (CR), alternate-day fasting and dietary restriction (DR).

## 3. History

The reasons for fasting include both health and spiritual

betterment. The history of fasting goes back to antiquity. There's no reason to think that early man did not fast in the normal course of his existence. All animals, even today, will fast during times of stress or illness. It is a natural tendency for the organism, whether human or animal, to seek rest, balance and to conserve energy at critical times. Dietary restrictions were common in primitive cultures as most of these cultures have their own system of belief on what is safe to eat or what one must avoid eating.

The practice of ancient fasting had highly spiritual motivations. Ancient traditions require that one should fast before undergoing any important event in life. Shorter spiritual fasting in ancient cultures symbolizes cleansing rites. Other motivations of ancient fasting include the belief in purity of the spirit, rewards, and mysticism.

Fasting as a religious or spiritual activity has been a part of human customs even before major religions were established. The belief on the spiritual benefits of fasting is prevalent in Christianity, Islam, Buddhism, Hinduism, Jainism and other religions. It is mentioned that all the 24 Jain *Tīrthaṅkaras* observed prolonged fast and meditation to achieve salvation. Fasting is also mentioned in great religious books like the Āgamas, Bible, Quran, Mahabhārata, and Upaniṣads.

Yogic practices, including that of fasting, date back thousands of years and fasting is one of the oldest therapies in medicine. Many doctors of ancient times and many of the oldest healing systems have recommended it as an integral method of healing and prevention. *Āyurvedic* medicine, the world's oldest healing system, has advocated fasting as a major treatment. Hippocrates, Plato, Socrates, Aristotle and Galen all praised the benefits of fasting.

The scientific study of the health benefits of fasting seriously began in 1935 when Clive McCay and colleagues observed that restricting the calories fed to rats in a laboratory, without producing malnutrition, prolonged their lifespan (McCay, 1935). Thus science of Calorie Restriction (CR) was born. Hundreds of studies since then have shown that CR slows aging not only in mice and rats, but also in yeast, flies, worms and fish. In rats, it was shown that the intermittent 'fasting' could produce the same result as continuous fasting.

## **4. Physiology of Fasting**

While the spiritual importance of fasting is widely believed, its physical effects on the body are less clear. How does the human body begin to change when it is systematically deprived of food and water, particularly over long periods? Are there any biological benefits that accompany spiritual ones? Scientists do not yet know if long-term CR is safe, beneficial and practical for humans. Currently, the bulk of the scientific evidence for the health benefits of intermittent fasting has come from animal studies (Longo and Mattson, 2014).

### **4.1 Circadian Rhythm, Feeding and Health**

Story has been developing for a number of years about the connection between the gut and the brain. There is a need for increased metabolism during state of alertness and a decreased metabolism during state of sleep. Circadian disruptions can prime animals toward obesity. It has been observed that sleep-deprived night owls, eating less during late night hours may help curb the deficits in concentration and alertness that accompany sleep deprivation. Hatori et al. (2012) observed that mice fed a high-fat diet only during normal waking hours staved off obesity, metabolic dysfunction, and liver damage—all of which plagued animals with access to food round the clock. In a human study, it has been observed that there is negative neurobehavioral performance including significantly slower reaction times and more attention lapses during sleep restriction (Spaeth et al., 2013). They also concluded that late-night fasting attenuates the performance decrement on vigilant attention caused by sleep restriction.

The body has a special mechanism that is initiated when no food is eaten. For many centuries, fasting was probably a normal occurrence for most people, and the body adapted to it. Through evolution, the body became very efficient at storing energy and handling situations when no food is available. When the intake of food is temporarily stopped, many systems of the body are given a break from the hard work of digestion. The extra energy gives the body the chance to heal and restore itself, and burning stored calories gets rid of toxic substances stored in the body.

## **4.2 Physical vs. Psychological Hunger**

Fasting is not starvation but rather the body's burning of stored energy. It is estimated that even very thin people can survive for 40 days or more without food. Many people think hunger is an emergency and panic when it kicks in. When we experience hunger, it is not a true physiological (body) hunger, but rather psychological hunger.

When fast or calorie restriction is initiated, there is a critical transition period of about 3-6 weeks during which the body and brain adapt to the new eating schedule (Longo and Mattson, 2014). This period can be very uncomfortable, as restricted eating has been associated with extreme hunger, irritability, loss of strength, loss of libido, and other side effects (Johnstone, 2007; Heilbronn et al., 2005). Once the body is accustomed, however, the hunger levels may decrease and mood could become more positive compared to before the fasting program started.

Lack of fuel in the body can be corrected by a variety of substances that provide energy. Many physiological changes occur in the body during fasting. The food resources during the fast are mainly fat and to a lesser degree the cytoplasm of muscle, liver, bones marrow and other organ cells. Most of its carbohydrate source is depleted within the first 24 hours of fasting and after that body begins using fat as source of energy. Fat burning results in ketosis that occurs usually during the third day of a fast for men and the second day for women. In this highly efficient state, the liver begins converting stored fat and other nonessential tissues into ketones, which can be used by the brain, muscles, and heart as energy. It is at this point in the fast that sensations of hunger generally go away and many people experience normal or even increased energy levels. Hormone levels and certain functions become more stable in this state as well. The goal of most fasts is to allow the body to reach the ketosis state in order to burn excess fat and unneeded or damaged tissue.

However, ketosis is not sufficient to meet energy requirement and the body gets the rest of it from breaking down the amino acids in muscle tissue. To fuel the additional requirement, the body would need to burn over 500 grams of muscle a day. However, body has developed another way to create energy that saves important muscle mass. After prolonged fasts of more than a week, the body starts seeking out non-body protein



sources of fuel, which include nonessential cellular masses like degenerative tissues, bacteria, viruses or anything else in the body that can be used for fuel. The conservation of the body's protein is believed by many to be an evolutionary development that exists to protect muscle tissue and vital organs from damage during periods of insufficient food availability.

### **4.3 Protection of Vital Organs**

A most brilliant design characteristic about life is that while we are fasting and securing our nutrition from many internal resources, not one minuscule fragment of the eyeball or the brain is consumed as food. None of these living tissue structures are sacrificed. They are only reduced in size. The more vital the tissue, the less it is touched.

### **4.4 Role of Brain**

Brain has a complex neural and humoral (chemical) circuitry to control food intake. Feeding is resumed either because of emptying of the digestive tract by digestion and absorption or because of fuel depletion by catabolism. Taste, and perhaps other (e.g. visual), receptors are stimulated by palatable food and motivation for feeding is increased. Signals from distended digestive tract and behaviour pattern results in satiety and feeding motivation is lowered. The net result of this interplay of positive and negative feedbacks from food responses is that caloric intake, observed over a sufficiently long period (at least several days), is equal to energy output over that period, so that body fuel content (body weight in fully grown individuals) remains constant.

The neural circuitry involves limbic system (the marginal zone of the forebrain) and the hypothalamus that detect hunger and satiety signals from other parts of the body. The lateral hypothalamus has hunger centre that facilitates feeding responses. Electrical or chemical stimulation of this area elicits voracious feeding in satiated subjects, and its destruction causes more or less prolonged non-eating (aphagia). In contrast, the ventromedial (lower central) nucleus of the hypothalamus controls satiety. Subjects with lesions in this area stop feeding only at an abnormally high level of energy content and grossly overeat.

There are two peptides in the hypothalamus that produce hunger,

melanin concentrating hormone (MCH) and orexin. MCH plays a bigger role in producing hunger whereas orexin plays a greater role in controlling the relationship between eating and sleeping. Other peptides in the hypothalamus that induce eating are neuropeptide Y(NPY) and agouti-related protein (AGRP). Satiety in the hypothalamus is stimulated by leptin. Leptin targets the receptors on the arcuate nucleus and suppresses the secretion of MCH and orexin. The arcuate nucleus also contains two more peptides that suppress hunger. The first one is cocaine- and amphetamine-regulated transcript (CART) and the second is  $\alpha$ -melanocyte-stimulating hormone ( $\alpha$ -MSH).

#### **4.5 Molecular Mechanism of Benefits from Fasting**

Fasting acts as a form of mild stress that continually stimulates cellular defenses against molecular damage. For instance, occasional fasting increases the levels of “chaperone proteins,” which prevent the incorrect assembly of other molecules in the cell. Additionally, fasting mice have higher levels of brain-derived neurotrophic factor (BDNF), a protein that prevents stressed neurons from dying. Low levels of BDNF have been linked to everything from depression to Alzheimer's, although it is still unclear whether these findings reflect cause and effect. Fasting also ramps up autophagy, a kind of garbage-disposal system in cells that gets rid of damaged molecules, including ones that have been previously tied to Alzheimer's, Parkinson's and other neurological diseases.

Animal studies have shown that intermittent fasting strengthens the body's innate response to stress (Longo and Mattson, 2014). In a human study in which eight males and eight females of a healthy body weight, fasted every other day for 21 days, participants lost about  $2.5 \pm 0.5\%$  of body weight including  $4 \pm 1\%$  of fat mass (Heilbronn, 2005). Neither fasting blood glucose nor ghrelin (an appetite hormone) concentrations changed before vs. after the intervention, but fasting insulin concentrations decreased suggesting greater insulin sensitivity. They did not observe changes in genes involved in mitochondrial biogenesis, fatty acid transport or fatty acid oxidation suggesting that the metabolic machinery required for generating energy from fat was sufficient at the start of the study.

In trying to find the mechanism by which CR produces its benefits, scientists have discovered a family of proteins called the *sirtuins* with a

variety of functions in keeping cells healthy. It has been shown that CR leads to an activation of SIRT1, the first and the best-studied sirtuin. This raises the possibility that instead of reducing calories, one could achieve the same result by consuming these substances, or even a pill containing resveratrol and similar compounds. Human growth hormone release (HGRH) showed an increase of an average of 1,300 percent in women and nearly 2,000 percent in men later in the fast.

## **5. Fasting in Different Faiths**

Fasting has a long tradition in most cultures and religions. Religious fasting is intertwined with ritual and spiritual discipline and became a form of penitence and identification with the poor and unfortunate.

### **5.1 Buddhism**

Prior to attaining Buddhahood, Prince Siddhārtha practiced a short regime of strict austerity—following years of serenity meditation during which he consumed very little food. Buddhist monks and nuns commonly do not eat each day after the noon meal. This is not considered a fast but rather a disciplined regimen aiding in meditation and good health. Lay Buddhists are instructed to observe the eight precepts which include refraining from eating after noon till the following morning on Uposatha days (roughly once a week).

### **5.2 Christianity**

Biblical fasting and fasting rules under the Christian tradition are broad and varied. The Lent fast observed in the Catholic Church and the Eastern Orthodox Church is a forty-day partial fast to commemorate the fast observed by Christ during his temptation in the desert. As per Christianity, fast is not merely abstinence from food or water, but a decision to fully obey God's commands to care for the poor and oppressed.

### **5.3 Hinduism**

Fasting is an integral part of the Hindu religion. Individuals observe different kinds of fasts based on personal beliefs and local customs. Some Hindus fast on certain days of the month such as Ekādaśī,

Pradoṣa, or Pūrṇimā depending on personal belief and favorite deity. For example, devotees of Śiva tend to fast on Mondays, while devotees of Viṣṇu tend to fast on Thursdays and devotees of Ayyappā tend to fast on Saturdays. Fasting during religious festivals is also very common e.g. *Mahāśivarātri* and the nine days of Navarātri.

Methods of fasting also vary widely and cover a broad spectrum. If followed strictly, the person fasting does not take any food or water from the previous day's sunset until 48 minutes after the following day's sunrise. Fasting can also mean limiting oneself to one meal during the day and/or abstaining from eating certain food types and/or eating only certain food types. Amongst Hindus during fasting, starchy items such as potatoes, sago and sweet potatoes; milk products, peanuts and fruits are allowed.

## **5.4 Islam**

Fasting in the month of Ramadan is one of the pillars of Islam. It is essentially an attempt to seek nearness to God and increase one's piety. Fasting is a unique moral and spiritual characteristic of Islam. Literally defined, fasting means to abstain "completely" from foods, drinks, intimate intercourse and smoking, before the break of the dawn till sunset during the entire month of Ramadan. Whether these practices can be termed as fast or it is a change in circadian pattern, we need to discuss out. Fasting also includes abstaining from any falsehood in speech and action, abstaining from any ignorant and indecent speech, and from arguing, fighting, and having lustful thoughts. They are also encouraged to temper negative emotions such as anger and addiction. The *Siyam* (fast) is intended to teach Muslims patience and self-control, and to remind them of the less fortunate in the world.

## **5.5 Bahá'í Faith**

In the Bahá'í Faith, fasting is observed from sunrise to sunset during the Bahá'í month of `Alá'. It is the complete abstaining from both food and drink during daylight hours. Consumption of prescribed medications is not restricted. Along with obligatory prayer, it is one of the greatest obligations of a Bahá'í. It is essentially a period of meditation and prayer, of spiritual recuperation and to refresh and reinvigorate the spiritual forces latent in their souls.

## 5.6 Sikhism

Sikhism is probably the only major organized world religion that does not promote fasting except for medical reasons. The Sikh Gurus discourage the devotees from engaging in this ritual as it is considered to "bring no spiritual benefit to the person". It does not regard fasting as religiously meritorious. According to them, God has given us the human body which has to be nourished and cared for. Fasting as an austerity, as a ritual, as a mortification of the body by means of willful hunger is forbidden in Sikhism. A Sikh is encouraged to practice constant temperance and moderation in matters of food. Neither starves nor overeats; just eat simple and nourishing food: this is the golden rule. Healthy food but in small quantities (*Alpa Āhāra*), just to keep body and soul together and to prevent sleep and sloth, is recommended for a Sikh.

## 5.7 Jainism

The principles of Jain religion are most compatible and most relevant in the present context for reinstating total physical and mental health. Fasting creates positive health and removes diseases. Fasting is very common among Jains, spiritually and as a part of Jain festivals. Although a Jain may take it upon him or herself to fast at any time, especially if he or she feels that some misconduct has been committed, most of them will fast at special times during the year e.g. Paryuṣaṇa.

Paryuṣaṇa is the most prominent festival, lasting eight days in Śvetāmbara Jain tradition and ten days in Digambara Jain tradition during the monsoon. If one fasts for the eight days of *Paryuṣaṇa*, it is called *Aṭhāi*, and if one fasts for 10 days it is called *daśa-lakṣaṇa*, and when it is for one month, it is known as *Māsakhāmaṇa*. During this period they maintain a strict water-only fast. The warm water to be consumed should be only between sunrise and sunset and not during the night, since night is a highly-susceptible time for micro-organism activity.

*Santhārā* or *Sallekhanā* is a form of fasting which is carried out to voluntary death. It is supposed to help shed karma according to Jain religion. The vow of *Santhārā* is taken when one feels that one's life has served its purpose. The goal of *Santhārā* is to purify the body and, with this, the individual strives to abandon desire. However, further discussion on *Santhārā* is beyond scope of this paper and is discussed in some accompanying articles (L. Soni; Raksha Shah).

Also, it is common for Jains not to fast but only to limit their intake of food. When a person only eats lentils and tasteless food with or without salt and pepper as the only spice, the person is said to do *Āyambila*. There are other types of fasts in which a Jain eats only one meal a day, which is known as *Ekāsana*. Similarly, another fast, called *Biyāsana*, allows for two meals a day. The goal of all these fasts is to decrease desire and passion for the physical world, and attain spirituality by meditation.

### **5.7.1 Aim of Fasting**

It is not sufficient for a Jain simply to not eat when fasting. They must also stop wanting to eat. If they continue to desire food, the fast is pointless. Jain fasts may be done as a penance and to purify the body and mind. It also reminds the practitioner of Mahāvīra's emphasis on renunciation and asceticism.

### **5.7.2 Methods of Fasting in Jains**

Fasts can be performed for varying lengths of time, depending on the person and his or her health requirements. There are several types of fasting:

- Continuous fasting: A continuous fast for varying duration as defined below.
- Intermittent fasting: It includes everything from periodic multiday fasts to skipping a meal or two on certain days of the week, alternating with period or days of eating.
- Complete fasting: giving up food and water completely for a period.
- Partial fasting (*ūnodarī*): Eating less than you desire and to simply avoid hunger. It may also have *Rasa Parityāga* or giving up favourite foods and *Vṛtti Saṅkṣepa* or limiting the number of items of food eaten.

### **5.7.3 Duration of Fast**

- *Upavāsa*: To give up only food for the whole day (starting from previous sunset to 2<sup>nd</sup> day sunrise - approximately 36 hours)

- *Chauvihāra Upavāsa*: Like *upavāsa*, to give up food as well as water.
- *Tivihāra Upavāsa*: One may drink boiled water between sunrise and sunset.
- *Digambar Upavāsa*: One may drink water only once a day before sunset.
- *Śvetāmbar Upavāsa*: One may drink boiled and cooled water after Porasī, provided this is done before sunset.
- *Belā/ Chatṭha*: To give up both food and water or only food continuously for two days.
- *Telā /Atṭham*: To give up food and water or only food continuously for three days.
- *Aṭhāi*: To give up food and water or only food continuously for eight days.
- *Navāi*: To give up food and water or only food continuously for nine days.
- *Māsakhamāṇa*: To give up food and water or only food continuously for a whole month.
- *Varṣitap*: This fast is very rigorous since it entails a whole year with eating no food on alternate days and eating food on rest of the days, while following the prescribed rules like not eating in the evening after sunset, not eating root vegetables (like potatoes, onions, ginger), and various other rules. In *Śvetāmbara Varṣitap* they do *Ekāsana* alternate days and *Upavāsa* on the rest of days.
- Great Fasts: Some Jain monks fast for months at a time, following the example of Mahāvīra, who is said to have fasted for over 6 months to one year or more.
- *Santhārā* or to "fast unto death": To give up food and water entirely.
- *Ekāsana*: To eat one meal a day at one sitting and drink boiled water as desired between sunrise and sunset.

- *Biyāsana*: To eat two meals a day in two sittings and drink boiled water anytime between sunrise and sunset.
- *Āyambila*: Eating food once a day in one sitting. The food contains only cereals and pulses (not sprouted) and it is spice free and boiled or cooked, without salt, milk, curds, ghee, oil, oil seeds, or green/raw vegetables, fruits and sugar and its products.
- *Navakārasī*: Food and water is consumed a minimum forty-eight (48) minutes after sunrise. Devout Jains brush their teeth and rinse their mouths only after sunrise.
- *Porasī*: Taking food and water after 1/4 (25%) of the day passes.
- *Sadh-porasī*: Taking food and water after 3/8 (37.5%) of the day passes.
- *Purimārdha*: Taking food and water after 1/2 (50%) of the day passes.
- *Avaddha*: Taking food and water after 3/4 (75%) of the day passes.
- *Chauvihāra*: No food or water after sunset till at least *Navkarsi* next day. Many Jains practice this daily all their life. Many Jains leave food or water before forty-eight (48) minutes before sunset.
- *Tivihāra*: Like *Chauvihāra*, but one may drink water.
- *Navapada Oli*: During every year for 9 days starting from the 6/7th day in the bright fortnight until the full moon day in *Āświna* and *Chaitra* months, one does *Āyambila*. This is repeated for the next four and half years. *Āyambila* may be restricted to one kind of grain per day.

#### **5.7.4 Preparations**

To enter a fasting period, the diet should be gradually lightened over a few days. First, heavy foods such as meat and dairy products should be eliminated for a day or two. The day before a fast, only easily digested foods like fruits, light salads, and soups should be taken. This period is



called *Dhāraṇā*. During the fast, only pure water and, in some cases, occasional herbal teas are allowed.

Fasts should be ended as gradually as they are entered, going from lighter to heavier foods progressively (*Pāraṇā*). The diet after a fast should emphasize fresh, wholesome foods. Fasters should particularly take care not to overeat when they complete a fast.

## 6. Benefits of Fasting

*“Everyone has a doctor in him; we just have to help him in his work. The natural healing force within each one of us is the greatest force in getting well. ...to eat when you are sick, is to feed your sickness.” – Hippocrates*

Like all age-old customs and traditions, fasting has interesting health benefits that we are now discovering with modern technology. Although it started out as a religious or spiritual activity, fasting has become a legitimate secular practice especially when applied to Western and alternative medicine. Medically, fasting allows the body to reorganize its nutrients. Human organs regenerate during the fast. Most of these benefits are realized only after a longer periods of fasting – around 20-24 hours. Many diseases are prevented with occasional fasting and extended fasting is recommended as therapy for various conditions. The majority of health-specific findings related to fasting are mixed and it depends on breed of animal, age when fasting was initiated, health and disease status of individual, activity status including exercises, type and duration of fast, history of smoking, earlier food choices and eating habits (Longo & Mattson, 2014).

### 6.1 Brain Health

Mattson and other researchers have championed the idea that intermittent fasting lowers the risks of degenerative brain diseases such as Parkinson's and Alzheimer's diseases. They have also shown that periodic fasting protects neurons against various kinds of damaging stress, at least in rodents. In follow-up rodent studies, his group found that intermittent fasting protects against stroke damage, suppresses motor deficits in a mouse and slows cognitive decline in mice genetically engineered to mimic the symptoms of Alzheimer's.

Improved neurogenesis, neuronal plasticity and high insulin levels have been linked to better cognition. In mice, reducing calories also promotes neurogenesis and slows certain Alzheimer's-related changes in parallel with reductions seen in blood insulin and inflammation. Thus, there is great interest in examining the effects of CR on brain health in humans and in comparing its effects with those of other diets (for example, diets rich in healthier unsaturated fats) that may also help memory.

### **6.2 Longevity**

Research in some animals has shown calorie restriction of up to 40 percent or fasting every other day (intermittent fasting) have an impressive positive effect on diseases, stress resistance, insulin sensitivity, markers of aging and life span (Mattson et al., 2004; Martin, 2006). Even though calorie restriction appears to work in a variety of species, its effects on longevity are far from universal. It has been found to extend the life of protozoa (very small, one-celled organisms), yeast, fruit flies, some strains of mice and rats, as well as other species. However, several animal models, including wild mice, show no lifespan extension by CR. In some strains of mice, calorie restriction even appears to shorten lifespan. Studies in nonhuman primates has also given conflicting results.

Given the growing older population and the rising rates of obesity, the role of diet in maintaining peak brain performance has taken on added importance. Although the links between CR and longevity in humans are still not fully established, short-term human trials have clearly shown that CR can improve many vital surrogate health markers such as body weight, blood pressure, blood sugar, insulin, cholesterol and triglyceride levels and measures of inflammation. Prolonged fasting also lowered levels of IGF-1, a growth-factor hormone that has been linked to aging, tumor progression and cancer risk.

### **6.3 Weight Loss**

Weight loss occurs most rapidly during the first few days of a fast, up to 1 kg per day. In following days, the figure drops to around 250 grams per day. An average weight loss of half a kg a day for an entire fasting period can be expected. A weight loss rate of almost one and half kg per day was achieved in water fasting weight loss experiments, while less than

half of the lost weight were actual body fat losses. Everything else was fat-free mass, which included water released from glycogen stores depletion, water released because of zero-sodium intake, muscle tissue breakdown and the emptying of the colon. There are conflicting views on whether intermittent CR vs. daily CR best preserves lean muscle mass (Varady et al., 2009; Johnstone, 2007).

According to nutritionist, fasting should never be undertaken to lose weight. At the same time, some weight loss is reported by most people who fast. They warn, however, that excess fasting can lead to starvation and should be avoided at all costs.

#### **6.4 Metabolic Syndrome and Atherosclerosis**

Metabolic changes with fasting are lowering of body mass, increased high-density lipoprotein cholesterol (HDL or good cholesterol), decreased triglycerides and low-density lipoprotein cholesterol (LDL or bad cholesterol), lower fasting glucose and insulin concentrations, increased sensitivity to insulin-mediated glucose uptake and reduced biomarkers of oxidative stress and markers of inflammation (including CRP, IL-6, TNF, BDNF, and more) (Wing et al., 1991; Horne, 2008). One of the main effects of fasting is to increase the body's responsiveness to insulin. Long-lived animals and people tend to have unusually low insulin, because their cells are more sensitive to the hormone and therefore need less of it. Decreased sensitivity to insulin often accompanies obesity and has been linked to diabetes and heart failure (Mattson, 2004). There is a lowering of heart rate, blood pressure, atherosclerosis and risk for coronary disease with increase in heart rate variability and improved cardiac response to myocardial infarction (Fontana, 2004; Varady and Hellerstein, 2007).

Findings of the Comprehensive Assessment of Long-term Effects of Reducing Intake of Energy (CALERIE) pilot study in humans showed that overweight adults who cut their calorie consumption by 20 to 30 percent lowered their fasting insulin levels and core body temperature (Stewart, 2013). Both of these changes correlate with increased longevity in animal models. The lower calorie intake also reduced their risk for major causes of mortality such as heart disease and diabetes.

## **6.5 Cancer**

Fasting not only protects against immune system damage - a major side effect of chemotherapy - but it also stimulates the regeneration of the immune system by shifting stem cells from a dormant state to a state of self-renewal. (Cheng et al., 2014). One of the amazing characteristic of fasting is the principle of *autolysis*. This is the ability of the organism to selectively self digest and removes unwanted material and accumulations from within the body without touching vital structures. In fasting, this quality of life becomes greatly enhanced so that many tumors, cysts, abscesses, abnormal accumulations, fatty deposits etc. may be completely or largely absorbed.

## **6.6 Mental Health**

Fasting may be religiously mandated but the social and community traditions that accompany the practice carry just as much benefit. Engaging in fasting brings families and social groups closer together. This often helps people suffering from depression and loneliness by reassuring them that they are not alone.

## **6.7 Other Diseases**

CR delays the onset of the autoimmune diseases, cardiomyopathies, renal diseases, neurodegenerative diseases and respiratory diseases. Fasting can be used for nearly every chronic condition, including allergies, anxiety, arthritis, asthma, headaches and digestive disorders. It is frequently prescribed as a detoxification treatment to people who have been exposed to high levels of toxic materials. Fasting is thought to be beneficial as a preventative measure to increase overall health, vitality, and resistance to disease. Malnourished or people with malabsorption symptoms can benefit from occasional fasting.

## **6.8 Political Application**

Fasting is often used as a tool to make a political statement, to protest or to bring awareness to a cause. A hunger strike is a method of non-violent resistance in which participants fast as an act of political protest, or to provoke feelings of guilt, or to achieve a goal such as a policy change.

## **6.9 Restriction on Fasting**

Restrictions have been imposed on too young (<15 years) and too old (>70 years); those suffering from illnesses; women who are pregnant, lactating or menstruating; travelers who meet specific criteria; and individuals whose profession involves heavy labor and in whom fasting would be dangerous (Longo and Mattson, 2014). For those involved in heavy labor, they are advised to eat in private and generally to have simpler and/or smaller meals than normal. Contraindications for fasting are those with asthma, cancer, diabetes, eating-disorders, schizophrenia, tuberculosis, ulcerativecolitis etc.

## **6.10 Side Effects**

Medical supervision is recommended for any fast over three days. Those with health conditions should always have medical support during fasting. Those performing extended fasts and those with health conditions may require blood, urine, and other tests during fasting. Plenty of water should be taken by fasters since dehydration can occur. However, excessive intake of water without the corresponding amount of electrolytes can lead to hyponatraemia. Any fast longer than 48 hours runs the risk of metabolism to slow down and one may gain weight more easily once the fast is over (Cheng, 2014). Taking time off from work or at least reducing the work load, is helpful. Exercise should be kept light, such as walking and gentle stretching.

Those fasting may experience side effects of fatigue, malaise, aches and pains, emotional duress, acne, headaches, allergies, swelling, vomiting, bad breath, and symptoms of colds and flu. Fasting leads to a loss of water,  $\text{Na}^+$ , and  $\text{K}^+$ , resulting in postural hypotension, and decreased blood sugar. Excessive fasting for calorie restrictive purposes, accompanied by intense fears of becoming overweight, are associated with mental disturbances including anorexia nervosa.

A recent study on athletic performance during Ramadan concluded that hunger and thirst cause stress to the athlete and only a modest decline in performance are observed (Chaouachi et al., 2009). These athletes have a high propensity for dehydration during Ramadan unlike during other approaches of intermittent fasting.

## **7. Research Potential**

Spirituality and science are coming together to show logical interlinking between science and religion. The majority of research that exists on fasting is testimonial, consisting of individual personal accounts of healing without statistics or controlled scientific experiments and needs proper documentation. Some of the areas of research are as below;

### **Literature Review:**

1. Fasting as a model of total health.
2. Pattern of feeding and fasting across animal kingdom.
3. Pattern of feeding and fasting across human evolution.

### **Experimental Studies:**

4. To study physiological changes with fasting and delineate anatomical, biochemical and hormonal pathways.
5. Beneficial effect on human health including cognition, mental health and physical fitness.
6. Beneficial effect on various diseases.

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## 24. Impact of Lifestyle Intervention through *Prekṣā Dhyāna* and Yoga on Holistic Health

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### Abstract

Main features of *Prekṣā Dhyāna* Yoga are described. Its practice provides holistic health. The various steps include *Kāyotsarga*, *Antaryātrā*, Perception of the Body and Perception of Psychic Centers.

### 1. Introduction

Like World Peace, health is also one of the major concerns of modern era, despite great advances in medical science. It is a paradoxical situation since, on the one hand, medical science aided by advance technology is trying to measure up to the ever-multiplying number of diseases, and, on the other, we humans are racing against them by creating more and more problems related to public health. Many factors are responsible for this. The principal among them are: (1) Environmental degradation (2) Erratic life style changes, and last but not the least, (3) Gradual extinction of the spring of Spirituality, out of which flows the human values. Thus the complex malady of holistic health cannot be contained and cured only through the clinical approach of medical science.

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In this context it is pertinent to note that the ancient Indian medical system - *Āyurveda*, since its roots were in the philosophical investigation into life, contemplated on the faculties of '*Ātman*'-(Soul) and '*Manas*' (mind) along with the physical system and functions of human body – the '*Śarīra*'. *Āyurveda* repeatedly emphasizes the crucial role of mind in maintenance of health and causation of diseases –“ *Prasannātmēna manah svastha ityabhidhīyate*”

In the famous *Āyurvedic* treatise – '*CarakaSaṃhitā* ', it is stated that there are three fundamental motives or biological human instincts (*Eśāṇās*) among human beings. They are — '*Prāṇaiśaṇā*' (life preservation), '*Dharmaiśaṇā*' (Worldly desires) and '*Paralokaiśaṇā*' (Other-worldly ambitions) and there is intricate relationship between them and the health. Similarly in *Suśruta- Saṃhitā*, the learned surgeon asserts that it is the soul that reflects itself in happiness or sorrow when it acquires a particular body and acts in the material domain. Any medical approach should therefore give due consideration to the mental states of mind '*Cittavṛtti*' that generate the psychosomatic impulses for physical ailments.

The philosophy and science of yoga therefore rightly preaches importance of containing and regulating the wild wavering of these '*Vṛttis*'. "*Yogaḥ cittavṛtti nirodhāḥ*" – this is how yoga has been defined. Although all this was said in the context of the spiritual pursuits of the ancient Indian philosophers, yet the science of Yoga developed by various schools has, over the last few decades, been attracting the attention of modern medical systems.

## 2. Prekṣā Dhyāna

In order to illustrate this relationship between yoga and the medical science, I would like to present the yogic formulations in '*Prekṣā Dhyāna*', a stream of yoga developed by the Jain philosophers. '*Prekṣā*' means perception –seeing and concentrating through mind on the subtle aspects of one's own consciousness. It helps to relieve and reduce the ill effects of physical and mental stress and emotional tensions, which are the cause of many psychosomatic ailments in today's complex life style. An aphorism from Jain canon '*Dasaveāliyam*' states the basis of this principle – '*Sampikkhae appagamappa eṇam*' i. e. 'See thyself'. It means one should

perceive and realize through concentration of mind what lies in one's consciousness. Perception is not mere thinking. It enables one to reach the inner depths of his/her consciousness.

The course of actions or steps to follow in *Prekṣā Dhyāna* system are as follows: They are easy to be practiced by any common person.

***Kāyotsarga*** (total relaxation of the body with self-awareness).

***Antarayātrā*** (internal trip of the consciousness through concentration on various limbs of the body).

**Perception of the Body** (focusing on each limb of the body and feeling its nuances).

**Perception of Psychic Centres** (situated at certain points i.e. *cakras* of the body).

'*Pātañjala Yoga*' has identified 7 such centres in human body. *Prekṣā Dhyāna-yoga* has extended this number to 11 through further sub-division. These centers are specific points where psychic energy is more concentrated. They are as follows:

*Jñāna Kendra* (centre of wisdom)

*Śānti Kendra* (center of peace)

*Jyoti Kendra* (centre of intuition and enlightenment)

*Viśuddhi Kendra* (centre of purity)

*Ānanda Kendra* (centre of bliss)

*Taijasa Kendra* (centre of bio-electricity, energy)

*Swāsthya Kendra* (centre of health and vitality)

*Brahma Kendra* (centre of celibacy)

*Apramāda Kendra* (centre of vigilance)

*Prāṇa Kendra* (centre of vital energy)

*Chakṣu Kendra* (centre of vision)

At these points ductless or endocrine glands like – Gonads, Adrenals, Thymus, Thyroid etc. are located and they exert profound influence on mental behaviour of an individual. Through visualization, specific colours are perceived at the above stated points and they are meditated upon.

**Anuprekṣā:** Through the process of visualization and auto-suggestion, one selects and sets his mind on a particular theme, wish or value and contemplates on it. This strengthens his will power.

The most important point to be noted here is that *Prekṣā Dhyāna* Yoga is a science of realization through practice with due patience and not merely a matter of conviction through logical or technical formulations. However, there is scientific basis for all that is envisaged in *Prekṣā Dhyāna* Yoga. To illustrate the point, one can take the example of stress or tension, the *modus operandi* of which is through the mechanism involving (a) hypothalamus and (b) pituitary glands, which are called the master of the endocrine system (c) the Adrenal gland, which provides the adrenalin to keep the body alert and, (d) the sympathetic component of autonomous mechanism which prepares and leads the body for strategies like— 'Flight away or fight it out'. '*Kāyotsarga*' technique helps in this process.

Similar is the case with the 'Perception of Breathing'. If one so desires, he can, without much practice, change and modify the rate, duration and depth of his breathing. It is a sort of supervision by a conscious mind over the functioning of cells in the body.

Nature has bestowed to humankind a mind with the faculty of discrimination and reasoning, which can control his responses to the force or dictates of instinctive drives like anger, hunger, sex etc. It has been proved through experiments based on bio-feedback and through other measuring instruments that meditation has the power to produce changes in the electrical activity of the nervous system as well as to transmute the synthesization of the outpourings of hormones produced by endocrine system.

Serious practitioners of *Prekṣā Dhyāna* have found that on physical level it also helps cells of the body to revitalize, improve digestion and respiratory mechanism. But the real benefits of *Prekṣā Dhyāna* are in the fields like mental, emotional and spiritual faculties. It helps to maintain poise, contain agitation and enjoy peace, which is a vital force to invigorate life. In conclusion, I would say that meditation, which is the principal instrument of *Prekṣā Dhyāna* is a healing process. The word itself has been derived from its Latin root —'*Mederi*'— meaning 'to heal'. It is not the forcible control over mind but a process to cultivate the

habit of positive thinking. Besides meditation, the *Prekṣā Dhyāna* Yoga also prescribes some easy to do physical and breathing exercises, which help to cure certain physical ailments of the body.

The sum and substance of all this discussion is that in order to enjoy perfect holistic health, one needs to invoke his innate forces of Soul and mind, along with physical treatment given as prescribed by medical science. Yoga teaches us how to activate our innate resources. In this context we should also consider the role that spirituality can play in achieving holistic wellness of human beings. As per *Bhagavad Gītā*, Yoga inculcates in us rationality and ethical discipline in dealing with worldly matters. Yogi Aurobindo qualifies this process as 'Affirmative Spirituality', in which human life, with all its natural traits like aspiration for progress, emotional urges etc., of course with reasonable restraints, should run parallel to *Yogiksāadhanā*. It is then that the man would be bestowed with peace, harmony and love.

The concept of holistic health is also related to adherence to human values, which evolves from the spirit that pulsates in the heart of man and not in the material world around. That would also ensure social health, which requires constant interaction between the inner spiritual impulses and the social environment around us. Many ills of modern world are related to the lack of such interaction. I would like to conclude with a quote from Swami Vivekananda's famous speech on *Karmayoga*:

“The miseries of the world cannot be cured by physical help only. Until man's nature changes, physical anomalies and problems will always be felt... the only solution of this problem is to make mankind pure. Let men have light and be spiritually strong. And then alone the miseries of the world would cease”.

## 25. Effect of *Prekṣā Dhyāna* in Bronchial Asthma

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### Abstract

*Prekṣā Dhyāna*, introduced by *Ācārya Mahāprajña*, does not only provide a better way of living but it also helps in improving various diseases. We planned a study to see the effect of this meditation on patients of Bronchial Asthma. 30 patients of age group 25-45 were studied who were having asthma of more than 3 years duration. Thorough clinical examination and relevant investigations were done. After 3 months of meditation by *Prekṣā Dhyāna*, review was performed. 24 subjects completed the study. All parameters showed improvement in subjective and objective conditions. Need of inhaler was reduced; however, Spirometry did not show very significant improvement. As this study was having small number of subjects a larger study is required for more informative results.

### 1. Introduction

*Prekṣā Dhyāna*, a life style, was introduced by *Terāpantha Ācārya Mahāprajña* many years ago.

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This era is full of lust for physical things which is causing a lot of strain and stress in life, leading to various psychological and psychosomatic disorders and even organic diseases. Pollution and smoking is also one of the major causes of respiratory diseases. Various treatment modalities were used to treat these diseases, including allopathy and alternative medicines. *Prekṣā Dhyāna* is one of the alternative methods of treatment. Before discussing effect of meditation on these diseases, I will like to say a few words about *Prekṣā Dhyāna*. *Prekṣā* means to enter from inside and, once one becomes an observer and not doer; it gives immense rest and peace to mind and body.

There are 8 parts of *Prekṣā Dhyāna*:

1. *Kāyotsarga*
2. *Antaryātrā*
3. *Śvāsa Prekṣā*
4. *Kāya Prekṣā*
5. *Caitanya-Kendra Prekṣā*
6. *Leśyā*
7. *Bhāvanā*
8. *Anuprekṣā*

One can practice *Prekṣā Dhyāna* in these 8 steps. By practicing these steps of meditations, many persons are said to be getting better quality of life. It requires some time to master all the steps but, with some devotion, one is able to practice *Prekṣā Dhyāna* completely.

We planned to study the effect of meditation on patients of bronchial asthma scientifically. It has been postulated that *Prekṣā Dhyāna* acts via altering the activity of nervous system and endocrine system. Wallace has stated that transcendental meditation produces restful, alert state of mind, reduces oxygen consumption, carbon dioxide elimination, reduces serum lactate concentration, and decreases cardiac output by 25%. It has been proved by many authors that meditation produces a state of wakeful hypo-metabolic state and thus gives rest to all the organs of the body. Nevertheless, this state, produced from *Prekṣā Dhyāna*, is different from sleep.

Asthma (from the Greek ἄσθμα, *ásthma*, "panting") is a common chronic inflammatory disease of the airways, characterized by variable and recurring symptoms, reversible airflow obstruction and bronchospasm. Common symptoms include wheezing, coughing, chest tightness and shortness of breath. Asthma is thought to be caused by a combination of genetic and environmental factors. Its diagnosis is usually based on the pattern of symptoms, response to therapy over time and spirometry ([https://en.wikipedia.org/wiki/Asthma-cite\\_note-lemanske-5](https://en.wikipedia.org/wiki/Asthma-cite_note-lemanske-5)). It is clinically classified according to the frequency of symptoms, forced expiratory volume in one second (FEV1), and peak expiratory flow rate. Asthma is characterized by recurrent episodes of wheezing, shortness of breath, chest tightness, and coughing. Sputum may be produced from the lung by coughing but is often hard to bring up. During recovery from an attack, it may appear pus-like, due to high levels of white blood cells called eosinophils. Symptoms are usually worse at night and in the early morning or in response to exercise or cold air. Some people with asthma rarely exhibit any symptoms, usually in response to triggers, whereas others may have marked and persistent symptoms.

## 2. Aim

The present study was planned to find out if *Prekṣā Dhyāna* can cause subjective and objective improvement in patients of bronchial asthma. A few preliminary studies that have been carried out on this problem have indicated clinical improvement in asthma after transcendental meditation and require further detailed study.

### 2.1 Material and Method

30 patients (15 males and 15 females) were enrolled for the present study. The patients were between 25-45 years of age and were having typical history of bronchial asthma for more than 3 years and were under allopathic treatment in form of bronchodilator and steroid inhaler and oral theophylline. Patients with severe disease (diagnosed by spirometry) were not included in the study. Records of medical history and thorough clinical examination were made before the program. X-ray chest, ECG and routine blood examination were performed in all patients and patients having any problem other than asthma were excluded from the study. A written consent of their willingness to join the program from all the patients was

taken. Only those patients were included who were willing to undergo this system of transcendental meditation and continue it at home for three months.

All the patients were given training of three forms of meditation, namely *Kāyotsarga*, *Anuprekṣā* and *Śvāsa Prekṣā*. All patients were given training by trained teachers for one week at MDM Hospital, Jodhpur, and then they were asked to continue meditation at their homes for at least 6 days a week for 3 months. All patients were advised to avoid allergens and to continue their treatment with drugs, whatever they were taking.

The following parameters were studied in these patients:

1. Subjective improvement VAS Scale of 1-10
2. Objective improvement as clinically judged VAS Scale of 1-10
3. Reduction in daily requirement of inhaler and oral medicines
4. Spirometry to check Vital capacity and FEV1 parameters of bronchial asthma.

## 2.2 Results

Out of 30 patients, 6 were dropped from the study as one of them developed severe attack requiring nebulisation and this developed after 2 months of study; 5 patients discontinued due to personal reasons. The

Table 1. Effect on Subjective Improvement

No. of Persons	Average Frequency of Attacks before <i>Prekṣā</i> (per day)	Average Frequency of Attacks after <i>Prekṣā</i> (per day)	No. of Inhalations before <i>Prekṣā</i> (per day)	No. of Inhalations after <i>Prekṣā</i> (per day)
30	5	3	5	3

Table 2. Effect on Objective Improvement

	No. of persons	Clinical Observation	Chest Examination	Any Other Sign
Before <i>prekṣā</i>	30	Average	Extensive rhonchi and crepts in 24 patients	Average respiration rate 20/min
After <i>prekṣā</i>	24	Better	Less rhonchi with no crepts in 22 patients	Average respiration rate 16/min



Table 3. Spirometry Change

No. of Patients	Average FVC		Average FEV <sub>1</sub>		FEV <sub>1</sub> /FVC (FEV <sub>1</sub> %)		P Value
	Male	Female	Male	Female	Male	Female	
30 (before <i>prekṣā</i> )	3.9 L	3.1 L	2.34L	1.83L	60%	59%	
24 (after <i>prekṣā</i> )	4.1L	3.21 L	2.62L	1.95L	64%	61%	0.5; Not significant

Table 4. Need for Inhaler

No. of Patients	Requirement of Inhalers before <i>Prekṣā</i> average/day	Requirement of Inhalers after <i>Prekṣā</i> average/day	Percent reduction
24/30	4.5	3.5	22%

results of changes in various parameters, before and after the practice of *Prekṣā* meditation for 3 months, for the remaining 24 patients are shown in Tables 1, 2, 3 and 4. It may be noted that out of 24 patients, 14 showed significant improvement clinically and subjectively. There is significant decrease in their doses of medicine and inhaler need. All these patients showed small improvement in FEV<sub>1</sub> and vital capacity as well. Thus this study, though based on small numbers and statistically weak, showed that *Prekṣā Dhyāna* meditation may be effective in improvement of bronchial asthma in 60% of the patients.

## 2.3 Discussion

There are some reports showing favourable response to transcendental meditation in patients of bronchial asthma. Wallace has shown that respiratory exercises like *prāṇāyāma* helps a lot in patients of asthma. A few studies like that by Manocha et al. in Australia and Chugh et al. on *Sahaja Yoga* in London have shown excellent response.

Similarly, studies done at other places by Graf, Kirtane and Browne have shown good response to TM in patients of asthma. Although no study is available on response of bronchial asthma to *Prekṣā Dhyāna*, our study shows that there is a significant subjective and objective improvement in patients (Table 1 and 2). Also the daily dose of inhalation

therapy requirement decreased by 22% (Table 3). However, Spirometry shows small, though marginal improvement. Longer duration study with larger sample size is required to confirm these results.

The explanation of improvement by *Prekṣā Dhyāna* in bronchial asthma may be that when someone is unable to catch his breath, one may fear that his heart will stop beating or that his brain will not fully recover from the lack of oxygen. This frightening experience can create a negative association of the stimuli that prompted the attack in one's mind, creating its irrational fear. For example, if one was hospitalized with an asthmatic episode after visiting a pet store, this experience may lead to dizziness or shortness of breath from the mere sight of a pet store. This is due to anxiety and panic arising from the negative association of asthma attack and pet store, not to an actual physical irritant. Because panic attacks and asthma attacks give similar feeling, mentally and physically, the onset of one can lead to the other. But by addressing the underlying fear and anxiety from them, a person who suffers from asthma can learn to avoid or at least reduce the intensity of panic-induced asthma attacks.

Meditation can lower stress hormone levels and decrease activity in the body's sympathetic nervous system. This essentially puts one in better control of his/her body's “fight or flight” response, which is the physical defense mechanism that helps one flee from danger or fight it. Therefore, when one perceives some danger, such as the pet store mentioned above, he/she uses the techniques practiced in meditation to stop the mind and body from responding to it with stress and anxiety.

The deep breathing used in meditation improves airflow to the lungs and it may help the patient to remain in control of his breathing at the onset of an attack. While practicing meditation one remains aware of the discomforting physical sensations as well as the troubling thoughts in the mind — but the inner core remains objectively detached from them. By refusing to entertain the thoughts or focus on the sensations, one can allow them to pass through rather than aggravate the condition. The increased flow of oxygen and time spent in state of relaxation can also help the mind and body heal more quickly than it would in a normal state of consciousness.

Meditation produces a calming effect in the body that one can

eventually learn to switch to consciously. For beginners it may take time to attain a pure meditative state; however, daily practitioners often develop the ability to attain it quickly. This is beneficial to those with asthma because they are sometimes able to stop a panic-induced attack before it debilitates them.

Medical treatments for asthma are effective, but carry with them a host of very unpleasant long-term side effects. A complementary technique, and potentially a replacement to inhalers and other corticosteroids may be meditation. Meditation has been used successfully to lessen the severity of asthma attacks and may play a significant role in the prevention of future attacks. Many studies have shown reduced airway resistance and decreased severity of symptoms when meditation is used as complementary treatment for bronchial asthma, and profound improvement and decreased need for medicines. In a study at University of Cincinnati it was found that meditation could act as a complementary medicine to alleviate symptoms of asthma attacks.

### 3. Conclusion

In view of the results presented here, we conclude that *Prekṣā Dhyāna*, especially *Prāṇāyāma* and *Śvāsa Prekṣā*, can help patients of bronchial asthma by improving them subjectively as well as by reducing the requirement of inhalers. The effect of *prekṣā* meditation is probably due to changes in sympathetic tone and improved psychology.

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## 26. Jain Literature on Health Science

*Bipin Doshi<sup>1</sup>*

### **Abstract**

Jain scriptures give much importance to physical and mental health care as also on salvation. The medicines and cures were based on the Jain principle of nonviolence, theory of karma, diet and meditation with minimum application of surgery. Emphasis was laid on prevention. In this article, Jain literature and many scholars are quoted and it is pointed out that integrating health care systems and faith-based practices described in scriptures have great potential to positively and materially meet the growing demands of simple and economical health care in an era of escalating health care costs.

### **1. Jain Literature on Health Science**

Historically there is an antipathy between religion and health care. It is time that we gradually reverse this through the influence of the wider movement and reintegrate spirituality into health care system. We need to take a concise yet substantive tour of the burgeoning research to examine the relationship between religion and health. It appears that spiritual practices and the rituals influence the physiological systems of the body that are directly responsible for good health and the ability to fight disease.

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Therefore, if religious/spiritual involvement can be shown to enhance physical and psychological health, it is reasonable to hypothesize that religious factors may improve physical health as well, doing so by reducing psychological stress, increasing social support, and encouraging positive health behaviours. Critics may point out methodological weaknesses and difficulty in measuring intangible concepts but when one sees the profound benefits of spirituality on health improvement and its promotion, one cannot deny to look at religious practices with sensitivity.

Truly speaking, Jainism is a way of life to achieve happiness not only for the present life but for the next life and forever. Actually we focused on concept of *Mokṣa* so much that we rejected the very existence of any kind of body. We overemphasized it and ultimately missed to look at the practical need of health care science. Again the implication of karma theory was so much adhered to that care of physical health was not given its due importance in Jainism. However, an intelligent study of scriptures will clearly reveal that Jain practices are full of health care dictums and doings. By reinvigoration of collaboration between health care systems and faith-based practices described in our scriptures, there is great potential to positively and materially meet the growing demands of simple and economical health care in an era of escalating health care costs.

In the past decade, numerous studies have touted the positive impact of prayers and spiritual practice on physical health. For example, the well-known Duke University physician and psychiatrist Koenig has demonstrated the benefits of the relationship between religion and medicine as well as a detailed survey of the ways in which religion and medicine might work together beneficially. Using research studies of medical patients, he demonstrates that many patients say that their religious practices and beliefs enable them to cope with their illnesses or diagnoses. Koenig broadens his study to focus on the ways that religious belief influences mental health, immunological and neurological diseases, cardiovascular problems and longevity. For example, one study links the incidence of type-II diabetes with nonattendance at religious services; those not attending such services were twice as likely to have elevated levels of a protein that predicts the development of the disease, as compared to attendees.

King Bharata prays to *Tīrthaṅkara* Ādinātha and says, “O Lord,

now in this part of time cycle there are people with short life span and they would suffer from many diseases due to wrong food, *Vāta*, *pitta* and cough. For their benefit show us the path for their care and treatment. You are omniscient and our protector. O Lord.....”.

In response to this, *Tīrthaṅkara Ādinātha* gave a science of life through his divine language. Jains believe in infinite cycles of time and each cycle has two parts, the *Avasarpiṇī* and *Utsarpiṇī* meaning declining and growing phases respectively. In each part there are 6 *Ārās* or parts going from best to worst and vice versa. At present, we are in *Avasarpiṇī* part where 1<sup>st</sup> and 2<sup>nd</sup> *ārās* are devoid of any misery. People get everything from *Kalpvrkṣa*, a tree which fulfills all the needs. They do not die of disease but die at the completion of their *Āyusya Karma*. From 3<sup>rd</sup> *ārā* onwards the misery starts and religion and *Tīrthaṅkaras* show us the path of salvation. It is during such time that King Bharata requested Lord *Ādinātha* to show us the path of good health.

First *Āgamic* reference about health science in Jainism is found in *Prāṇāvāya Pūrva*. *Pūrvas* are *āgamic* scriptures prior to *Tīrthaṅkara Mahāvīra*. There are 14 of them and *Prāṇāvāya* is the 12<sup>th</sup> *Pūrva*. *Prāṇokāyāpaṇa* means “Science of Life”. From *Tīrthaṅkaras* this science came to *Gaṇadharas* and then to *Śrutakevalīs* to yogis/*munis* and to ascetics and scholars. What we know of the divine sermons of *Tīrthaṅkaras* is only a drop of the ocean. *Digambara* sect believes that it had 130 million verses while *Śvetāmbaras* puts it as 15.5 million verses. It was in *Ardhamagadhi* language. It was detailed in 12<sup>th</sup> *Aṅga ‘Dṛṣṭivāda’* after *Tīrthaṅkara Mahāvīra*’s era. However, both these texts are extinct and only literature available is *Kalyāṇakāraka Grantha*. *Prāṇāvāya* had detailed eight Sciences namely Medicine (*Kāyacikīṭsā*), Surgery (*Śalyatantra*), ENT and Eyes (*Śālakyatantra*), Psychiatrics (*Bhūtavidyā*), Pediatrics (*Kaumārabhr̥tya*), Toxicology (*Vīṣacikīṭsā*), Science of non-aging (*Rasāyanatantra*) and Sexual medicine (*Vājīkaraṇa*).

In Jainism, basics for health care are based on four concepts known as *Vastucatuṣṭaya*. They are Human beings (*Manuṣya*), Diseases (*Roga*), Therapy (*Auśadha*) and Life span (*Kāla*). Therapeutics described five pillars called *Yama*, means awareness, *Niyama*, means observance, *Āhāra*, means food habits, *Vihāra* means exercise, and *Auśadha*, means medicines. The causes of disease are not only present adversities but also

the ripening and exhibition of past bad deeds and suffering thereof by *Asātā Vedanīya Karma*. Emphasis is more on karma theory and the present causes are *Nimitta* (Co-factors and not the causative factors).

In Jainism fitness of physical body is not for lust, not for sensual pleasures, not for showing strength, not for power but *Only for Spiritual Growth and Liberation of Soul by Destruction of eight types of Karmas*.

In spite of great treasures in health care concepts in Jainism, this science did not become popular in Jain literature because traditionally Jain ascetics were not allowed to use this knowledge for general public or for self; science of medicine was considered as one of the nine false sciences; act of crushing or destroying plants was considered a sin. The learned Jain *Munis* (monks) were never static at one place and their life style was such that they did not require it much. But after 12<sup>th</sup> Century it was realized by Jains that we need to use this science for public to enhance their influence in society.

*Āgamic* references on medical science are found in the following texts. *Ācārāṅga* mentions 16 types of diseases; *Nāyādharmakahāo* describes hospital with 100 pillars; in *Brhatkalpa* use of animal skin in leprosy is given. *Pinḍa Nijjutti* shows that tying of leg of vulture is beneficial in paralysis. *Niśitha Cūrṇi* gives list of diseases while *Ogha Nirvyukti* describes use of horse fly to remove eye dirt.

There are more than 1000 books written by Jain ascetics, *Munis* and scholars and a few are still available as manuscripts. They have been written in many languages and not only they had tremendous contribution to the science of *Āyurveda*, but Jain literature has been frequently quoted in much other health literature. They are original works, translations, analysis or subject specific.

Uniqueness of Jain Health Science are mainly: 1) minimum violence in all respects and hence more drugs and less surgery, 2) more use of minerals, metals, stone, salts and other alternative means but little of plants, 3) no alcohol, meat or honey; the underlying principle was 'how can one kill someone to save others?', 4) no food after sunset and other diet rules, 5) more emphasis on preventive aspect of disease (boiled water, *tapas*, *Brahmacarya* etc.), 6) equanimity and other rituals for mental health and 7) preferred use of local remedies and local language.

Jain philosophy of life and diseases is also much different and moves around the theory of karma. Accordingly both life and suffering are due to karmas. Even the success or failure of any treatment is *Nimitta* or cause of premature ripening of karma. To avoid binding of new karmas in sufferings, one needs to have equanimity in disease or death, as life span is predetermined. The highest realization is “*I am not body but a Soul which is immortal*”.

As a doctor giving or helping a life is the best act of compassion or donation and it is a kind of penance. One cannot do it for greed, ego, money or attachment. Helping sick is a type of *Vaiyāvachha* that binds *Punya* and if done with highest purity it can cause *Nirjarā* or shedding of karmas.

Some of the great Jain ascetics who contributed a lot to the health science include Pādaliptasūri (1st and 2nd century) who could fly in air with an application of some kind of ointment on legs. Even concept of *acupressure* therapy is described in his work. Nāgārjuna (2nd and 3rd Century) compiled 59 texts on various health subjects and had complete knowledge of “*Rasa siddhi*”. *Samantbhadra* in 3rd century wrote three important books namely *Aṣṭāṅga Saṅgraha*, *Siddhānta Rasāyana Kalpa* and *Puṣpa Āyurveda*. *Kalyāṇakāraka* by Ugrādityācārya is the only script which is directly from *Prāṇāvāya*, written in Sanskrit in 8<sup>th</sup> century and is an extensive work on health care. In this book, prevention is described first. Health care has two aims: firstly keeping body and mind fit and secondly using it for spiritual growth to have ultimate happiness - that is Liberation. Detailed description of daily routine for good health e.g. oil massage, sex, sleep etc. with well written 25 sections on various systems of body are described. Their diseases, signs and symptoms, diagnosis, treatment and prognosis are also described. There is also a special chapter on uselessness of meat, alcohol and honey in any therapy, keeping in view the Jain principles.

Swami Puṣyapāda was another genius and scholar to the extent that even Heavenly beings (*devas*) worshipped him. Apart from his exhaustive work on all health subjects, he had two special types of knowledge 1) Traveling in air with the help of special ointment applied on legs (*Gaṅgāmī*) and 2) Converting Iron into Gold (*Suvarṇasiddhi*). He wrote 15 unique books on various health related subjects covering all the



sciences of health. To purify body he gave us health scripture (*Vaidyakaśāstra*), to purify speech he wrote Grammar (*Vyākaraṇa*) and to purify mind he gave the science of meditation (*Samādhiśāstra*). After Puṇyapāda there were many eminent ascetics who did scholarly work on health sciences. Then we come to the era of *Kalikāla Sarvajña* Hemcandrācārya who again nourished the literature on health. I will not cite the various names who worked on special branches of medicine but the fact remains that Jain *Ācāryas* contributed a lot to Indian systems of medicine, keeping in view the Jain principles of nonviolence and the theory of *karma*.

Jain rules about diet, its rituals and its philosophy can offer a lot to alleviation of sufferings, whether physical or mental. We are doing extensive research on this topic and we wish that in near future we will be able to establish a Jain system of therapeutics which can cure many diseases and also complement modern medicine for the welfare of humankind.

## SECTION V : Matter, Universe & Cosmology

### 27. Matter (*Pudgalāstikāya*) in Jain Philosophy

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#### Abstract

*Pudgala* or *Pudgalāstikāya* is one of the six constituent *dravyas* of *loka* in Jainism and is the only substance that is sense perceptible. The sense attributes of *pudgala* are colour, taste, smell and touch properties which become the basis of its diversity of forms and structures. The smallest constituent of *pudgala* is *paramāṇu*, the other forms are its combinations. The combination of *paramāṇus* forms various states of the matter. The paper describes different types of combinations and modes, rules for combinations and properties of aggregates known as *vargaṇā*. Some *vargaṇās* associate with the soul and form various types of bodies of organisms and others exist as forms of matter in *loka* (universe). The *paramāṇu* defines the smallest units of energy, space, time and sense quality of *pudgala*.

*Pudgala* exists in visible and invisible forms but anything that is visible is definitely *pudgala*. *Pudgala* is classified in various ways, one of them is on the basis of touch property and there are *pudgalas* having two touches, four touches, and eight touches, each class having some specific character that differentiates them in respect of stability and motion.

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*Pudgala* is also classified as living, *prayoga-pariṇata*, and non-living, *visrasā-pariṇata*. The living matter existing as bodies of organisms exhibits some properties that are not found in non-living matter. Modern science has no such distinction which has become a cause of confusion in recognizing the existence of soul. The description of body remains incomplete without considering the presence of soul in the body.

In modern terminology, a *paramāṇu* is a vibrating and moving charge that is bosonic in character. The two-touch and four-touch *pudgalas* do not appear to follow the speed limits prescribed by Special Theory of Relativity. Jain canonical works describe two types of motions *sprṣada* type and *asprṣada* type and these determine the motions of different class of *pudgalas*. Jain philosophy describes the dynamics and motion of *paramāṇu* in detail.

The paper describes the Jain concepts of matter in detail and compares them with the modern concepts to highlight the strength of Jain views. Modern science has explored the properties and behaviour of matter in great detail but still there are many concepts that Jain philosophy has to offer.

## 1. “Matter” in Jainism

Matter has been studied in Jain Philosophy and by every system of Indian Philosophy. According to Jain metaphysics one form of *Ajīva dravya* (Non-living substance) is *pudgalāstikāya* (matter substance) which exists in the Universe in various forms such as earth, water, fire, air, shadow, objects of four senses- hearing, smell, taste, and touch, physical mind, speech, bodies, etc. up to karmic matter and *paramāṇu* (unit of matter). *Pudgala* is tangible reality within the sensuous and super sensuous experiences in perceptible and imperceptible conditions. *Pudgala* is permanent, non-living, non-conscious, extensive, physical, corporeal and concrete, active, disintegrating and integrating, and changeable substance [1]. It is characterized by origination, decay and permanence without giving up its essential nature of existence.

*Pudgala* is the only substance which is *mūrta* (corporeal) and perceivable. *Rūpatva* (form) /*mūrtatva* (corporeality) or sensory perceptibility is the sum total of the four sensuous qualities as follows [2].

- ❖ Colour- five types of primary colour: Black, blue, red, yellow, white
- ❖ Taste- five types of taste: Sweet, bitter, pungent, sour & astringent
- ❖ Smell- two types of odour: Good smell and bad smell.
- ❖ Touch- eight types of touch: Cold, hot, smooth (positive charge), rough (negative charge), light, heavy, soft and hard.

All colours, tastes and smells can vary in magnitude and range.

Based on the above qualities the matter substance in nature is of three types [3]:

- (i) Matter substance having one colour, one smell, one taste and two touches.
- (ii) Matter substance having five colours, two smells, five tastes and four touches.
- (iii) Matter substance having five colours, two smells, five tastes and eight touches.

*Paramāṇu* is the two-touch matter substance (*pudgala*); it has only one colour, one smell and one taste [4]. The four-touch *pudgala* comprise the subtle (*sūkṣma*) class of matter substance, as aggregates (*skandha*), which has substantial energy. This matter has five colours, two smells and five tastes. On the other hand the eight-touch matter constitutes the gross (*bādara*) class of aggregates comprising of energy and matter. These aggregates have the five colours, two smells and five tastes. Thus according to Jainism, all aggregates, containing a large number of *paramāṇus*, necessarily possess all colours, smells and tastes. Generally only one or a few of the colours, smells and tastes manifest in gross state at a time, the others remain un-manifest. The manifestation of colours etc. is dependent on the mode of the substance. Some attributes manifest in the natural mode while some other attributes manifest in the alienated modes. The manifestations are both intrinsic and extrinsic. For example, some colours, smells and tastes manifest in a fruit in the green state and other colours, smells and tastes manifest in the ripen state.

Cold, hot, smooth and rough are primary touch qualities of *pudgala*. The smooth touch is also regarded as positive charge and the rough touch is regarded as negative charge. The other four touch qualities viz. light, heavy, soft and hard are secondary touch qualities. These touch qualities are supposed to develop when bonding between infinite *paramāṇus* produces a gross aggregate. If number of negative *paramāṇus* is more in the bonding process, the aggregate contains light touch quality and if positive *paramāṇus* are more, than heavy touch is produced in the aggregate. When positive *paramāṇus* are in majority and they bond in cold condition, soft touch is produced and when a majority of negative *paramāṇus* bond in hot condition, hard touch is produced in the aggregate [5]. The weight (or mass?) of the aggregate is said to relate to the light and heavy touch qualities. The four touch aggregates and *paramāṇu* are weight-less. The weight is a property of gross aggregates having eight-touch [6]. This aspect is further discussed below.

In the true sense, the *paramāṇus* and their aggregates as a class have no origination; they have always been in existence. But a particular aggregate or *paramāṇu* has a beginning and a life time. The minimum lifetime of a *paramāṇu* as free *paramāṇu* and that of an aggregate can be one '*samaya*' and maximum life duration can be innumerable '*samayas*' [7]. Thereafter they undergo change. The *pudgala* are of two types, subtle and gross, as mentioned earlier. The subtle does not remain subtle and gross does not remain gross for all times. After innumerable '*samaya*' the subtle changes to gross and gross splits into subtle form [8]. Similarly, the colour and other attributes of *pudgala* also change with time. A black colour of one degree can stay in the same condition for a minimum time of one '*samaya*' and a maximum time of innumerable '*samaya*'. Thereafter, one degree black shall change to innumerable degree black by the internal process of '*śaḍguṇa – hānī – vṛddhī*'. Intrinsic modification occurs in every substance every moment. Extrinsic modification of gross aggregates is also certain after innumerable '*samaya*'. So, the *paramāṇu* has a dynamic character.

## 2. Integration (*Bandha*)

All physical matter is produced either by integration or association (*saṅghāta*) or by disintegration or dissociation (*bheda*) process. The integration is of two types – (i) natural (*vaisrasika*) and (ii) by animate

organisms (*prāyogika*) [9]. The natural kind is again of two types – (i) with a definite beginning and (ii) without a beginning. Some instances of natural integration, which have a beginning, are clouds, lightning, rainbow etc.

Integration made by living organisms necessarily has a definite beginning and can be divided into two kinds [10].

- (i) Integration of one kind of matter with another, e.g., production of chemical composites.
- (ii) Combination of matter with soul in worldly living beings.

The last one is again of two types – (i) *karma-bandha*, bondage of *karma-vargaṇā* (with soul), and (ii) *nokarma-bandha*, combination of other groups of *pudgala* with soul in vital functions and formation of gross body.

Jain philosophy provides elaborate rules for bonding among *paramāṇus*. The bonding takes place due to positive and negative charge of *paramāṇus* [11]. The charge of a *paramāṇu* varies in a range. Let  $q$  be the minimum indivisible unit charge, positive ( $q^+$ ) or negative ( $q^-$ ), and that the charge increases in multiples of 1, 2 or 3..... $n$  units. The *paramāṇu* can have a charge  $q, 2q, 3q, 4q, \dots, nq$ ,  $q$  being positive or negative.

The rules for bonding between *paramāṇus* are given in Table 1 [12, 13]. It is seen that there is some variation in the rules of bonding in *Śvetāmbara* and *Digambara* traditions. In both traditions a *paramāṇu* having a minimum charge does not bond with other *paramāṇu*. If charge is more than the minimum value and differs by two units or more than the two *paramāṇus* can bond according to both traditions. These rules are also applicable to bonding between an aggregate and a *paramāṇu* or between two aggregates.

The qualities of the aggregate produced by bonding depend on the qualities of the constituent *paramāṇus* or aggregates. For instance one unit black *paramāṇu* on combining with higher degree white *paramāṇu* becomes white. When one degree black *paramāṇus* combine with one degree white *paramāṇus*, a grey colour is produced in the aggregate.

### 3. *Paramāṇu*

The canonical literature in general and the *Bhagavatī Sūtra* in particular defines *paramāṇu* in various ways from different perspectives. It is the basis (ultimate constituent) of the physical universe. It is indivisible, indestructible, impenetrable, incombustible and imperceptible to sense organs [14]. It cannot be split or destroyed by any means whatsoever. It has no half-portion, no middle portion and no *pradeśa*. It has no length, no breadth and no depth. It is dimensionless. It is truly infinitesimal.

**Table 1: Rules for Bonding of *paramāṇus***

	Value of charge of two <i>paramāṇus</i> ' bonding $q_1 + q_2$	Śvetāmbara Tradition		Digambara Tradition	
		Similar charge <i>paramāṇu</i>	Dissimilar charge <i>paramāṇu</i>	Similar charge <i>paramāṇu</i>	Dissimilar charge <i>paramāṇu</i>
1	$q + q$	No	No	No	No
2	$q + 2q$	No	No	No	No
3	$q + 3q$	No	No	No	No
4	$q + 4q$ and up to $nq$	No	No	No	No
5	$2q + 2q$	No	Yes	No	No
6	$2q + 3q$	No	Yes	No	No
7	$2q + 4q$	Yes	Yes	Yes	Yes
8	$2q + 5q$ and up to $nq$	Yes	Yes	Yes	Yes

*Paramāṇu* is the pure form of *pudgala* and possesses the intrinsic qualities of touch, taste, smell and colour. These qualities are attributed to a *paramāṇu* for a fundamental reason. It is the basic assumption in Jain philosophy that the fundamental properties of a substance are also eternal; they are neither created nor destroyed. Hence the basic properties observed in aggregates are also present in *paramāṇu*. A *paramāṇu* has one of the five primary colours, one of the two smells, one of the five tastes, two of the four primary touches i.e. either hot or cold and either smooth (positive charge) or rough (negative charge) [15]. Although the four qualities are permanently possessed by a *paramāṇu*, the intensity of the qualities does not remain constant. A *paramāṇu* possessing one unit of blackness at any moment may sometimes later possess two, three or many

units of *blackness* [16]. In the *free-state* the mutation is only in the intensities of colour etc. i.e. x unit black changes to y unit black but black does not become white or red etc., however during and after union with other *paramāṇus* change in colour etc. may also take place. It follows from this that at any given moment there would be *paramāṇus* with different intensities of blackness etc. In the same way there would be *paramāṇus* with various degrees of other qualities.

A single free *paramāṇu* is invisible not only to the naked eyes but also to other physical instruments. Its existence is to be inferred by the collective action and reaction of aggregates of infinite *paramāṇus*. Only the omniscient (*kevalajñānī*) and those possessing superlative visual intuition (*paramāvadhi jñānī*) can perceive and cognize the nature of a free *paramāṇu*.

The *paramāṇu* is the direct unit of physical substance (*pudgala*) and also the indirect unit of space, time and quality magnitude of attributes [17]. The quantitative and qualitative difference in the various form of the matter (aggregates/*pudgala*) in space and time domain ultimately depends on the action/reaction of attributes of *paramāṇu*. Thus, being the fundamental constituent of physical composite bodies, it may be considered to be the determinant of the difference of aggregates, and for the same reason it is also their substantial cause. By its own motion it becomes the measure of time unit *samaya*<sup>1</sup>.

The *paramāṇus* have the innate capacity of uniting with one another to form composite bodies. The composite bodies are liable to the process of disintegration and the united *paramāṇus* may become free *paramāṇus* and thus the process of association and dissociation goes on eternally [18]. *Paramāṇu* is capable of being dynamically active (*kriyāvān*). When dynamic, it may have spin, vibratory and migratory motions [19]. The activity of a *paramāṇu* is not continuous, rather it is in quanta. The dynamics of *paramāṇu* in some respect follow certain rules but it also follows some rules of uncertainty. *Paramāṇu* generally cannot be stopped or hindered by any object (*apratighāti*) and at the same time it does not cause hindrance to others [20].

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<sup>1</sup>*Samaya* is the smallest indivisible unit of time and is the time taken by a *paramāṇu* moving at slowest speed to move a distance of one *pradeśa*. A *pradeśa* is the space occupied by one *paramāṇu*.



A *paramāṇu* in a given space-time domain has various energy states: potential, electro-thermal, kinetic etc. in view of their embedded attributes and their variation as a consequence of change in energy states, which reveals that a *paramāṇu* is a vibrating and moving charge. It has also been said that infinite number of *paramāṇus* can occupy one space point [21]. This means that *paramāṇu* is bosonic in character. As the *paramāṇu* is indivisible, the energy of a *paramāṇu* is the smallest amount of energy that can exist in Free State and therefore it can be regarded as a quantum of energy.

It should be mentioned that the atom described by modern science is not the same as *paramāṇu*. The *paramāṇu* is weightless (it has infinitesimal energy) and has one colour, one taste, one smell and two touches whereas an atom has mass and belongs to the class (iii) matter, mentioned above; it has five colours, five tastes, two smells and eight-touches. According to Jainism each of the elementary particles contains infinite number of *paramāṇus* as described below. These *paramāṇus* may have positive or negative charge and bond together according to the prescribed rules. That is, there is bonding between positive and positive, positive and negative, and negative and negative *paramāṇus*. The particle formed in this manner has a net charge depending on the majority population of a particularly charged *paramāṇus*. For example an electron has majority population of negative *paramāṇus* and a proton has a majority population of positive *paramāṇus*. The total negative charge of electrons is equal to the total positive charge of protons for a stable structure. Jainism does not rule out formation of particles having fractional or multiple charge of electron or proton, but such particles are known not to form a stable structure and have no practical value.

#### 4. *Vargaṇā* (Energy Fields and Aggregates)

*Vargaṇā* is an important concept to understand nature particularly at subtle level. *Vargaṇā* has been defined as *pudgala* aggregate made up of similar *paramāṇus* or as a cluster of *paramāṇus* [22]. There are infinite numbers and types of *vargaṇās* according to *Bhagavatī Sūtra* but eight types are important from the point of view of their association with the soul [23]. *Gommaṭasāra Jīvakāṇḍa* provides another type of classification of *vargaṇās* on the basis of number of *paramāṇus* present in the cluster [24]. According to this, there are 23 types of main *vargaṇās* found all over

*loka*. The *vargaṇās* fall into two broad categories, one has four- touch and the other has eight-touch. The 2<sup>nd</sup> to 14<sup>th</sup> order *vargaṇās* are four-touch type and weight less. The 16th to 23rd order *vargaṇās* are eight-touch type and have weight. The 15<sup>th</sup> order *vargaṇā* falls in between the two categories and its nature is uncertain [25].

The lower order weightless *vargaṇās* can be divided in two groups—

1. **Associable *vargaṇās*** – *vargaṇās* that associate with the soul and form various kinds of subtle bodies and other structures that assist the soul in its worldly functioning.
2. **Non associable *vargaṇās*** – *vargaṇās* that do not associate with the soul.

The following are the associable *vargaṇās*:

- 1) *Āhāravargaṇā*: This *vargaṇā* constitutes the gross, protean (*vaikriya*) and migratory (*āhāraka*) bodies of organisms.
- 2) Fiery (*Tejasa*) *Vargaṇā*: These *vargaṇā* constitute the fiery body of organisms.
- 3) Sound (*Bhāṣā*) *vargaṇā*: The sound *vargaṇā* is suitable for producing all kinds of sound including the sound produced by inanimate objects like musical instruments and natural phenomena like thundering of clouds and sound produced by living organisms including speech by humans.
- 4) Mind (*Mano*) *Vargaṇā*: This *vargaṇā* constitutes the physical mind (*dravya manah*) of organisms.
- 5) *Kārmaṇa Vargaṇā*: This *vargaṇā* constitutes the karma bodies of organisms.

The higher order *vargaṇās* can be divided in three groups –

- 1) *Vargaṇās* that are helpful in formation of gross bodies of plants and small microorganisms (*nigodas*), belonging to category of non-mobile (*Sthāvara jīvas*). These *vargaṇās* assist in formation of plant bodies and bodies of small microorganisms. The *vargaṇā* that assists in formation of

plant body compares with sun light (photons).

- 2) Permanent Nil (*Śūnya*) *Vargaṇās*: Detailed information about these *vargaṇās* is not available in scriptures.
- 3) Gross Matter (*Mahāskandha*) *Vargaṇā* (GMV): This *vargaṇā* is supposed to constitute all ordinary matter, visible and invisible, in the universe including bodies of mobile beings.

The charge in *vargaṇā* produces an electric field. A moving electric charge in *vargaṇā* also produces a magnetic field. In view of modern science, a field is nothing but a charge in the space-time continuum. All fields, magnetic, electrical and gravitational, are physical realities. A *vargaṇā* contains a bundle or packet of energy. The energy density or energy intensity increases with the order of *vargaṇā*. As mentioned above, *vargaṇās* of 15th and higher order are supposed to have eight- touch i.e. in addition to four basic touches, namely cold, hot, positive and negative charge, and other four secondary touches - light, heavy, soft and hard are also present. These additional touch properties are supposed to come in existence due to bonding between *paramāṇus*. The light and heavy touches are supposed to produce the property of weight. In the lower order *vargaṇās* of four touch types the *paramāṇus* cluster but do not bond.

The act of bonding between *paramāṇus*, i.e. interaction, requires energy. When two *paramāṇus* bond, a part of their energy (potential energy) is used up in bonding, reducing the free energy of the *vargaṇā* that exists as kinetic energy of motion and vibration. Therefore, the maximum velocity of a two-*paramāṇu* bonded *vargaṇā* will be less than the maximum velocity of a single *paramāṇu* or a two *paramāṇu* unbound *vargaṇā*. We thus see that lower order *vargaṇās* having four- touch must have higher maximum velocity than eight touch *vargaṇās* of higher order. The *paramāṇu* having two-touch has the highest maximum velocity. The lower order *vargaṇā* are weightless and must be free of gravitational effect. The higher order *vargaṇā* have gravitational property.

#### 4.1 Gross Matter *Vargaṇā* (GMV) and Matter

All ordinary matter (visible or invisible) is made up of GMV according to Jain view as mentioned above. We examine now how the subatomic particles may be produced from GMV [26]. Consider the case

of leptons first. The neutrino is the smallest lepton having negligible mass and no charge. If neutrino is made of GMV then it must be a combination of at least two GMV, one having positive charge and the other a negative charge. This will be the case when the two GMV have equal and opposite charge. As *vargaṇās* exist with differing charges it is very likely that more than two GMV combine to produce a neutral charge in neutrino. So a neutrino of negligible mass should be made up of many GMV. There are three types of neutrinos. The mass of all three types is negligible but still there is a minor difference between them. Such minor variation in mass is obtained by variation in number of GMV in the three types of neutrinos. It may be noted that when the mass of a neutrino is considered to be negligible, the mass of GMV is still less.

Now consider another lepton, the electron. The mass of electron is 0.511 MeV, which is millions of times greater than the mass of a neutrino. This means that an electron is made of millions of GMV. In an electron the number of negative charge GMV exceeds the positive charge GMVs giving a net negative charge of  $-1.6022 \times 10^{-9}$  coulomb. This also shows that the charge of one GMV is millions of times smaller the charge of an electron. And since a GMV contains infinite *paramāṇus*, the quantum charge of a *paramāṇu* is really unimaginably small. The lepton muon is more than 200 times heavier, and tau is about 3500 times heavier than electron and therefore, they must contain more GMV in the same proportion.

Next consider the stable baryon particles proton and neutron. These particles are supposed to be made up of quarks. The mass of a proton is 1836.12 times greater than that of the electron and neutron is very slightly heavier than proton. The mass of a quark is uncertain but it is many times more than that of the electron. So a quark is made of that many times more GMV than an electron. There are six types of quarks having fractional charges, both positive and negative, and masses ranging from 2 MeV to 18000 MeV. According to Jain view the fractional charges of quarks are possible by appropriate combination of positive and negative GMV. Another thing we observe is that the charges of up quark, charm quark and top quark are the same but their masses vary considerably. Similar is the case with down quark, strange quark and bottom quark. Formation of these quarks is clearly possible with suitable combination of

GMV. So, in Jain view quarks and leptons are composite particles and subject to gravity. Many more types of particles can be formed, including those not discovered so far.

Mass of matter is nothing but transformation of energy, that is, both matter and energy are but two modifications of a single entity, as has been only recently realized in science. Jain physics has identified all forms of matter and energy as modification of the same substance *pudgala*. Intra-convertibility of various forms of energy - mechanical into electrical, electrical into heat, light, sound etc., - which is the basis of modern technology - has been recognized by Jain philosophers as the basic attributes of *pudgala*, since all forms of energy are fundamentally the modification of the same substance, *paramāṇupudgala*.

## 5. Dark Energy and Dark Matter

There is no direct mention of dark energy and dark matter in Jain scriptures. The existence of dark energy in science has been postulated to satisfy the condition of expanding and accelerating universe and it is supposed to have anti-gravity property. The non-associable *vargaṇās* described above are weightless and gravity free. These *vargaṇās* may comprise a good fraction of the total mass present in the *loka* that is gravity free but do not possess anti-gravity property as postulated by modern science. The Permanent Nil *Vargaṇās* may be considered to constitute the dark matter as they are not detected by ordinary means. These *vargaṇās* may constitute a significant portion of mass present in the *loka*. The matter formed by these *vargaṇās* could be non-baryonic as the baryonic matter is formed by higher Gross Matter *Vargaṇā* (GMV). Jainism supports the scientific view that mass is not the exclusive property of ordinary matter. According to Jainism even photons have mass.

Jain canon *Bhagavatī Sūtra* describes existence of dark structures in space comparable to black holes. These structures are of two types, one *Tamaskāya*, Mass of Darkness, and two *Kṛṣṇarājī*, Black Streaks [27]. Both are pitch dark structures containing no parts like stars, sun, moon, planet etc. and no life. Both have rains meaning thereby that they attract neighbouring matter that appears as showers on the surface. The light of other stars and moons becomes dim as they approach these structures. *Tamaskāya* is a huge structure extending from a location far away from

*Jambūdvīpa* (supposed to be our Earth), and going up to fifth heaven in the upper *loka*. This is said to have been formed by transformation of water bodies of organisms and other matter. The *Kṛṣṇarājī*, eight in number in a closed loop structure located in fifth heaven in upper *loka*, is said to have been formed by transformation of earth (bodied beings) and other matter. This indicates that dark holes (or dark matter) can be formed in two ways, one from water source i.e. fluidic matter and the other from earth like solid matter.

## **6. The Laws of Subtle Cosmos**

Modern science has discovered that as we go down from the macro to the micro state of matter, new attributes of matter come in action and the number of attributes increase. The macro world is deterministic and follows the laws of classical mechanics. The micro world follows the laws of quantum mechanics. Some laws of classical mechanics are not valid in the micro world. It may be noted that macro and micro world of science are comprised of 8-touch gross aggregates possessing mass, which consists of higher-order *vargaṇās* in bonded form. The weightless four-touch *vargaṇā* subtle aggregates which exist only in energy form is a different class of matter. The weightless, four-touch *vargaṇās* do not carry the fundamental forces as their *paramāṇus* are supposed to be in unbound state. Their behaviour, therefore, must not be governed by known laws of science. On extrapolating, we expect that at subtle level of the physical world e.g. weightless four-touch *vargaṇā*, there may be yet another set of principles in operation, which is still not discovered by science.

## **7. Organic and Inorganic Matter**

The *pudgala* can be classified into three types in respect of the cause of transformation [28] viz. –

- (i) *Prayoga–Pariṇata* (Living organic matter). The *pudgala* (matter), which is taken in and transformed into body form by vital processes of living beings, falls in this category.
- (ii) *Misra–pariṇata* (Past living matter, dead organic). The *pudgala* (matter), which was associated with living beings in the past, but is now abandoned by it, and therefore, is no longer being transformed by the agency of vital processes,

but undergoes self-transformation, is *miśra* (mixed)–*pariṇata*. Shoe-leather, meat, etc. are instances of this type.

- (iii) *Visrasā-pariṇata* (Non-living matter, inorganic). Matter, which undergoes natural transformation i.e. without interaction with living beings, is *visrasā-pariṇata*. Clouds, rainbows, meteors, etc. are instances of this class.

Subtle changes take place in every substance every moment. Gross changes occur in soul and *pudgala* only. In this respect, both the soul and *pudgala*, are similar but as far as the total changes are concerned *pudgala* far exceeds soul. Changes in *pudgala* make the world change. Everything from the beginning to end in the world is governed by the natural changes taking place in *pudgala* and soul. The universe is self-managed from this point of view. The universe is governed by extrinsic changes as well, caused by union and separation of soul and *pudgala*. Soul and *pudgala* influence each other and both experience self-generated and extrinsic modifications.

The living matter exhibits some properties that are not found in non-living inorganic matter. Modern science does not differentiate between these two types of matter and considers them to be made up of the chemical elements and applies similar rules to both. Jain philosophy says that living body is a combination of soul and *pudgala* and exhibits the properties of both the components and just not the chemical elements. For example a living body shows the consciousness like property which is the property of the soul and not of matter. Modern science is trying hard to explain consciousness as an emergent property, reducible to the properties of matter, and this has become a subject of controversy even amongst the scientists. The behaviour of body parts is also influenced by soul through karma. For example the behaviour of genes cannot be explained purely on the basis of material properties, they are also influenced by karma. Thus complete explanation of behaviour of organisms needs consideration of existence of both the soul and the matter.

Taking a comparative view, the amount of *prayoga-pariṇata* (body matter) is least of all, the *miśra-pariṇata pudgala* is infinite times more and the *visrasā-pariṇata pudgala* is still infinite times more than this.

## 8. Motion

Two types of motions are described in Jainism [29]:

1. *Spr̥ṣad gati* – motion under the action of touch properties.  
This applies to the motion of *pudgala*.
2. *Aspr̥ṣad gati* – motion without the action of touch properties.  
This applies to the motion of pure soul.

We know that there are eight touch properties. These are divided in four groups:

- (a) **Heat** – cold and hot touch
- (b) **Electric Charge** – *snigdha* and *rūkṣa* touch
- © **Stress/Strain** – *mṛdu* and *karkaśa* touch
- (d) **Gravity (Weight)** – light and heavy touch

This implies that motion may take place due to (i) heat e.g. convection currents in fluids, (ii) electric force (and also magnetic force) e.g. propagation of photons and radiations, electric motor, etc., (iii) stress and strain e.g. stretching of solids, viscous action in liquids, etc., and (iv) gravity e.g. motion of falling objects, motion of astronomical objects, etc. The *Aspr̥ṣad gati* does not involve any of these forces.

We now consider motion of different types of *pudgala* objects –

- (a) **Motion of a *paramāṇu*:** The motion of a *paramāṇu* is *apratighāti*, i.e. unobstructed. It does not get obstructed by any other object. Hence, there is no external influence of any kind on the motion of a *paramāṇu*. A *paramāṇu* moves due to its intrinsic characteristic of dynamism. Its motion is hindered only when it collides with another *paramāṇu*, a very rare possibility. It may be noted that the laws of motion of science and the limit imposed by Special Theory of Relativity does not apply to *paramāṇu* as the forces on which these laws and theories are based are absent in this case. The dynamic activity of a *paramāṇu* has some uncertainty as described before and it may move with low, medium or high velocity as determined by the property of *śadguṇa-hānī-vṛddhi*. In the extreme case of highest velocity the *paramāṇu* can travel from one



end to another end of loka in one *samaya*, if not hindered by another *paramāṇu*.

- (b) **Motion of four-touch *Vargaṇā*:** A four – touch *vargaṇā* may contain two to infinite number of *paramāṇus*. The fundamental forces are still absent in this type of *vargaṇā* and its motion is not governed by known laws of science and the Special Theory of Relativity. However, there is affinity between *paramāṇus* in a *vargaṇā* and so the maximum velocity of this *vargaṇā* would be less than the maximum velocity of a *paramāṇu* as explained above. Due to large number of *paramāṇus* the chances of its colliding with other *vargaṇā* are significant. On collision the two *vargaṇās* may merge and form a bigger *vargaṇā* of the same kind or a *vargaṇā* of another kind.
- (c) **Motion of eight–touch *Vargaṇā*:** Eight–touch *vargaṇā* contains *paramāṇus* in the bound state and all the fundamental forces must be present in it. All electromagnetic radiations fall in this category. This eight–touch type of *vargaṇās*, therefore, are expected to obey the known laws of science and the limit on speed imposed by the Special Theory of Relativity may apply. On account of small mass the gravitational force must be negligible and the motion is largely governed by electromagnetic force e.g. in the case of a photon and small microorganisms (*nigodas*).
- (d) **Motion of particles (made of *Mahāskandha Vargaṇā*):** In the case of matter formed of GMV, at the level of subatomic particles and *paramāṇus* the gravitational force is still very small and other forces determine the motion. As the aggregates grow in size the gravitational force increases and the effect of electromagnetic force diminishes because the number of *paramāṇus* having positive and negative charge in the aggregate is likely to be of the same order canceling the effect of each other. Thus the motion of large particles and objects is governed mainly by gravitational force.

## 9. Conclusion

The *paramāṇu* of Jain philosophy is the smallest indivisible entity, the quantum of energy. The Jain *paramāṇu*, the real energy quanta, is far

too smaller than the quantum of energy, photon, assumed by science. Science has discovered particles like quarks but it still remains a mystery what makes the quark. The journey of science has been from gross to fine and it has gone to the level of quark and electron. Jain philosophy starts from the ultimate unit *paramāṇu* and proceeds up to the gross form of matter. Jain philosophy says that the fundamental constituent of nature is energy and *paramāṇu* is its ultimate unit. *Paramāṇu* makes up *vargaṇā* and *vargaṇā* make up photon and the gross particles like quark, electron, etc. Jain philosophy presents the subtler form of matter which science has not discovered so far. The story of matter from quark and electron onward is known to science. Jain philosophy also offers some plausible explanation to puzzling questions like what is the nature of matter other than the ordinary matter postulated by science. Thus Jain philosophy and science together reveal more complete picture of the physical reality.

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## 28. A Comparative Analysis of Particle Physics with Jaina Metaphysics

C. Devakumar<sup>1</sup>

### Abstract

The Jaina metaphysics has been nurtured and preserved since ancient times by Jaina preceptors and seers, notable among them were Lord Mahāvīra and his chief disciple Gaṇadhara Gautama. Ācārya Kundakunda and Ācārya Umāswamī about 2000 years ago compiled this knowledge in *Pañcāstikāya* and *Tattvārtha Sūtra*, respectively. The laws of conservation are emphatically stated in the Jaina metaphysics. After the discovery of Higgs Boson, the total number of known particles, (counting both the particles and their corresponding antiparticles, including the many colour states of quarks and gluons, leptons and force carriers) is 61. According to the Jain metaphysics, there are 200 such fundamental particles as distinguished by five types of tastes, five colours<sup>2</sup>, two smells, two charges and two thermal bands. The idea of gravity and magnetic properties are not explicitly understood from the Jaina metaphysics. Even

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<sup>2</sup>The terms *aṇu* and *Paramāṇu* are used here to denote atoms and molecules and are not the *paramāṇus* as defined in Jain philosophy. Likewise colour used in Jain metaphysics and in particle physics and fission and fusion in nuclear physics imply different properties and processes and must be distinguished-[Editors].

modern astrophysicists are struggling with the discovery of graviton, the particle of gravity. Only 'massless' particles such as neutrino, antineutrino and photon qualify to be compared with Jaina *Paramāṇu*. This is again borne by two facts that Jain *Paramāṇus* are formed only by fission or decay and the mass energy conversion as per Einstein equation is germane to the *Paramāṇu*. The Jaina metaphysics provides us some novel leads that the taste and smell may not be the exclusive properties of the large aggregates and may provide some deeper insight into the realm of particle physics.

## 1. Introduction

The exploration of matter has been a matter of curiosity since time immemorial. Physical classification of matter into solid, liquid and gaseous states has been a common knowledge. Fire though not different from matter was another form included in the five primordial elements (*pañca bhūta*) by ancient Vedic people. Other ancient Indian philosophical systems such as Jaina, Buddhist and Vaiśeṣika knew much more than this gross classification and thus the terms *aṇu* and *skandha* representing the tiniest indivisible particle and compounds or composites, respectively find mention among their metaphysical systems. Ācārya Kaṇāda (600 BC) of Vaiśeṣika School is credited with the concept of *paramāṇuism*.

Thanks to the advancement of science during the last century, the knowledge about fundamental subatomic particles has expanded substantially. Just like the Periodic Table of elements, the 'Standard Model' has been developed to denote the properties and interactions of these particles and forces. Figure 1 is a depiction of these particles. The complete Standard Model took 118 long years to build ever since the discovery of the electron by cathode ray experiment by J.J. Thomson in 1897 till July 2012 when the physicists working with the Large Hadron Collider at CERN, the Geneva-based European Organization for Nuclear Research, discovered one of the Higgs bosons.

The Jaina metaphysics has been nurtured and preserved since ancient times by Jaina preceptors and seers notable among them were Lord *Mahāvīra* and his chief disciple *Gaṇadhara Gautama*. Ācārya Kundakunda and Ācārya Umāswamī about 2000 years ago preserved the metaphysical tradition of Lord Mahāvīra through their scriptures notably

*Pañcāstikāya* and *Tattvārtha Sūtra* respectively. In this paper, an attempt will be made to collate the available ancient knowledge and compare it with the scientific knowledge on fundamental particles in order to identify the gaps, and to get some clues from the ancient wisdom.

## 2. Methodology

The approach to this comparative analysis consists of listing the properties of the particles and the rules governing their interaction, binding and decay according to modern physics and the Jaina metaphysics. The resources for modern physics are plenty in literature and

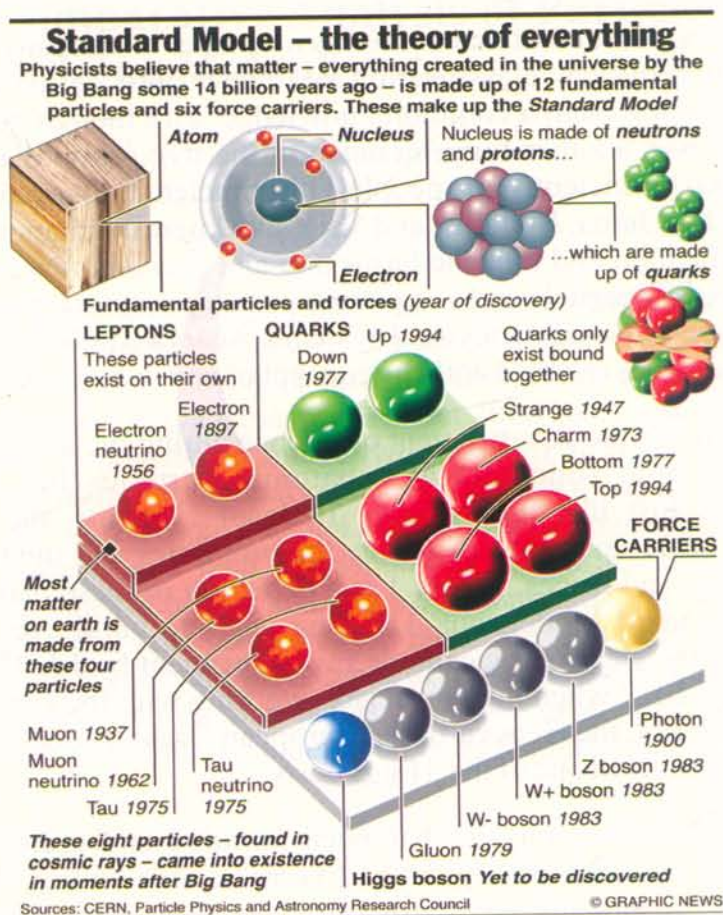


Fig. 1. A representation of the Standard Model of particles with labels of the year of the discovery of various particles (Wikipedia).



as mentioned earlier, the reliance for Jaina metaphysics in this paper is essentially based on *Tattvārtha Sūtra* with the aid of its Sanskrit commentary called *Sarvārthasiddhi* [1] by Ācārya Puṣyapāda Devanandī (5<sup>th</sup> century CE) through its Hindi translation by Pandit Phoolchandra Sastri, and its English translation called *Reality* [2] by Professor S. A. Jain and with due supplement from *Pañcāstikāya* [3]. The author's earlier papers are also used for refinement and comparison [4-7].

### 3. Results and Discussion

#### 3.1 The Current Status of Knowledge on Particles

As on date, the total number of particles known is 61 [8] (Table 1). The Standard Model denoting the mass, charge and spin values of the particles is shown in Fig. 2.

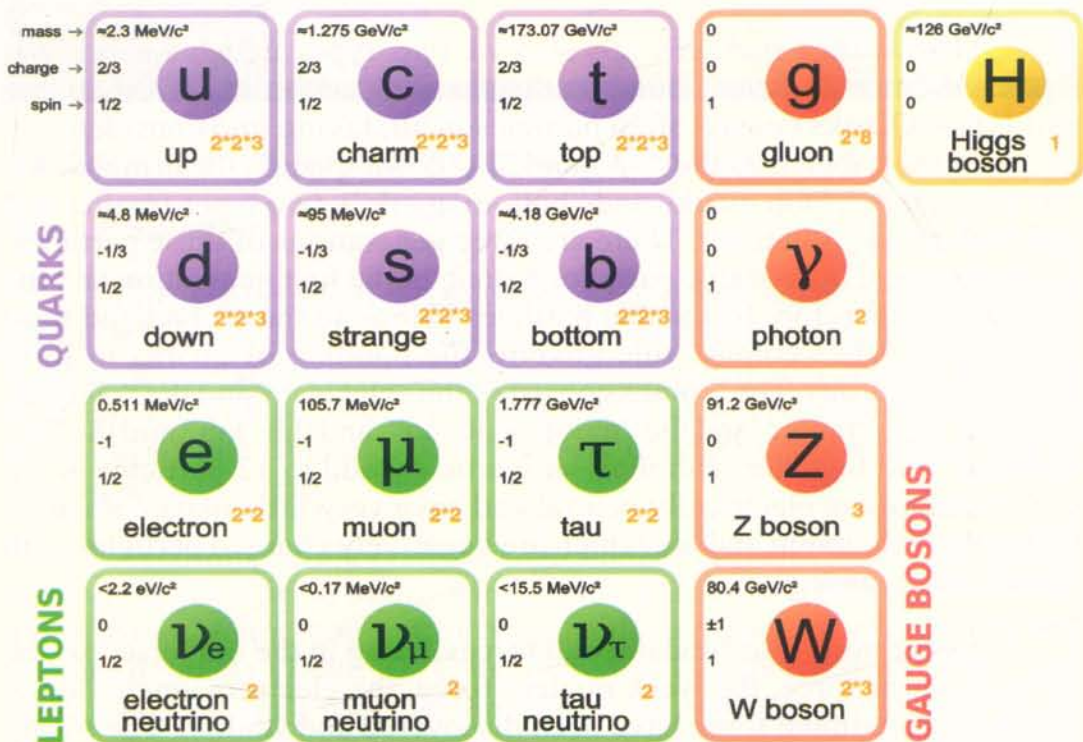


Fig. 2. Various particles in the Standard Model of the Particle Physics (Wikipedia).

**Table 1. The list of elementary particles of matter**

Elementary Particles	Types	Generations	Antiparticle	Colours	Total
Quarks	2	3	Pair	3	36
Leptons			Pair	None	12
Gluons	1	1	Own	8	8
Photon			Own	None	1
Z Boson			Own		1
W Boson			Pair		2
Higgs			Own		1
Total number of (known) elementary particles:					61

The basic particles are mainly of two types, viz. fermions which are building blocks of the matter and the bosons which are responsible for interaction.

The matter particles are also of two types called quarks and leptons. Matter particles complete their pairing with the corresponding anti-types. Quarks consist of 36 particles in all, taking into consideration six particles (labeled as the “up quark”, “down quark”, “charm quark”, “strange quark”, “top quark” and “bottom quark”), two types (matter and antimatter), and 3 colours. There are three generations of these particles: the lightest and most stable particles belong to the first generation and the heavier and therefore less stable particles belong to the second and third generations. The “colour” rule governs the bonding of quarks to form colourless hadrons. The leptons consist of the “electron” and the “electron neutrino”, the “muon” and the “muon neutrino”, and the “tau” and the “tau neutrino” and together with their antiparticles, add to 12 particles in all. The neutrinos are electrically neutral and have very little mass compared to the electron, muon and tau which are negatively charged particles with considerable mass.

As of now, four fundamental forces acting in the universe viz. the strong nuclear force, the weak nuclear force, the electromagnetic force, and the gravitational force have been discovered and studied. The strong nuclear force has a very short range and the weak has longer range. Gravity, though the weakest, has an infinite range. The electromagnetic force is relatively stronger than gravity but also has an infinite range. The



strong forces are highly effective only over a very short range and therefore dominate at the level of these fundamental particles. Other than gravitational force, whose particulate nature is yet to be discovered, other three forces are bracketed under a group called bosons. Particles of matter transfer discrete amounts of energy by exchanging bosons with each other. Each fundamental force has its own corresponding boson – the strong force is carried by the “gluon”, the electromagnetic force is carried by the “photon”, and the “W and Z bosons” are responsible for the weak force (Table 2).

**Table 2. Properties cross-linking the interactions of particles with the forces**

Property	Interaction	Gravitational	Weak (Electroweak)	Electromagnetic	Strong	
					Fundamental	Residual
Acts on:		Mass – Energy	Flavor	Electric Charge	Color Charge	See Residual Strong Interaction Note
Particles experiencing:		All	Quarks, Leptons	Electrically charged	Quarks, Gluons	Hadrons
Particles mediating:		Graviton (not yet observed)	$W^+$ $W^-$ $Z^0$	$\gamma$	Gluons	Mesons
Strength relative to electromag for two u quarks at:	$10^{-16}$ m	$10^{-41}$	0.8	1	25	Not applicable
	$3 \times 10^{-17}$ m	$10^{-41}$	$10^{-4}$	1	60	to quarks
for two protons in nucleus		$10^{-36}$	$10^{-7}$	1	Not applicable to hadrons	20

### 3.2 Exposition of Jaina Metaphysical Thoughts

#### Jaina *Paramāṇu*

*Paramāṇu* in Jain metaphysics is the most fundamental particle of matter. It is verily called *Pudgala* and it is the building block of all matter. It is beyond sensory perception. The Sanskrit word, *aṇu* denotes that 'it is inferred.' It is eternal, occupies one space point and is corporeal. It has no mass and is dimensionless. It is also used in defining fundamental unit of time, space and number.

According to the *Pañcāstikāya* stanza 80, each *Paramāṇu*, though beyond the perception of ordinary senses, has one out of five tastes, one out of five colours, one out of two smells and one out of four electro-thermal doublets (Table 3). Thus, there are 200 material particles. It is again said that the properties are quantized with integral values up to infinite in range. It must be noted that the gravity, though not specifically defined, appears to be the interactive force among these four intrinsic properties. The idea of mass is attributed only to aggregates of *Paramāṇu*

and sound is the energy released due to interaction of two or more aggregates. In fact, the electromagnetic spectra perceptible to our senses, emanating from the aggregates of *Paramāṇus* are too weak to be captured by our senses.

**Table 3. Fundamental properties of *Paramāṇus***

Properties		Remarks
Taste	Bitter, sour, acidic, sweet and astringent	Taste and smell as a fundamental characteristic of particles is surprising.
Colour	White, blue, yellow, red and black	This colour pattern differs from the colour classification based on optical spectrum.
Smell	Good and bad	The score of good and bad for smell is based on human perception and is therefore subjective.
Charge	<i>Snigdha</i> (+ve) and <i>rukṣa</i> (-ve)	This refers to positively charged and negatively charged particles or may be to matter and antimatter.
Thermal	Cold and hot	The classification of cold and hot is subjective.

Taste : Bitter, sour, acidic, sweet and astringent Taste and smell as a fundamental characteristic of particles is surprising.

Colour: White, blue, yellow, red and black This colour pattern differs from the colour classification based on optical spectrum.

Smell: Good and bad. The score of good and bad for smell is based on human perception and is therefore subjective.

Charge: *Snigdha* (+ve) and *rukṣa* (-ve). This refers to positively charged and negatively charged particles or may refer to matter and antimatter.

Thermal: Cold and hot. The classification of cold and hot is subjective.

Thus, we have infinite secondary types of *aṇus*. The Jaina metaphysical laws of interactions are summarized in Box 1.

### **3.3 Jainology and Particle Physics: A comparison**

1. There is no mention of mass in the basic characteristics of Jaina *Paramāṇu* though charges can be in multiple integers. Among the fundamental particles, massless photons seem to come close to Jaina *paramaṇu*. Neutrinos and anti-neutrinos (having small mass) may be composite particles.

**Box 1. Jaina metaphysical laws of interactions**

1. *Skandhas* are formed by the processes of fusion (aggregation), fission (dissociation) or both (*Tattvārtha Sūtra* 5:26).
2. Visible objects are formed both by fission and fusion of *skandha* composed of infinite *Paramāṇus* (*Tattvārtha Sūtra* 5:28). An invisible *skandha* can be made visible only by the twin processes of fission followed by fusion. Fission alone does not render it visible. The fragment combines with another fragment forming a visible *skandha*.
3. *Paramāṇus* are formed by fission only (*Tattvārtha Sūtra* 5:27).
4. *Snigdha* and *rūkṣa* are the driving forces of bond formation (*Tattvārtha Sūtra* 5:33). *Paramāṇus* having the least quantum of charge do not undergo fusion (*Tattvārtha Sūtra* 5:34).
5. *Paramāṇus* having equivalent charges (irrespective of sign) do not take part in fusion processes (*Tattvārtha Sūtra* 5:35).
6. Fusion of particles having two or more charges is allowed. Difference of charges by two units is allowed between same as well as oppositely charged particles.  $A_n$  can combine with  $A_{n+2}$  where  $n \geq 2$  but  $A_n$  does not combine with  $A_{n+1}$  (*Tattvārtha Sūtra* 5:36).
7. During synthesis of two *skandhas*, the product resembles the major reactant (*Tattvārtha Sūtra* 5:37).
8. Conservation laws are fundamental to *pudgala*. The *Tattvārtha Sūtra* 5: 29-31 emphatically states that the matter is permanent and does not lose its identity even during changes and modifications. This affirms the laws of conservation.

2. According to Jaina view, there are 200 fundamental particles but particles, having mass, discovered so far add up to only 61.
3. There are five fundamental colours as an intrinsic property of *anus*. In science, there are only three primary colours viz. red, blue and green from which secondary colours can be synthesized. The present understanding of spectroscopy dealing with colour is one of

electromagnetic spectrum having definite colour bands and the associated thermal properties. The red and infrared region refers to hot zone while the ultraviolet region is the high frequency band.

4. The science of odour and taste is not that advanced and these two properties get varied responses from different organisms. From the Jaina point of view, it is clear that the common human being is considered as the sensory standard in assigning good and bad smells as well as the taste stimuli.
5. The *snigdha* (+ve) and *rūkṣa* (-ve) charges are responsible for fusion (*Tattvārtha Sūtra* 5:33). In modern physics, force particles like gluons are assigned this role.
6. As there is nothing different to denote energy in Jaina metaphysics, the energy packets must be made only of *Paramāṇus* as they have no measurable mass.
7. There are striking resemblances in the nomenclature: quarks have flavours ([https://en.wikipedia.org/wiki/Flavour\\_\(particle\\_physics\)\)](https://en.wikipedia.org/wiki/Flavour_(particle_physics))) and colour changes (<http://hyperphysics.phy-astr.gsu.edu/hbase/Forces/color.html>); *Paramāṇus* too have colours and charges; gluon has colours.
8. Going through the Jaina view of *paramāṇu*, one thing is clear that scientific and Jaina concepts can be synthesised for a better understanding of matter.

#### **4. Conclusions**

There are striking similarities between the perception of Jaina seers and modern physicists in the realm of particle physics in terms of fundamental concepts, laws of conservation, quantum principles bearing some proximity in terms of charge and colour. The dual nature of *Paramāṇu* performing the functions of energy and contributing to the formation of material aggregates is consistent with the Einstein's principle of mass-energy equivalence. The Jaina metaphysics provides us some novel leads about the properties like taste and smell which are the properties of not only the aggregates but of *Paramāṇu* itself.

## Acknowledgements

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## 29. Cosmology in Indian Traditions

*Pankaj S. Joshi<sup>1</sup>*

### Abstract

We point out that considerable attention was devoted in Indian traditions towards understanding and exploring the nature and structure of the Universe through cosmological thought. The successes of modern cosmology are indicated, and its limitations are pointed out. We then consider what the ancient cosmological thought may imply for our current understanding of the Universe.

### 1. Introduction

Our purpose here is to discuss the considerable attention and effort that has been given in Jainism, Buddhism, Hinduism and other Indian traditions to understand and explore the nature and cosmology. The modern cosmology, which is based on the Einstein's theory of gravity, has achieved many successes in recent decades towards our understanding of the Universe. These are indicated, and as yet unresolved issues are pointed out. We then consider in some detail what the earlier and ancient cosmological thought may imply for our current efforts towards understanding the Universe as a whole.

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The ancient traditions in India, such as those mentioned above, gave considerable thought to the origins, nature and structure of the Universe, and the basic laws that govern the cosmos. In each of these traditions, we find definite statements on how the Universe works, and what are the fundamental entities that constitute the same. These traditions did ponder on the Universe as a whole, namely what it is, where it came from, and its past evolution and future. Deep issues on the structure of the Universe and the way it works certainly dominated ancient cosmological thought. These cosmological issues did occupy a central place in the Indian philosophy.

We would like to note that the subject is vast and expansive, and we do not aim to include here all the important issues and related facets, which is not possible within the limitation of this article. The effort here is only indicative of the strengths and weaknesses of the ideas proposed in ancient Indian traditions.

We first consider the successes and insights that modern cosmology has given on the physical universe that we see around us.

## **2. Modern Cosmology**

Modern cosmology basically deals with the physical universe as we see and perceive it through our five senses, and by means of the modern instruments and space missions that have been built in a big way in the past decades, to understand the Universe as a whole.

The modern day cosmology basically relies on the 'Scientific Method' that was pioneered by stalwarts such as Galileo, Newton, and many other scientists, who thought deeply about the Universe. Basically, such a method consists of observations of the Universe, both at the micro and macro scales, conducting experiments and collecting data, and finally building instruments such as telescopes working on different wavelengths to observe the far away objects in the skies and to probe the depths of the Cosmos (see Figure 1 below).



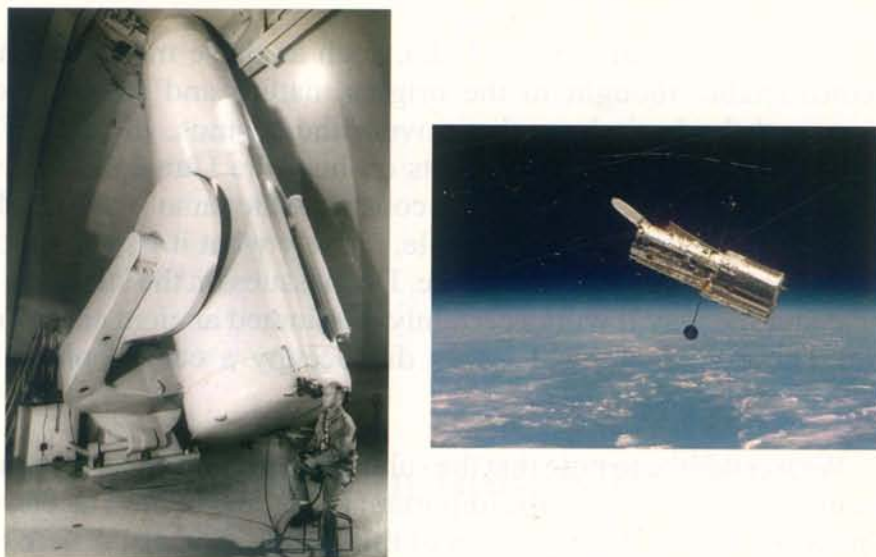


Figure 1. The picture on the left shows an optical telescope built in the earlier part of the twentieth century. Such telescopes, typically located on high mountains, enlarged our view of the Universe enormously, leading to path-breaking discoveries. However, ground based telescopes are limited by the atmospheric disturbances and other such issues. These problems are not faced, for example, by the Hubble space telescope (right), which is floating in the outer space, and which was commissioned a few decades ago. The far away cosmic structures such as galaxies are then visible much more clearly.

Such sustained efforts provided many observations on different aspects of the Universe and considerably enlarged our knowledge of cosmic reality. Earlier we only could see the dome of the sky, studded with stars. We had no idea on the cosmos beyond the same. But today we know that the Sun and other stars that we see are part of the Milkyway galaxy. We also know now that there are billions of such galaxies in the Universe, our own being just one of these so many! Then there are clusters of such galaxies that are interspersed by big voids in the cosmos. All this gives us a fair idea of what a vast cosmic entirety we are a small part of. How such a vast Universe emerged and where it came from? An integral part of the modern scientific thought is to build mathematical theories of the Universe to try to answer such questions. This effort requires intuitive, logical and mathematical thinking and understanding of the Cosmos. These are in fact the key ingredients of the scientific edifice, and this is the effort that has given huge successes to modern science.

In particular, the modern cosmology today is built upon and



emerges from the Einstein's theory of gravitation. It is the force of gravity that governs the Universe as a whole and in largest of its scales. Newton gave the basic principles of the force of gravity, but these were not consistent with other discoveries of natural phenomena such as electromagnetism, as obtained in the nineteenth century. This inspired Einstein to formulate a new theory of gravitation, called General Theory of Relativity that models the observed Universe as a fabric of space and time, so closely interwoven so as to create a single entity now known as space-time.

The cosmology based on the General Theory of Relativity tells us that Universe as we see it today emerged some 13 billion years ago from a 'space-time singularity', that we call the 'Big-Bang singularity', and that it is ever expanding with galaxies receding away from each other. On a universal scale, the force of gravity governs its dynamics.

## 2.1 Fathoming the Cosmos

While modern cosmology has told us so much about the Universe as a whole with our knowledge on cosmos taking giant strides; it has serious unresolved issues too, both at the observational and conceptual levels. We list some of these below, to get an idea of where the modern cosmology is heading today.

- (i) *Cosmic Homogeneity Problem:* We see an accelerated, expanding Universe today around us, which is largely homogeneous, with galaxies placed almost uniformly everywhere. The question is how such homogeneity came about? This is a big unresolved issue, because these faraway spatial regions in the Universe are causally disconnected from each other. In other words, these regions have had no possibility to communicate with each other in the past as the Universe grew, as per the Big Bang cosmological model. Still they managed to have roughly the same number density of galaxies or similar structures. How this happened is a big puzzle!
- (ii) *Space-time Singularity Problem:* According to the Theory of General Relativity, the Universe originated from the Big Bang Singularity. However, at such a singularity, all physical quantities such as density, temperature, space-time curvatures become arbitrarily too large and infinite! Then, what are the physical laws

holding there if any, and how to describe such a 'Singularity'? What is the physics there? Can we extend the Einstein's theory into a more complete theory of physics and can we resolve this Singularity through such a complete theory that unifies the Quantum theory and Relativity (see below)?

- (iii) Quantum-Gravity Problem: As of now, we have no good or workable Quantum Theory of Gravity. The issue here is the following. As we know, the Einstein GTR is a highly successful theory describing the Universe at its largest scales, the cosmos of stars and galaxies. On the other hand, the Universe in the small regime, that of the *paramāṇus* and *paramāṇuic* (atomic) nuclei and elementary particles, is ruled by the laws of Quantum theory. However, as it happens, the Einstein Theory of Relativity and Quantum Theory are totally different and disjointed frameworks. The mathematical frameworks describing each of these theories are very different from each other. Our idea and goal would be of course to describe the Universe, whether in the small or in large, by a single Unified Theory of nature. Until that happens, we are unlikely to have a correct cosmological picture of the Universe. But it is impossible to do so under the present situation mentioned above. This is called the Quantum Gravity problem.

In general, one could say that the Modern Cosmology or Modern Science also sometimes works on beliefs and make postulates, which are quite similar to 'blind faith' on which they criticize various religions. An example here could be the Inflationary Theories of the Universe, which are often invoked to solve the first two problems mentioned above. The key feature of a scientific theory is that it should be 'falsifiable'. That is, the theory must make predictions, which we are able to verify as true or false, by means of observations or experiments. The Cosmic Inflation, however, is merely an explanation or a postulated possibly, for the Universe being homogeneous or singularity free. It makes no new predictions of its own, and is therefore not falsifiable! The issues such as these raise a question whether the Modern Cosmology is a true and complete science in its own right, or needs further important inputs and improvements.

### **3. Modern and Ancient Cosmology—A Unified Approach?**

While the modern cosmology has intrinsic limitations as mentioned above, in our view, its biggest limitation is that it focusses only on the observed material Universe. This can and does bring a great precision, accuracy and intellectual rigour. As we remarked above, the superb method of observations through highly sophisticated and accurately designed instruments, supported by a strong theory, backed by mathematical and logical frameworks, has produced many useful results about our knowledge of the Universe.

However, such a focus could also turn out to be a big limitation and handicap as well. That is because, what is observed so far may not necessarily form the entirety of existence, and there might be elements which can enter the purview of observations as our theoretical and observational methods improve and sharpen.

It is important to emphasize here that the key difference between the modern and the ancient cosmological approach is that the cosmologies of Indian traditions, such as the Jain, Buddhist or Hindu traditions consider the mind, body and the external Universe as a Single Integrated Whole. In other words, they do not separate the Observer from the Observed. In fact, the modern Quantum Theory has already recognized this particular facet as a very important aspect of the Reality that the Universe is.

This feature from the Ancient Cosmology traditions can become one of the strongest helps towards our understanding of the Cosmos. The big problem, however, is as understood and practiced today; these traditions do not rigorously apply current tools of logic or mathematical thinking. What we mean to say is that, in general, the correct scientific methods are not followed frequently while considering the Universe by these traditions, even in the modern times. This is not to say that such tools do not exist in these traditions. In fact the ancient Hindu and Jain scriptures boast of a variety of logical and mathematical tools and concepts.

What is really needed, in our opinion, is the application of these tools by these traditions to correctly understand and interpret the Universe. Such an exercise will be of great help. Understanding the origin and evolution of the Cosmos, which includes the Self as well, is one of the



Figure 2. What is the relation of the Man with the Cosmos? There have been many speculations on this issue. It has been stated famously in the ancient traditions that '*Yathā Piṇde Tathā Brahmāṇde*'. That is, an individual is a replica of the Universe or entirety. Could such an adage become foundation of a new cosmology?

most basic and fundamental urge of the mankind.

So, would it be possible to develop a Unified Cosmic Perspective, using both the modern as well as the ancient cosmological approaches? In other words, how to comprehend the Universe in an integrated and holistic manner, using both the modern day and ancient tools?

In my own view, what is really needed in the current modern times is: We must find and obtain specific examples of insights, or highlight the 'science' that is there within these well-known ancient traditions. We need to show clearly and explicitly that scientific insights can be obtained and generated, using the concepts and methods of some of these age old Indian traditions. Perhaps This is the only way to illustrate and explain, or elaborate their usefulness in the modern times, to the youth and new generation in no uncertain terms. It is important to note, however, that such a task requires not only a careful research and investigation, but also a deep and sincere collaboration as well as commitment between modern scientists and Indian scholars, namely those who know the Indian traditions well and in a thorough manner. A clear communication between them is needed if anything definite is to be achieved.

In order to take an initiative in this direction, I like to propose below a few specific questions that one could take up, to start with. Though they may look like very ambitious or big conjectures, the hope is that these will serve as possible examples or initial directions to start with, and of course, as one moves in this direction, many more new possibilities may emerge:

- (i) One of the biggest questions or challenge that the modern physics faces today is, 'How to combine and view gravity and quantum physics in a unified manner. In this connection, can we study the key notions of the Jain doctrine of *Anekāntavāda* and *Nayavāda* that essentially says that each approach, either conceptual or mathematical, gives only a partial perspective of the Truth - the Whole Truth - needs integration of all these partial segments. Then we could possibly use mathematics to integrate these ingredients. Can this approach lead to new pathways to Quantum Gravity?
- (ii) The above is of course a big question, but even smaller, explicit and specific examples or questions will be extremely useful. As an example, we can consider an important question that the cosmologists are investigating now a days in great detail. This is: Are we alone in the Universe? Specifically, the issue is, there is life on earth, but does similar life exists elsewhere in the Universe? In this connection, it is relevant to note that we have today found several planetary systems, or exo-planets far away in the Universe. In fact, by now thousands of such planetary systems have been found. The key method here is to use the observations of the eclipse of the parent star by any one of its planets, orbiting the star. You may possibly remember the passing of the planet Venus against the limb of the Sun a few years ago. That was the eclipse of Sun by the planet Venus. A similar method is used here to find other planetary systems in the Cosmos.

This, however, is a very gross finding so far. The basic question is, would such systems harbor life as we see it on the Earth? One could ask here, whether the concept of the '*Loka*' in the Jain theory and philosophy can lead us to any possible answers. We note that there are several deep issues involved here. For example, what do we actually mean by 'life' itself, has to be clarified and specified first.

- (iii) At a much more specific level, it will help us find and illustrate specific examples of mathematics, metallurgy, astronomy and other such scientific facts, as hidden in ancient Indian traditions. This can highlight the fact that many scientific facts were known even in the earlier times, and that not all that we know today is totally new.

All the queries and the efforts such as above would highlight essentially the basic need today towards Unifying the Science and Spirituality. In our view, that is the need of the modern age. However, this has to be done through explicit examples, deep and careful insights, and through extensive research. Superficial statements or claims of blind faith and dogma would not help either the science or spirituality, or in other words, the mankind.

We can say that, what is needed really is an effort and investigation that brings out the science that is hidden within ancient Indian and spiritual traditions, and also, at the same time, the spirituality that is hidden within the modern science.

## **4. Conclusion**

We have attempted to highlight here the importance of bringing the ancient Indian traditions and modern scientific methods together, towards solving the greatest fundamental questions facing the mankind, on the nature and structure of the Universe. A few concluding remarks may be relevant here:

1. We highlighted that while both the modern scientific method and the ancient traditions have their own strengths, in the current times their coming together is becoming mandatory.
2. A serious research and collaborative effort between science and ancient traditions is necessary and inevitable if any definite progress is to be made in this direction.
3. We have specified here a few examples of how a beginning could be made in such a direction. These include learning from the holistic approaches of ancient traditions towards resolving unresolved issues on Universe, and vice versa, namely introducing scientific methods in interpreting these traditions.





Figure 3: A page from an ancient manuscript (left). The human being at peace with the Self is always intimately connected to the Cosmos. The Self and the Cosmos are then in harmony with each other and the cycle of knowledge is completed when nothing further remains to be known. On right is depicted a similar notion, as given in a modern sketch, where the human being and Cosmos are no different or separated from each other.

4. The key need is to ascertain and highlight the scientific contents of the ancient Indian traditions. This will purify and highlight their value for the people, freeing us from dogma and harmful blind faith.
5. Finally, many of our religious organizations have considerable resources, not just in financial terms, but also in terms of very useful goodwill in the society. These should be put to adequate use towards achieving such a goal.

## Acknowledgments

I would like to warmly thank the Conference Organizers for their kind invitation to the meeting. It was a great pleasure discussing with Dr Bipin Doshi, Profs. N. Bhandari, K. P. Mishra, and many other participants.

## 30. Nature of the Universe regarding Space, Time and Reality in Modern Science and in Jain Philosophy

*J. J. Rawal<sup>1</sup>*

### Abstract

In this paper, concepts of space, time and reality in the Universe are discussed according to modern science. A new order of space, time and reality in five-dimensional Universe with mass as the fifth dimension is proposed. It is found that these concepts are consistent with those propounded in Jain Philosophy in conformation with principle of *Anekāntavāda* of Lord Mahāvīra and the principle of conservation of energy. It is suggested that to get more light on the subject, Jain Philosophy should be studied in detail.

### 1. Introduction

A point cannot determine space. When a second point comes into being, we can measure the distance between two points and we can define space. It was sage Baudhāyana who gave the formula for distance between

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two points, 200 years before Pythagoras. Baudhāyana-Pythagoras Theorem  $r^2 = x^2 + y^2$  is at the base of measurements in the Universe. It gives infinite-linear dimension in space. A creature which has sense of only one direction cannot see a point near its path.

Then came to be known two dimensions  $x$  and  $y$ . They determine an area. It also expands the vision of that creature doubly infinitely. However the creature can see the impression of the feet of a person standing nearby, but cannot see the person as a whole, as it has sense only of two dimensions. When third dimension  $Z$  comes into being, the creature could see the whole Universe, and the concept of volume came into being, and our vision of the Universe became triply infinite. *Baudhāyana-Pythagoras* Theorem then becomes:  $r^2 = x^2 + y^2 + z^2$ .

In the Universe, as such, there is no object which has only one or two dimensions, all objects are of three dimensions. But there is time associated with every event. Newton used three dimensional, Euclidean space to describe his dynamics of the Universe with time ' $t$ ' as an external parameter.

Though, Newton succeeded in describing the dynamics of the Universe for small velocities and weak gravity, nevertheless there were a few genuine problems with his dynamics. It failed to describe motions of particles with high velocities and in the region of strong gravitational field. Moreover, it does not comply with Maxwell's electro-dynamics. To overcome these difficulties with Newtonian dynamics, Einstein set to generalize Newtonian dynamics. Einstein considered Universe to have four dimensions with time as the fourth dimension. Obviously then, Pythagoras Theorem becomes  $r^2 = x^2 + y^2 + z^2 - (ct)^2$ .

Note that time is measured in seconds and space, that is, lengths -  $x$ ,  $y$ ,  $z$ - are measured in meters. How to convert time into length? This can be done if we multiply ' $t$ ' by a Universal Constant having dimensions of velocity and that, is  $c$  – the velocity of light. That is, ' $ct$ ' can serve our purpose. Negative sign is put in before  $(ct)^2$ , not to make space distance imaginary when four dimensional distance is zero.

If we take  $x=y=z=1$  meter and  $t=1$  sec, then  $ct = 3 \times 10^8$  meter = 300 million meters. This shows that with respect to time, space-dimensions are very much suppressed. When  $x=y=z=300$  million meters then only, they

become comparable to time-dimension, that is, when  $x=y=z=1$  light year, space-dimension becomes appreciable compared to time-dimension. This is, indeed, interesting.

One should note that a physical quantity becomes a dimension, if it is independent and is present throughout the Universe.  $x$ ,  $y$ ,  $z$  and  $t$  are such quantities.

To think that Universe may have five dimensions, what should be that physical quantity which could qualify for that, i.e. a dimension? Velocity or acceleration certainly cannot.

Mass could qualify for that, as it is present throughout the Universe and is an independent physical quantity. Here mass means mass and energy ( $E = mc^2$ ).

But a question is: How to convert mass into length?

One can find a universal constant  $G/c^2 = 7.42 \times 10^{-28}$  meter/kg which when multiplied with mass gives dimension of length. Hence, we can write *Baudhāyana*-Pythagoras distance in five-dimensional universe with mass as its fifth dimension.

$$r^2 = x^2 + y^2 + z^2 - (ct)^2 - (G/c^2 M)^2 \quad (1)$$

where  $M$  is the mass in kg and  $m = (G/c^2 m)$  is mass in terms of length. But one can see that even with space dimensions, mass dimension is suppressed very much - to the extent  $7.42 \times 10^{-28}$ . Mass dimension would be seen if  $M = 10^{+27}$  kg, until then, it is suppressed.

### 1. Space Time and Reality in the Universe

The background metric [1] is:

$$r^2 = x^2 + y^2 + z^2 - (ct)^2 - (G/c^2 M)^2 \text{ with usual meaning and } G/c^2 = 7.42 \times 10^{-28} \text{ m/kg.} \quad (1)$$

The Lorentz transformation of coordinates along  $m$ -axis in the background of five-dimensional Universe with mass as the fifth dimension given by (1) is

$$x' = x, y' = y, z' = z \quad (2a)$$

$$m' = \beta(m - vt) \quad (2b)$$

$$t' = \beta(t - v/c^2 m) \quad (2c)$$

$$\text{where } \beta = 1 / \{1 - (v^2/c^2)\}^{+1/2} \quad (2d)$$

$m, m'$  are in length dimensions, that is,  $m = (G / c^2) M$  and  $m' = (G/c^2) M'$  where  $M$  and  $M'$  have mass dimensions.

Evolution of Mass of the Universe with evolution of the Universe with time –

$$m' = \beta(m - vt)$$

$$(G / c^2) M' = \beta \{ (G / c^2) M - vt \}$$

$$M' = \beta (M - (c^2/G) vt)$$

When  $t=0, v=0, \beta=1$  and hence  $M'=M_0$ , the rest mass of the Universe.

As ' $t$ ' increases

$$M' = \beta (M - 1.35 \times 10^{27} vt)$$

We have

$$M \geq 1.35 \times 10^{27} vt$$

At large distance, let  $v = c/2$  and  $t = 14$  billion light years - the present epoch of the Universe, we have

$$M \geq 1.35 \times 10^{27} \times 1.5 \times 10^8 \times 4.2 \times 10^{17} \sim 10^{53} \text{ kg} \quad (3)$$

In the Universe, there are about 100 billion galaxies. On an average each one contains 500 billion stars of average mass of the Sun. Therefore, total mass of the Universe can be approximated to be  $10^{53}$  kg. This is consistent with Eq. (3).

Evolution of Age of evolving Universe with evolution of its mass :

$$t' = \beta(t - (v/c^2)m)$$

$$= \beta \{t - (v/c^2)(G/c^2)M\}$$

When  $t=0, v=0, \beta=1, t'=0$

As 't' increases...

$$t' = \beta \{t - (v/c^2) 7.42 \times 10^{-28} M\}$$

taking  $v=c/2$

$$\begin{aligned} t' &= \beta \{t - (1/2c) 7.42 \times 10^{-28} M\} \\ &= \beta (t - 1.23 \times 10^{-36} M) \end{aligned}$$

Taking mass of the Universe at present epoch to be  $\sim 10^{53}$  kg

$$\begin{aligned} t' &= \beta (t - 1.23 \times 10^{-36} \times 0.84 \times 10^{53}) \\ &= \beta (t - 0.9338 \times 10^{17}) \end{aligned}$$

we have, now

$$t \geq 0.9332 \times 10^{17}$$

$$t \sim 10^{17} \text{ sec.} \quad (4)$$

which is consistent with the age of the Universe at present epoch.

This shows that a simple Lorentz transformation in five-dimensional Universe with mass as the fifth dimension can give the mass of the Universe, if we know its age. Alternatively it can give us the age of the Universe, if we know its mass. Note that Plank mass ( $\sim 10^{-8}$  kg), Plank time ( $\sim 10^{-44}$  sec.) and Planck length ( $\sim 10^{-34}$  m) cannot be seen. They give the lowest limits for mass, time and length to be appreciated.

## **2. Space, Time and Reality in the Universe and in the Jain Philosophy**

Here, we consider mass as a space dimension, and time as also a space dimension. One should note that, as dimensions, mass and time are independent, and also independent of space dimensions, but implicitly they are dependent on space, and they are real, in the sense that they describe reality and gives mass of the Universe at an epoch, if one knows

the time. If we take time as present age of the Universe, we get the total mass of the Universe at this epoch and vice-versa.

This is, in conformity with Jain philosophy that space and time are real in the Universe. This is reality in the Universe. Reality means, there is a correct theory to explain a particular phenomenon or object, or it may have real existence. Jain metaphysics described space as an *astikāya*, i.e., an extended substance, which has an independent objective existence.

This shows that the space no more remains a mere order of things, but takes the form of some reality or field which has curvature. This is an independent reality, that is, *ākāśa*. We are measuring everything with respect to this space, which is real and independent and therefore could serve as absolute space for our purpose. The whole finite universe is nothing but bubble of energy (*pudgala*). In the Universe, Maxwell's equations have solution even in vacuum, that is, electro-magnetic waves exist even in vacuum. So, residual curvature exists even in vacuum. One can, therefore, take space and ether as one and the same, synonym to each other and hence ether is not needed separately. In this sense ether has been abolished but has appeared in the form of space itself. Ether is not kind of matter (fluid) having some rigidity and other properties of matter. Symbols appearing in equations like  $E=mc^2$ , Einstein's Field Equations, tensors, etc., represent state of ether, while mathematical equations show the relationship among symbols, themselves, as its characteristics. Space itself is energy.

The Jain philosophy defines *ākāśa* as an objective reality or real substance giving room to other substances. General Theory of Relativity unifies space with gravitational field or the material field which includes electromagnetic field as well.

As far as the curvature of the Universe is concerned, a problem before scientists, on account of the solutions of field equations of the Universe, is whether the curvature is +ve or -ve. If the curvature is +ve the Universe would be finite and closed and if the curvature is -ve, the Universe would be infinite and open. The space of the Einstein Universe is +ve and hence, the Universe is finite and closed. On the basis of solutions of the field equations, it is also possible that the curvature is -ve. In that case, the infinite and open Universe has also been conceived.

Thus, on the basis of +ve or –ve curvature, there are two concepts of Universe (1) finite and closed and (2) infinite and open.

Now, if we assume that the curvature of *Lokākāśa* is +ve and that of the *Alokākāśa* is –ve, the finiteness of the *Lokākāśa* and the infiniteness of the *Alokākāśa* are possible. Confined to the finite but unbounded boundary, at the edge  $T=0$  (where  $T$  is absolute temperature), nothing can move, nothing can escape from the Universe, whatever dimensions their Universe have. No motion is possible in super cosmic space. *Pudgala* cannot reach there – the boundary of the *Loka*.

Thus, the Jain Theory of *Lokākāśa* and *Alokākāśa* can be taken as a combination of the two cosmological theories (Universe) which accepts +ve or –ve curvature of space.

### 3.1 Jain Philosophy

Einstein's Universe *Loka-ākāśa* is always occupied by *Pudgala*, finite and closed.

De Sitter Universe *Aloka-ākāśa* is empty space, infinite and open.

*Lokāloka-ākāśa* is *Ākāśāstikāya*, a combination of both Einstein's Universe and De Sitter Universe.

A circle is curved in 2-dimensional space and also finite but unbounded? Sphere is curved in three-dimensional space. Three dimensional space is curved in 4-dimensional space. Four dimensional space is curved in 5-dimensional space. Five dimensional space is curved in 6-dimensional space and so on. This implies that the Einstein Universe and the De Sitter Universe are sub-universes of the Universe propounded in Jain Philosophy.

*Pudgala* is that which possesses the attributes of touch, taste, smell and colour. In modern language, *Pudgala* is matter or energy. The smallest indivisible part of a *Pudgala* is a *paramāṇu*. *Pudgalas* are many in number. Substance in Jainism has the same meaning as substance in modern science.

Two points are reality and therefore, distance between two points

is also reality; as two points define space, so space is also a reality. Space provides support to everything. Jain metaphysics described space as an *astikāya*, i.e. an extended substance which has an independent objective existence

In Jain Philosophy of Mahāvīra, *Kāla* (Time) is accepted as a substance (*dravya*), a reality.

In Jain Philosophy, there is concept of Planck-time ( $10^{-44}$  sec.) time-*paramāṇu* (*kālāṇus*).

Relativity theory now also indicates that there exist quanta of space, time and mass, hence one can treat General Theory of Relativity under Thermodynamics.

Jain Ācāryas have thought about space and time very deeply. It should, therefore, be paid attention to (Muni Mahendra Kumar, [2]). There are marvelous concepts like empirical time, transcendental time and *kālāṇus* in Jain *Darśana*. In *Śvetāmbara* tradition, transcendental time (*kāla*) is believed to result in various modes of *jīva* and *ajīva*, whereas, in *Digamabara* tradition, the transcendental time is considered to be independent objective reality (*Dravya*). Time is a real enigma of the Universe. It is taken to flow straight, but is measured in terms of cyclic phenomena. We can make sense of timeless existence. Measure of space and time is objective. Effect of motion on the dimensions of length, time, even on mass can be sensed.

### **3.1.1 *Anekāntavāda* - Solution of All Disputes (Infighting)**

*Anekāntavāda* of Lord Mahāvīra is, indeed, a great principle. It states that different views of scholars and scientists, old and new, are complementary and therefore should be respected and understood, and we should remove defects, if any, in our own concepts by understanding good and bad points of various concepts and theories of others, thereby, strengthening our own views. Do not reject views of others outright. Do not be prejudiced against any theory but understand it well, as if it is correct, and then and then only, you will find strengths and shortcomings of theories proposed by others. This can improve the concepts of our own theory.

### **3.1.2 Principle of Conservation of Energy and Jain Philosophy:**

The Principle of Conservation of Mass and Energy in modern physics and the theory of persistence through modes in the Jain philosophy are propounding the same truth that the reality is ultimately eternal, although the scientific principle is related with physical reality, the Jain philosophy applies to all fundamental substances (living and non-living) and, in that sense, is more general.

According to Lord Mahāvīra, the Universe should be understood from the following four points of view:

1. Universe from substance point of view.
2. Universe from space point of view.
3. Universe from time point of view.
4. Universe from modes point of view.

We have seen in this paper that the modern science can explain the Universe from all these four points of view which are consistent with those described in Jain philosophy of Lord Mahāvīra.

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# SECTION VI: Environment

## 31. Jain Views on Environmental Responsibility

*Kim Skoog*<sup>1</sup>

### Abstract

With the onslaught of Global Warming upon us, some nations have taken to reducing emissions from industrial plants and automobiles. Yet there remains the need to find some overarching philosophical and social principles that will guide human activities toward improving the environment, removing pollution. It might seem unlikely that an Indian philosophical system that dates back over three thousand years could play an important role in supplying this guidance. Yet, the Jaina concept of *ahimsā* (nonviolence), coupled with their overall metaphysical system, can lead one towards a very robust, environmentally responsible life.

In this paper my task is three-fold: (i) reconstruct a Jaina ecological ethic based on the notion of *ahimsā* as well as other Jaina conceptual distinctions; (ii) locate the Jaina approach within a broad spectrum of ethical positions related to the environment; and (iii) provide a critical analysis of this Jain ethic in comparison with strengths and weakness of other environmental ethics, i.e., Anthropocentrism, Sentientism, Deep Ecology, Vitalism, etc.

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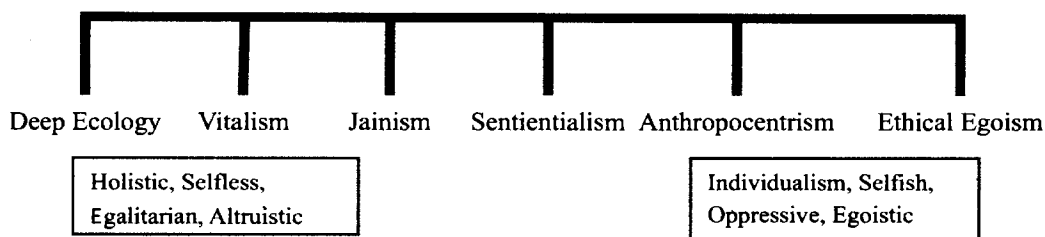
It will be argued that Jaina ecological ethics incorporates many of the positive elements of other current approaches, while at the same time minimizing problems facing them. The Jain's central doctrine of *ahimsā* provides an overarching directive to respect and preserve all living beings (*jīvas*)—including the nonliving (*ajīva*) areas.

## **1. Introduction**

At the time of Mahāvīra (~ 2600 years ago) modern concepts of “ecology,” “environmental ethics,” “sustainability,” biodiversity” and so forth did not exist; thus, the question naturally arises, “Is it an anachronism to look for a Jain view on ecology and environmentalism?” In reply, it can be acknowledged that while Jain authors did not use Sanskrit or Prakrit correlates to these terms, it doesn't necessarily follow that the Jains had no views about the constitution of nature nor had an ethic on the proper relation to the natural world. In fact, the defining concept of Jainism, *ahimsā*, entails very specific views and practices guiding one's interaction with the world in a non-violent way. Ecological terminology may be recent, but arguably humans have observed specific attitudes and practices toward nature from prehistoric times. Yet given that there is no historic, formal “Jain position on the environment,” this paper will attempt to construct what a Jain position could be. Before attempting to do this, it will be useful to survey current environmental stances to help find where a Jain view might stand in relation to these alternatives.

## **2. Spectrum of Ecological Positions**

Currently there is a wide spectrum of differing positions: (1) *Ethical Egoism*—one should do that which is of benefit to one's self alone; (2) *Anthropocentrism*—acts should align with humans' interest alone; (3) *Sentientism*—all sentient beings warrant our concern; (4) *Vitalism*—all life is sacred, adopt a general “reverence for life” attitude; and (5) *Deep Ecology*—moral considerations should encompass both animate and inanimate entities. While we will go into greater detail regarding these theories shortly, it is useful to see them as a spectrum of viewpoints ranging from egoistic to holistic attitudes toward the world. The Jain location within this spectrum is also included below:



The observance of nonviolence (Sanskrit: *ahimsā*)—do no harm mentally or physically to another being—is seen by the Jain thinkers as the basis for proper conduct. There can be no question of the central role that the principle of *ahimsā* has played in shaping Jain/ Indian thought and lifestyle. Yet avoidance of harm to others is certainly not a novel idea in the development of ethical thought throughout the world. Indeed, it is hard to imagine a culture that has not adopted some expression of this principle within its history [1].

Despite this commonality of respect for others shared by all ethical systems, it remains a matter of difference as to whom to include in this circle of kindness and care. Accordingly, there is a spectrum of ethical practices distinguished principally on how far each approach chooses to extend its area of concern for the avoidance of harm to others. On the left, one finds the vitalists who propound “reverence for life” that extends to all living things, for all life is sacred so must be respected and preserved without qualification or exception [2]. Arguable, deep ecology could be seen as even further left than vitalism, in that it extends moral considerations to animate *and* inanimate entities, including not only human and non-human life, but also the soil, waters, collectively, the land: everything in the cosmos has intrinsic and inherent value [3].

On the right, there exist those who espouse an anthropocentric perspective, that care and consideration should be directed principally toward humans [4]. Any consideration toward the health and well-being of other living or non-living entities can be justified only if it has an *instrumental* value to a human—but it has no *inherent* value or moral rights. One might extend the spectrum even farther to the right by adding the doctrine of Ethical Egoism. Ethical Egoism contends that one should only do that which is of benefit to oneself. People adopting this position

value only their own lives: their moral domain includes only themselves—care for others is only incidental [5]. All other ethical positions fall between these extremes.

Sentientists contend that only sentient beings warrant our concern [6]. This view is to the left of the Anthropocentric position in that it recognizes that some nonhuman beings (the ones held to be sentient or self-conscious) have inherent (*intrinsic*) value, rather than merely *instrumental* value (how they can be exploited for human usage). *Ahiṃsā* (as propounded by the Jains) could plausibly be seen as constituting a form of sentientism. Most sentientists extend their moral domain to include humans and some nonhuman mammals (i.e., whales, dolphins, apes, etc.); yet, Jains, expressing a more *radical* form of Sentientialism which includes *all* life forms—down to single-sensed *nigodas*.

### **3. Jainism within the Ecological Spectrum**

Jains should be classified as sentientists rather than vitalists in that the reason to avoid injury to another lies in the entity's capacity to feel pain and suffer rather than allegiance to some metaphysical doctrine regarding the sacredness or sanctity of all life. Similarly, the Jain position can't be linked with *Deep Ecologists* as it has no *direct* concern for *ajīvas* or unconscious beings. Deep ecologists believe that any meaningful ecological analysis must see nature as an expansive ecological bio-system, interdependent amongst all its components—including soil, water ways, climate systems, etc., recognizing equal importance and preservation amongst all elements—animate or inanimate. In contrast, Jainism is committed to a basic dualism between souls (*jīvas*) and matter (*ajīva*), spirit and substance, with moral concern directed toward the treatment of souls and not matter. Still, as matter in all its forms contains living being with souls, caution and respect is *de facto* directed by Jains toward the inanimate world through this integration of spirit with non-spirit. Hence, while Jainism and Deep Ecology are motivated by very different theoretical considerations, their actual ecological practices might coincide [7].

"He who injures these (earth, water, fire, air-bodied beings) does not comprehend and renounce his demeritorious act...a wise man should not act sinfully toward the earth, water, fire, or air." (*Ācārāṅgasūtra* 1.1.2-4,7) [8].

## **4. Exploration and Evaluation of Jain and Contemporary Views**

As a means to evaluate Jain ecological ethics and put it in perspective to other environmental ethics, I will conduct a comparative critical analysis of the positions identified in this paper. Given the space limitations of this short paper, I can only allude to potential problems and benefits found in each approach.

My analysis will focus on three factors that any plausible ethical system must satisfy: (i) internal coherence; (ii) external coherence; and (iii) moral reasonableness. A cogent environmental ethic must cohere with two domains: (a) the “internal” interests, instincts, and beliefs of the human practitioner, and (b) the “external” interests or welfare of the surrounding world made up of other living beings (i.e., humans, animals, plants, and organisms), and the physical (inanimate) world. Further, one needs to ask if the ethical position is reasonable: Can we buy into it and its goals? More to the point, is it a workable position: does it make sense from a practical point of view?

## **5. Internal and External Coherence**

### **5.1 Egocentric Views**

The positions expressed in ethical egoism and anthropocentrism seems to be consistent with basic internal instincts for survival, but are likely to create tension or violence in the agent's interaction with the surrounding world. One's drives for self-preservation and advancement are enhanced and supported by these two positions that strive to benefit oneself through use of others and the environment. Yet in relation to others (externally), each party's efforts to fulfill their individualist goals and needs naturally displaces other's needs and interests, and hence, competitive disputes arise.

Stronger or dominant forces regularly exploit smaller and less aggressive elements in nature, as individual domains and welfare are ignored. What is perceived as correct by one agency (“what's right is what is good for me”) frequently is at odds with other agencies who strive to do

that which benefits them. In Anthropocentrism, this attitude expands to one “specie” or “collective group” endorsing a plan to exploit or use another for their collective benefit at the exclusion of other groups or individuals in nature. This abusive state-of-affairs has been dubbed “speciesism.” [9].

In defense of these two positions, an advocate might argue that there is nothing wrong with humans satisfying their basic drive for survival through violence. In the natural biosphere, there is continual exploitation of one animal by the other, as violence or *himsā* is not a human invention. Violence is unavoidable when one exists in a bodily form—maintenance and protection of a mortal existence requires the destruction and use of other living beings.

In evaluating this line of argumentation, one must first observe that ethical considerations are ostensibly in the purview of humans alone; hence, it is *not* appropriate to justify human aggression by merely comparing it to animal aggression in the world. Other animals are not moral agents while humans are morally culpable. Humans alone are capable of ethical reflection, so must *choose* which course of action appears to be right, not just self-satisfying. At times, prudence is at odds with morality: do what is right, not just what is beneficial to oneself. Further, what is particularly distinctive about human violence against other humans and/or other species is the nature, extent, and motivation for such violent acts, i.e., genocide is a distinctively human endeavor. We can conclude, then, that Ethical Egoism and Anthropocentrism as environmental ethics are doctrines that are particularly insensitive to the welfare of those individuals around the human agent, their pain simply does not matter. The environment exists as a resource for human fulfillment and pleasure, as such any effort to restrict harm to others or damage of the environment is based *only* on the concern for preserving this resource for one's own future use or for the use by future (human) generations.

## **5.2 Ecocentric Views**

Ecocentric views as found in Vitalism and Deep Ecology, by their very nature, are created to avoid the type of external tension and general breakdown of coherence and mutual respect found in the Egocentric

positions just discussed. These altruistic Ecocentric positions are strong in coherence with external entities, as the welfare of others and the world as a whole are preserved and promoted. Yet, problems can arise in cohering with the internal needs of the individual, as instinctive directives for self-preservation and advancement are not always supported or met by the Ecocentric approach. Self-preservation and sustenance generally require some use and imposition on other existing entities. Those adopting this Ecocentric approach to the environment are faced with an internal dilemma, as one must either suppress one's instinctive drive for preserving one's self and personal advancement or violate one's commitment to egalitarianism with the entire ecosphere. Authors of these approaches do not give much guidance on how to curb or mitigate one's instinctive and egoistic drives, other than to note that many humans need to reduce their standard of living in order to assure proper distribution of world resources and preservation of the ecosphere. But can this reduction in egoistic and instinctive demands be accomplished primarily on a conscious level based on suggested attitudinal modifications [10]?

## 6. Sentientalist Views

### 6.1 Traditional Sentientalist

Sentientalism takes a middle position and as such tries to cohere with at least some external forces or interest (i.e., well-being of other “perceived” sentient beings), while at the same time be cognizant of internal needs and directives. Through a “coherence of attitude,” humans recognize the ethical status of other animals who appear to share similar human-like characteristics, i.e., traits that “cohere” with human sensibilities and behaviours. Ecocentric critics frequently argue that the traditional Sentientalism position is too limited in its moral domain to cohere with many external interests, leading to the repeated exploitation of others and a general disregard for nature as a whole. Its *limited* “intrinsic” or (ultimately) instrumental position gives no justification for preserving wilderness that has no immediate or long-range benefit for sentient beings. Further, acts of cruelty toward nonsentient beings (e.g., use of lower animals in painful medical research), would involve no moral violation according to this position.

## 6.2 Jain Sentientism

Regarding external coherence, the Jain practice of *ahimsā* covers a broad moral domain, including all life forms and most of the natural world as microscopic organisms exists in even the most remote and hostile areas. Internal coherence is also maintained, as personal interests are not necessarily mitigated to preserve outside entities. Self-preservation is not violated, as practitioners of *ahimsā* are permitted to defend themselves when needed. This “suspension” of *ahimsā* should not be perceived as purely or even mainly egoistic or exploitative, as the motive is not purely for the benefit of oneself, i.e., continuation in an embodied form for one aspiring toward spiritual advancement is beneficial to others. Further, Jain philosophy maintains that purely egoistic or selfish thoughts and actions are ignorance-based, erroneous states-of-affairs; as the aspirant ascends to higher states of awareness and spiritual advancement; such egoistic attitudes fade away, replaced by holistic, altruistic attitudes toward all life.

For the Jain practitioner *ahimsā* becomes a way of life, a general attitude toward the world, rather than an abstract ideal, a foreign ethical principle that one encounters. The natural or inherent state of existence is *ahimsā* according to Jainism, it is simply a matter of removing the ignorance that blinds life from perceiving its truth. *Ahimsā* becomes an ethic for environmental responsibility that advocates complete respect for all living beings in the world, while at the same time elevates one's personal orientation toward a selfless way of life, not bound by selfish, destructive tendencies.

“All breathing, existing, living, sentient creatures should not be slain, nor treated with violence, nor abused, nor tormented, nor driven away. This is the pure, eternal law which the clever ones, who understand the world, have proclaimed (*Ācārāṅgasūtra* 1.4.1.1-2) [11]”.

## 7. Moral Reasonableness

One of the most important aspects of an ethical principle is its workability: does it make sense from a practical point of view? For no matter how profound and inspired a moral directive may appear from a theoretical or emotional level, if it cannot be implemented and adopted for an extended period of time amongst a people, then it is of little worth.



## 7.1 Vitalism

Vitalism, especially as linked with Albert Schweitzer's "Reverence for Life," has gained widespread attention, yet it is questionable if anyone can adopt it literally. While such a nonviolence doctrine is laudable, it is often questioned whether it has application in the real world. For example, who would not resort to bacteria-killing antibiotics when running a 104-degree temperature and vomiting fluids continuously. In fact, not to act in this way would itself be a violation of the principle of reverence for life, as personal suffering or even death when avoidable, entails not respecting one's own life. Life is full of moral and spiritual dilemmas; hence, compromises must be worked out. Any doctrine that does not offer some allowance and guidance for such eventualities are flawed and weak [12].

## 8. Deep Ecology

The Ecocentric approach of Deep Ecology gives equal moral status not only to all living beings, but nonliving entities as well. Yet like Vitalism, it is often questioned how to live a life if one truly perceives the world from this perspective. While it is praiseworthy and useful to instruct people to see their interconnectedness with their environment and discourage selfish dominance over others, it is unrealistic to expect that humans will ever (truly) place their concerns regarding life and health on the same level as bacteria, clods of dirt, or plants.

Some Deep Ecologists (i.e., Bill Devall and George Sessions) do recognize that humans have a right to influence the diversity and richness of life on earth for *vital needs*. Unfortunately, this allusion to allowable concessions or compromises is never clearly worked out. Further, any effort to give humans priority or rights to control and destroy others for their own gain and/or survival slides their Deep Ecology stance back toward an Anthropocentric approach. Deep Ecology, if practiced literally, would ask humans to radically alter their life plan, not only in the areas of economic productivity and standard of living, but possible concerns over personal health and survival. Finally, Deep Ecology provides no real method of transformation for the type of attitude changes they advocate.

Intellectual appreciation of a holistic perspective in life is not the same thing as an actual personal transformation at the most fundamental level of existence. Jainism and other Indian schools of thought integrate and in fact emphasize the personal transformation *alleged* to arise in meditation, yoga, compassion, and reflective contemplation. (Even if there is no “objective verification” of these transformative claims, they at least offer this yogic means while Deep Ecology does not).

## **9. Anthropocentric Perspective**

Nonviolence or ethical sensitivity from an Anthropocentric perspective is directed to other human beings exclusively, and any further concern for other living beings or the environment is purely incidental, caused by its instrumental value to some human interest. The practical implications of this view is that people witness and are outraged by the suffering and death of many animals and the senseless and short-sighted destruction of natural resources that harm living creatures and that deprive future generations. Some exponents of the anthropocentric view argue that they *do* take into considerations many factors such as future generations, the aesthetic and spiritual benefits of preserving some forest reserves, etc., in their moral calculations. But this show of concern for others— again— only occurs when it would directly aid human welfare. Finally, it is hard to provide evidence to support the metaphysical presuppositions/dogma regarding the inherent superiority and mandated dominance of humans over all other living beings, and the right to use the environment for exclusively human interests. Anthropocentrism cannot be justified as an ethical position, so it would be hard to introduce to a sensitive, intelligent populace.

## **10. Sentientist Perspectives**

Ethical obligations regarding nonviolence are limited to all “recognized” sentient beings. What beings or entities one includes in the set of sentient beings, directly affects how one interacts with the world. Traditional expressions of this view tend to include humans and selected animals as sentient (conscious) beings—i.e., all animals that can feel pain, fear, anxiety, loneliness, pleasure, boredom, and so on. Traditional sentientists exclude plants, nonsentient natural objects and quasi-abstract

entities (e.g., species, ecosystems) in their moral domain; they argue that Deep Ecologist cannot establish that harm to these entities matters to them in the same way that it does to animals. This approach better resonates with common moral feelings regarding the displeasure felt when animals suffer or are tortured. Yet, environmental concerns remain based on instrumental considerations, “kicking in” only when it would harm a sentient beings welfare, e.g., pollution should be avoided *when* it is hazardous to some animals' health.

Difficulties for Traditional Sentientist arise on two different levels. (1) Efforts to articulate the defining characteristics of a sentient being are usually *ad hoc* and vague. How are we to know whether a simpler being is *actually* suffering (based on intelligence and consciousness) or merely reacting instinctively or mechanically to an outside stimulus? (2) Delimiting one's moral domain to only sentient beings results in an environmental ethic that is insensitive to blatant misuse and destruction of natural resources—protect the environment only if its destruction harms sentient beings. Prevalent sentiment toward environmental destruction requires more. Jainism applies its mandate of nonviolence to a much wider spectrum of the ecosphere than the aforementioned version of sentientism.

### 10.1 Jain Sentientialism

Jainism—in contrast to the traditional expression of Sentientialism—appears to have struck an enviable balance: it avoids the insensitive instrumentalism of other forms of Sentientialism, yet it does not “lower” higher forms of life to the same level as inanimate objects, abstract concepts, or primitive life forms as found in Deep Ecology. Its demands on its practitioners are achievable and provide a method for transforming one's attitudes and dispositions that goes beyond mere conscious effort or preference. This claim is based—in part—on the fact that Jainism is a system of thought and action that has been in place for at least three thousand years and has found the proper balance between the internal and external demands of life for oneself and others; it allows for occasional acts of violence for self-preservation as a last resort, but fundamentally gives equal status to all things in the world [13].

When Jainism does make some distinction between different levels of living beings, it still recognizes that all forms of life should be respected and violence should be avoided on all levels. Its distinction regarding beings with different number of senses provides a logical basis for determining which types of beings are to be killed, when violence is unavoidable. Higher forms of life, one's with more senses and the capacity for mobility, experience more intense fear, pain, and suffering due to their increased ability to sense the world, their capacity to try to escape from harm, and their more developed nervous system to consciously contemplate their pending demise. Causing more intense pain and suffering should cause one to acquire karma that is more difficult to remove.

Finally, Jainism does not require an unprovable presupposition about life, i.e., "All life is sacred," to establish its ethical position; rather, it is founded on the simplest and most immediate of observations about ourselves and the world, i.e., "No one likes to suffer."

### Notes/Bibliography

- [1] In recent times the *harm principle* is the most widely recognized moral (liberty-limiting) principle, and arguably the basis of modern jurisprudence. John Stuart Mill, *On Liberty*, (London, 1859), states "The object of this essay is to assert one very simple principle...that the sole end for which mankind are warranted, individually or collectively, in interfering with the liberty of action of any of their number, is self-protection. That the only purpose for which power can be rightfully exercised over any member of a civilized community, against his will, is *to prevent harm to others*.... To justify that, the conduct from which it is desired to deter him, must be calculated to produce evil to someone else." (my italics).
- [2] Albert Schweitzer, "Civilization and Ethics" in *The Philosophy of Civilization*, Part II, trans. John Nash (London: Macmillan Publishing Co., 1929).
- [3] Bill Devall and George Sessions, *Deep Ecology: Living as if Nature Mattered* (Salt Lake City: Peregrine Smith Books, 1985), Bill Devall, *Simple in Means, Rich in Ends: Practicing Deep Ecology* (Layton, Utah: Gibbs Smith Publishing, 1988), Arne Ness, *Ecology, Community, and Lifestyle*, trans. David Rothenberg (Cambridge, England: Cambridge University Press, 1989), George Sessions, ed. *Deep Ecology for 21<sup>st</sup> Century* (Boston: Shambhala Books, 1995).
- [4] William F. Baxter, *People or Penguins: The Case for Optimal Pollution* (New York: Columbia University Press, 1974).
- [5] Some might argue that this position is antithetical to an ethical life. Yet, it is likely

that a person living by this ethic would do acts of kindness toward others on a regular basis. Ethical egoism differs from other more altruistic ethics principally in the area of motive, as benefit or care for others is indirect; an action is done only if it benefits the agent him/herself. However, the act can (and often does) benefit others as a consequence of the act. For example, an ethical egoist, being an intelligent person and out of enlightened egoism, chooses to help others in the belief that sometime in the future they might help oneself when in need; failure to assist others will likely lead to bad consequences for oneself at a later date—i.e., “what goes around comes around.”

- [6] Bernard E. Rollins, *Problems of International Justice* (Boulder, Colorado: Westview Press, 1988), Tom Regan, *Earthbound: New Introductory Essays in Environmental Ethics* (New York: Random House, 1984).
- [7] In this context, I have encountered some Jains (this point was brought up in the oral presentation of this paper) that do not seem to like taking a position “right” of Deep Ecology—perhaps they see this as a weakness or deficiency in Jainism in comparison to Deep Ecology. In defense, they tend to focus on the fifth *anuvrata* or *aparigraha* (nonpossession), which requires the aspirant to avoid attachment to worldly things. Hence, they argue Jainism *does* have moral views about and interaction with the material things (*ajīva*) just as with selves or *jīvas*. But this whole line of thinking is misguided, as Deep Ecologists include material reality as part of the moral community since it is part of the ecosystem itself. *Aparigraha* has nothing to do with the objects themselves, but only with our attractions to them and certainly gives no moral status or sense of protection to them. Acharya Mahaprajna has been an advocate for focusing on this fifth *anuvrata*, contending that it is as important if not more important than *ahimsā* in Jain thought. This might help to explain the use of *aparigraha* in this line of defense.
- [8] This *Ācārāṅgasūtra* passage repeats the same prohibition against harming any of the element-based, single sensed beings (i.e., fire-bodied, water-bodied, air-bodied, earth-bodied souls) as expressed in this condensed quotation taken from (book 1, lecture 1) lesson 2, 3, 4, and 7 of the text. Lesson 5 prohibits harm to plants while lesson 6 disallows hurting the animate (insects, animals, gods, hell-beings). *The Sacred Books of the East, Jaina Sūtras* (Part 1). Vol.22, trans. By Hermann Jacobi, Delhi: Motilal Banarsidass Publishers, 1989, p.5.
- [9] The term “speciesism” is usually attributed to Peter Singer when he used the term in his influential book, *Animal Liberation*, 2<sup>nd</sup> ed., New York: New York Review, 1990). However in his book, he states his debt to Richard Ryder for the creation of the term.
- [10] Part of the mission of Deep Ecology is to raise the consciousness of the human race, to take an alternative view about human relations with the rest of the world. While the authors of Deep Ecology at times put forward support for their views by providing energy models or explanations of life in terms of the flow of energy through an ecosystem, one must question the overall effectiveness of this sort of methodology in transforming people's apparently innate, ego-based mode of action. Some of the Deep Ecologists—especially Bill Devall and George

Sessions—do incorporate the element of self-realization as part of their overall plan for greater environmental sensitivity by humans. Calling upon elements from the world's religions, and especially Asian traditions—they see the need for humans to refocus their sense of self from isolation, competing egos to a holistic self, extending first to family, then community, then species, and finally the whole nonhuman world. While they do advocate the use of a deep meditative process in arriving at this “new” sense of self, they still do not give specifics on how this is to be done—especially in comparison to the work in this area done by such spiritual traditions as Jainism, Buddhism, Hinduism, Taoism, etc.

- [11] *The Sacred Books of the East, Jaina Sūtras* (Part 1). Vol. 22, trans. by Hermann Jacobi (1989) p.36, Motilal Banarsidass Publishers, Delhi.
- [12] It should be noted that Schweitzer was not *totally* naïve about the conflicts between the needs of different living beings just discussed. At times he did take life, particularly when it saved other lives or served to end the life of a suffering animal. Yet, Schweitzer never attempted to work out some methodology or ethical process to resolve conflicts and establish priorities.
- [13] This effort to find a balance or happy medium amongst positions is reflected in the unique Jain doctrine of *anekānta*; it advocates “multi-perspectivism” so accepts two or more perspectives as equally “partially” right, giving perspectives on a phenomenon, but the truth is found only by uniting all these perspective into one full and complete understanding. In this case it incorporates *egocentrism*—*nonviolent* position is best thing for personal growth and liberation while at the same time incorporates *ecocentrism*—*no* being wants to suffer, so increase happiness/harmony for all beings, not just oneself.

## 32. *Śrāvakācāras* and Ecological and Environmental Ethics

Ashok K. Jain<sup>1</sup>

### Abstract

Many scientific principles lie hidden in the ancient Jain philosophical treatises. Jain philosophy has laid utmost stress on the importance of environment and its conservation. The life style of ancient people was very simple, within the limits of natural changes and eco-friendly. People never exploited or made excessive use of any component of nature, either living or non-living. Subsequently, the man's greed for accumulating several worldly things or attitude towards possessiveness of items beyond requirement has disturbed all the ecosystems of the world. Out of several scriptures written by Jain *Ācāryas*, *Śrāvakācāras* seem to be unique treatises, which direct *śrāvakas* (lay persons who lead life with religious principles) about their activities, to be done or not. A good number of *Śrāvakācāras* have been written by various *Ācāryas*, in which '*Ratnakaraṇḍa Śrāvakācāra*' is a popular one. A comprehensive analysis of these scriptures explains their close relationship with several ecological principles. *Śrāvakācāras* even mention that one should also fix the limit of travel, to prevent unnecessary destroying/disturbing micro or macro-organisms, whose presence could be important for maintaining the

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balance of an ecosystem. Various components of an ecosystem lie in a balanced form and perform functions without harming nature, but the man's interference has changed the scenario of earth and resulted in deterioration of nature. As per Jain principles, several activities such as draining hazardous and toxic waste and washing clothes in rivers/ponds are serious and sinful acts. Many activities which have less gain and more loss, are also sinful and cause the bonding of karma with soul, e.g. unnecessarily plucking plants, digging land without any purpose, making fire without need, throwing stone or any other object in water etc. are strictly prohibited.

In Jainism violation of any principle of nature is known as '*aticāra*' and a true '*śrāvaka*' never contravenes the principles. From ecological point of view even the minor and negligent activities may cause a great harm to flora, fauna and other components of nature.

## **1. The Concept of Ecosystem**

The concept of Ecosystem was first put forth by A.G. Tansley (1935). It has both structure and functions. The structure is related to species diversity. The more complex is the structure, the greater is the diversity of the species in the ecosystem. The functions of ecosystem are related to the flow of energy and cycling of materials through structural components of the ecosystem. According to Woodbury (1954), ecosystem is a complex in which habitat, plants and animals are considered as one important unit, involving exchange of materials and energy. According to E.P. Odum, the ecosystem is the basic functional unit of organisms and their environment interacting with each other and with their own components. An ecosystem may be conceived and studied in the habitats of various sizes, e.g., one square meter of grassland, a pool, a large lake, a large tract of forest, balanced aquarium, a certain area of river and ocean. There is a great bearing of ecosystem on the economy and welfare of human society. In balanced condition the ecosystem happens to be a self-sufficient and self-regulated functional system but at the same time, if qualitatively or quantitatively any component of ecosystem decreases or increases, the entire system becomes imbalanced.

The ecosystems are of various kinds and named after the types of organisms and habitat conditions such as grassland ecosystem, desert



ecosystem, forest ecosystem, crop ecosystem, fresh water ecosystem, river ecosystem, marine ecosystem etc. The social environment of mankind can also be termed as 'social ecosystem' which includes human activities, thoughts, behaviour, mutual relationships etc.

Any kind of the above mentioned ecosystem gives all due importance to all micro as well as macro organisms. Man is an important part of any of the ecosystems because of developed skill and capacity to carry out all kinds of activities. It is mainly due to human unethical and illegal activities that most of the ecosystems of the world either got destroyed or are facing serious problems.

## **2. Structure of Ecosystem**

The structure of an ecosystem is basically a description of the organisms and physical features of environment including the amount and distribution of nutrients in a particular habitat. It also provides information regarding the range of climatic conditions prevailing in the area. From the structure point of view, all ecosystems consist of abiotic as well as biotic components.

### **1) Abiotic Components**

Ecological relationships are manifested in physicochemical environment. Abiotic components of ecosystem include basic inorganic elements and compounds, such as soil, water, oxygen, calcium carbonates, phosphates and a variety of organic compounds (by-products of organic activities or death). It also includes such physical factors and ingredients as moisture, wind currents and solar radiation. Radiant energy of sun is the only significant energy source for any ecosystem. The amount of non-living components, such as carbon, phosphorus, nitrogen, etc. that are present at any given time is known as standing state or standing quantity.

### **2) Biotic Components**

The biotic components include all living organisms present in the environmental system. From nutrition point of view, the biotic components can be grouped into two basic components:

- i     Autotrophic components, and
- ii.   Heterotrophic components

The autotrophic components include all green plants which fix the radiant energy of sun and manufacture food from inorganic substances. The heterotrophic components include non-green plants and all animals which take food from autotrophs. Biotic components of an ecosystem can be described under the following three heads:

1. Producers (Autotrophic components),
2. Consumers, and
3. Decomposers or reducers and transformers

The amount of biomass at any time in an ecosystem is known as standing crop which is usually expressed as fresh weight, dry weight or as free energy in terms of calories/meter<sup>2</sup>.

### **3. Functions of Ecosystem**

In any ecosystem the following functional components are present:

- i. Inorganic constituents (air, water and mineral salts)
- ii. Organisms (plants, animals and microbes), and
- iii. Energy input which enters from outside (the sun).

These three interact and form an environmental system. Inorganic constituents are synthesized into organic structures by the green plants (primary producers) through photosynthesis and the solar energy is utilized in the process. Green plants become the source of energy for renewals (herbivores) which, in turn become source of energy for the flesh eating animals (carnivores). Animals of all types grow and add organic matter to their body weight and their source of energy is complex organic compound taken as food. They are known as secondary producers.

All the living organisms, whether plants or animals, in an ecosystem have a definite life span after which they die. The dead organic remains of plants and animals provide food for saprophytic microbes, such as bacteria, fungi and many other animals. The saprobes ultimately decompose the organic structure, break the complex molecules, and liberate the inorganic components into their environment. These organisms are known as decomposers. During the process of

decomposition of organic molecules, the energy, which kept the inorganic components bound together in the form of organic molecules, is liberated and dissipated into the environment as heat energy. Thus in an ecosystem energy from the sun, the input is fixed by plants and transferred to animal components.

Nutrients are withdrawn from the substrate, deposited in the tissues of the plants and animals, cycled from one feeding group to another, released by decomposition to the soil, water and air and then recycled. The ecosystems operating in different habitats, such as deserts, forests, grasslands and seas are interdependent on one another. The energy and nutrients of one ecosystem may find their way into another so that ultimately all parts of the earth are interrelated, each comprising a part of the total system that keeps the biosphere functioning. Thus the principal steps in the operation of ecosystem are as follows:

- (1) Reception of radiant energy of sun,
- (2) Manufacture of organic materials from inorganic ones by producers,
- (3) Consumption of producers by consumers and further elaboration of consumed materials;
- (4) After the death of producers and consumers, complex organic compounds are degraded and finally converted by decomposers and converters into such forms as are suitable for reutilization by producers.

The principal steps in the operation of ecosystem not only involve the production, growth and death of living components but also influence the abiotic aspects of the habitat. It is now clear that there is transfer of both energy and nutrients from producers to consumers and finally to decomposer's and transformer's levels. In this transfer there is a progressive decrease of energy but nutrient component is not diminished and it shows cycling from abiotic to biotic and vice versa. The flow of energy is unidirectional. The two ecological processes, energy flow and mineral cycling which involve interaction between biotic and abiotic components lie at the heart of ecosystem dynamics. The principal steps and components of ecosystem are illustrated in Fig. 1.

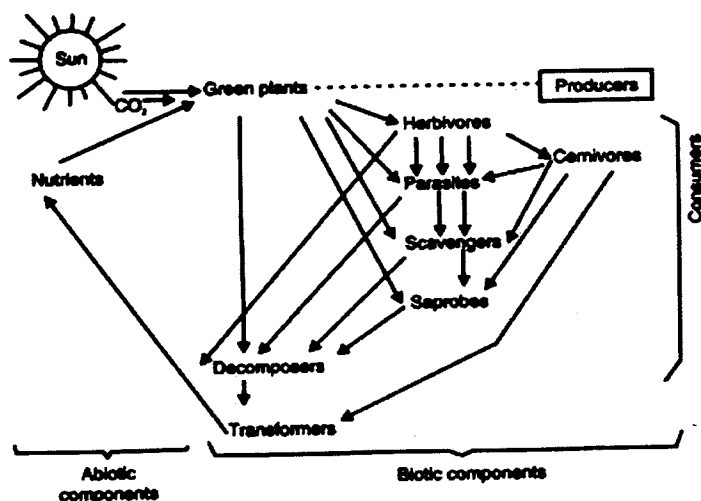


Fig. 1: Schematic Components of Ecosystem

The ecological principles mention that there is some sort of relationship between the numbers, biomass and energy contents of primary producers i.e. green plants, consumers of first, second orders and so on. This relationship can only be maintained by having minimum use of resources and adopting conservational attitude. There is a self-regulatory mechanism in ecosystem of *checks and balances* known as *homeostatic*. For example, in a balanced ecosystem usually the balance between oxygen and carbon dioxide is maintained at certain level so that neither of the two becomes limiting or in excess. Now due to excess air pollution and deforestation, this balance has been disturbed. The fluctuation in proportion of plant and animal population tends to disturb this balance.

### 3.1 Ecological Pyramids

Ecological pyramids are diagrams that illustrate how ecologically important factors, such as energy, biomass, and population size, vary between trophic levels in an ecosystem. Traditionally, these diagrams place the primary producers (photosynthetic organisms such as plants) at the bottom and the highest trophic levels at the top of the diagram. The size of the portion of the diagram associated with each trophic level illustrates the amount of energy, biomass, or number of individuals found in each trophic level.

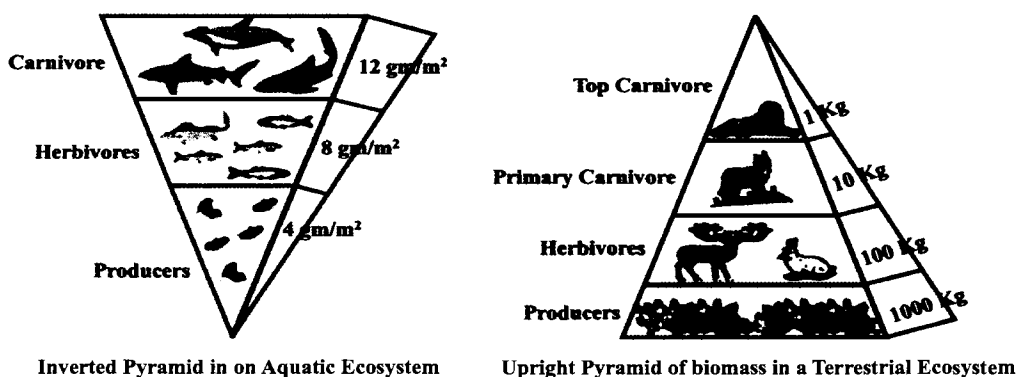


Fig. 2. Ecological Pyramids

#### 4. Concept of Ecosystem in Jainism

The concept of environment in Jainism has been dealt with holistic approach. Its principles mention that all kinds of living beings, either macro or micro have *equal right* to lead life without any interference. Strict instructions are given for the use of not only the living beings but even non-living resources of nature, i.e. abiotic components. Any kind of violation in its principles has been considered as sinful act. The prime and most important principle of Jainism is non-violence or *Ahimsā* which provides right to all living beings, either animals or plants, to lead a better life. Besides macro-organisms, much emphasis has also been laid on conservation of micro-organisms; therefore, the edibles containing even smallest tiny living organisms like '*Nigodiya*' are not eaten. The modern bioscience mentions similar micro-organisms e.g. bacteria which play important role in various biochemical and physiological activities of various living beings. Soil fertility and atmospheric nitrogen fixation are well-known phenomena, performed by these micro-organisms. Several species of microscopic fungi have an intricate relationship with roots of higher plants and are manifested in the form of mycorrhiza, which again is a significant aspect. Mycorrhiza are required for the growth and nutrition of many plant species. Jainism says that one should be careful in any activity at any time and place, and keep in mind not to harm even minute invisible microorganisms.

The modern biological science mentions that total biodiversity on the Earth consists of approximately 13-14 million species of all living

beings including plants and animals. These species happen to be important parts of their respective ecosystems. Disturbing or killing of any of the species ultimately harms the entire network of the system. Today the entire world is taking steps for the conservation of renewable and non-renewable resources; and efforts in this direction have been started. But the compassionate attitude i.e. non-violence towards all living beings alone can be helpful in achieving the goal. Thus the concept of environment and ecosystem in Jainism is very clear and supports the modern view. Almost all Jain scriptures directly or indirectly lay emphasis on the conservation and protection of environment.

## **5. *Śrāvakācāras***

*Śrāvakācāras* are the treatises compiled by various Jain monks i.e. *ācāryas* from time to time, after the last Jain '*Tīrthaṅkara*' Lord Mahāvīra. It is said that such *Śrāvakācāras* comprise the teachings and preaching's of *Tīrthaṅkaras* on leading an eco-friendly and religious life which does not harm others and maintain the equilibrium among various living and nonliving components of nature. In modern sense these may be considered as 'Code of Conduct' for all human beings. Over 32 *Śrāvakācāras* have been compiled by various Jain *Ācāryas*. The main and important '*Śrāvakācāra*' is '*Ratnakaraṇḍa Śrāvakācāra*' written by *Ācārya Samantabhadra* during 2<sup>nd</sup> or 3<sup>rd</sup> century CE. Some other '*Śrāvakācāras*' are Kundakunda *Śrāvakācāra*, Pūjyapāda *Śrāvakācāra*, Padamkṛta *Śrāvakācāra*, Umāsvāmī *Śrāvakācāra*, Lāṭī Saṃhitā, Praśnottara *Śrāvakācāra*, Vasunandi *Śrāvakācāra*, Amitgati *Śrāvakācāra*, Puruṣārthasiddhyupāya, Dharmopadeśa-Piyūśavarṣā *Śrāvakācāra*, Vṛtodyotana *Śrāvakācāra* etc.

*Śrāvaka* and *Śrāvikā*, male and female house-holders respectively, in Jain society who actually lead life according to religious principles, do not indulge in the five sins and minimize their possessions. This sect of the society happens to be most eco-friendly in their activities. Eight fundamental virtues or '*Aṣṭamūlaguṇa*' are strictly followed by them. Some of these virtues are:

- Abstinence from alcoholic drinks, meat and honey.
- No consumption of fig fruits.
- Not eating food at night.

- Praising five supreme souls.
- Compassion for all living beings.
- Use of filtered water.

In real sense one can only be called a 'Jain' if the above practices are followed.

In *Śrāvakācāra, Parigraha* i.e. excessive possessiveness of things beyond requirement has been considered as one of the five sins. One should fix the limit of acquisition and not have attachment to the belongings. This principle is directly concerned with the conservation of any ecosystem. Out of greed for unlimited property, man has exploited almost all natural resources and polluted the entire environment including the soil, water and air. Jain saints are the best conservationists of nature who possess nothing, travel on foot and use minimum necessary items.

Even for a common Jain lay adherent i.e. '*grhastha*', several limitations for possessing the property have been laid down. An ecosystem can only be sustained by maintaining an equilibrium between biotic and abiotic components. Therefore, in Jainism the biota is conserved through non-violence, while abiota by non-possessiveness. A comprehensive analysis of these virtues explains their close relationship with many ecological principles. Consuming wine, meat and honey involves the killing of innumerable micro and macro-organisms which are important for performing various functions of an ecosystem. Alcoholic drinks also deteriorate family and social life. Killing of animals for meat has disturbed the food chain and food web of various ecosystems. At and around slaughter houses air borne micro-organisms occur in huge quantity and deteriorate other organic matter too. 'Fig' fruits are the habitat of a large number of small insects which maintain the pollination activity of its flowers. Therefore, eating such fruits is not allowed. Praising five supreme souls provides mental satisfaction which ultimately enables one to do only good activities required for a healthy and pleasant social ecosystem. Ecological studies indicate that various types of aquatic organisms in one water body cannot survive if transferred to another water body. Therefore, after filtering the water the remaining material which consists of several types of organisms must be transferred very carefully back to the reservoir from where the water was collected. This scientific concept was well

known to Jain society since time immemorial. Organisms of an aquatic environment get adapted to its physico-chemical characteristics and establish a mutual relationship with other organisms. Another significance of filtration is that several toxic macro and micro-organisms living in the water get separated, thus their contamination is checked. Jain saints always use filtered boiled water which prevents several water borne diseases. In the trophic level of any aquatic ecosystem, the presence of such organisms is required to regulate various activities and cycling of matter.

### **5.1 *Aticāras* i.e. Violation of Provisions**

*Śrāvakācāras* mention that '*Śrāvakas*' must strictly follow '*Digvrata*', '*Deśavrata*' and '*Anarthadaṇḍavrata*'; it means one should define limits of travelling, eating and using things. Directions for use of edibles and non-edibles (*Bhakṣya* and *Abhakṣya*) are given. Even the edibles should not be used after certain period. Consumption of some substances like urine, saliva, hair, sealing wax, *dhaturā* etc. has been prohibited. In *Śrāvakācāras*, the violation of any provision of such '*Vratas*' is called '*Aticāra*'. Several such '*Aticāras*' have been defined and true *śrāvakās* never contravene the provisions. In modern terms the '*Aticāras*' may be compared with the provisions of 'Environment (Protection) Act, 1986', which protects several illegal and unethical human activities. *Śrāvakas* lead a very simple life by limiting their food, clothes, property and other belongings to the minimum. All unnecessary, violent and anti-nature activities are restricted. The boundaries of movement are fixed and travel beyond the limits is supposed to be a sinful activity. Jain saints always travel on foot and never use any vehicle, ship or aeroplane. Activities like unnecessary plucking plants and their parts, throwing stone or any other object in water, burning fire, and digging without any purpose are strictly prohibited. From ecological point of view even minor and negligent activities of humans may cause a great harm to flora and fauna. Any change may affect and alter the micro-climatic conditions which are important for the survival and growth of biota. Draining hazardous and toxic substances and washing residues in rivers and other water reservoirs is considered as a serious sinful act. Present day water pollution problem may be resolved to a certain extent if such principles are followed. By observing such limits and using limited amount of resources of land, water and air, such resources may be conserved and eco-cycle of the system may



run smoothly. All the ecosystems of the earth are interdependent and interconnected, e.g., river ecosystem is connected with the ecosystem of ocean, and a small ecosystem of dead logs is a part of the large ecosystem of a forest. A complete self-sufficient ecosystem is rarely found in nature but situations approaching self-sufficiency may exist.

## **6. Discussion**

Various components and functions of any ecosystem clearly mention that at each tropic level of an ecosystem, all living beings should live within their limits and should not interfere in other's jurisdiction. In a perfect and undisturbed ecosystem, there lies a balance in number, biomass and flow of energy. Even if some minor changes take place the balance is regained after some time. But now due to human interference, the equilibrium among various components of ecosystem has been disturbed drastically. Everywhere on the Earth such situation can be seen. For example due to excessive use of insecticides and pesticides, the soil microflora are getting disturbed. It has affected the growth of plants by way of reducing mycorrhizal activity and due to decreased deterioration of dead and decayed organic matter, lying in or above the soil. Several hazardous chemicals are getting incorporated in our crops and vegetables, causing serious diseases. Excessive denudation of forests has created serious problems to wildlife, plants and other species which are the important components of its ecosystem. Now a large number of plant and animal species have come under endangered/threatened category. Pollution in water due to various reasons is affecting the survival of many aquatic animals. Air pollution due to emission of gases, nuclear and other kinds of explosions has increased several kinds of respiratory, skin and other diseases. Global warming is the result of man's interference with the atmosphere. Its consequences have started appearing now by way of melting of arctic and Antarctic ice and increasing water level of the seas. Almost all major cities of the world have now been converted into 'Gas chambers'. In spite of imposing several legal provisions through acts and rules, the situation is becoming severe day by day. All this has happened due to excessive and unwise use of natural resources. Such activities of man are unnecessarily affecting the life of animal's right from microorganisms to mega species, who are not at all responsible for these activities and cannot express their grievances. Not only the living beings have been affected due to such activities but it has also disturbed the cycle

of almost all non-living components of nature due to excessive exploitation of natural resources.

This has happened due to not following religious traditions, violation of ethics, drastic changes in life style, attitude of possessiveness of materials, greed, and finally due to lack of compassion towards other living beings. Now man is trying to encroach upon all spheres of nature. Long back when our ancestors were leading a disciplined life and using natural resources in a limited manner, no such problems existed. *Ācāryas* wrote scriptures for the safety and conservation of nature in the name of *Śrāvakācāras* and cautioned people about the consequences if any of its provisions were violated. *Aticāras* or violation of the provisions of *Śrāvakācāras* would be considered a sinful activity and the violator has to bear its serious consequences. *Śrāvakācāras* mention that one should define limits of consumption and possessions which are the primary factors for exploitation of resources and harming other living species. Even one should decide limits for travelling on earth, by air and in water. Such concept is very scientific and enables conservation of nature. Unnecessary and excessive use of water, making noise etc. are considered sinful acts. In modern terms the '*aticāras*' may be compared with the violation of provisions of Environment Protection Acts.

The above observations on modern concepts of ecosystem and guidelines for every human being for leading an eco-friendly life as mentioned in *Śrāvakācāras*, indicate that Jain *Ācāryas* were very much concerned about the conservation of nature and warned people of activities which are sinful. Even today the Jain monks and *Śrāvakas* follow the provisions of *Śrāvakācāras*. It fulfills two objectives; first, compassion towards all living beings and second, the conservation of nature.

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### 33. Man-Nature Relationship & Jain Science (A Spiritual Perspective)

*Kokila Shah*<sup>1</sup>

#### **Abstract**

*“Dhammo Maṅgala Mukkiṭṭhaṃ, Ahimsā Sañjamo Tavo”  
Dasvaikālika Sūtra[1].*

It is said in Jain scriptures that, “*Dharma* is the highest bliss and it consists in non-violence, self-control and penance.”

Environmental concerns are serious issues today. Philosophers, scientists and environmentalists have expressed grave concerns that modern man has been disturbing the whole ecosystem with his greed. Human activities are important. In this context man-nature relationship needs to be reconsidered in the light of consumerism and spirituality. Nature should be viewed from spiritual angle. Ethical considerations and metaphysical concepts are inseparable. Jain ecological concepts are grounded in 'respect for all life'; what is needed is 'Right' vision. A global environmental ethics is required. Jain ethico-spiritual rites, rules, vows like *Sāmāyika*, *Pratikramaṇa* etc., are important from the point of view of spirituality. Jainism may provide environmental ethics by respecting the

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community of all living beings, men, animals and plants and by preserving Earth, air, water and soil.

The paper highlights the following key-concepts:

1. Non-violence- Scientific classification of six kinds of living beings
2. Biocentrism - Ecocentrism
3. Ecological self
4. Global Jain values and spirituality

The present paper deals with man-nature relationship which assumes greater importance in Jain Science. *Ācāraṅga Sūtra* - which is the code of conduct- preaches that one must refrain from violence as regards all life forms [2]. This is stated by Omniscient and this is said to be pure and eternal religion. Jain Science is unique in accepting the view that earth has life. Likewise air, water, fire and vegetation possess life. Jainism does not talk only about five sensed human beings but includes all sentient beings. It preaches the principle of equality of all souls and offers ethics for life protection.

## **1. Fundamental Teachings of Jainism with reference to Ecology**

### **1) Non-violence**

Jain philosophy can make its own distinct appeal with its special emphasis on non-violence. It is based on the principle of 'reverence for all life'. It is the first principle of higher life. 'Nothing is higher than Mount Meru' or nothing is more expansive than the sky'. Likewise no religion is higher than non-violence in the world [3].'

It would be appropriate to begin this discussion by clarifying Jain position in general and Jain attitude- way of life as reflected in the concept of non-violence (*Ahiṃsā*) in particular.

Apart from its religious implications and aesthetic sensitivity, it is based on certain considerations, which are essentially naturalistic and which can be linked to conservationism. Its pragmatic and scientific basis

must be recognized. In the final analysis, it seems to reflect man's relationship to non-human world. Lord Mahāvīra threw new light on the perennial quest of the soul for the truth and showed the path of non-violence to achieve this goal. He said that there is no quality of soul more subtle than nonviolence and no virtue greater than reverence for life. *Ahimsā* is the principle that Jains teach and practice not only towards human beings but towards all nature. It is at once ancient and contemporary. "Lord Mahāvīra not only pointed out but demonstrated that it is practical and should be adopted as a way of life to be followed in our daily routines."

Jain philosophy considers the problems of human existence, codes of conduct, how man should live, what is his relation to the lower creatures around him, how he should guide his life and actions that he may not injure any living being and he may not destroy nature.

One can sum up the essence of Jainism in one phrase we find in *Sūtrakṛtāṅga* [4] that man by refraining to injure living creatures attains *Nirvāṇa*, which is eternal peace. It is relevant to note that non-violence is the Supreme Law of this world.

In this connection, it is worthwhile to present Jain teachings outlined in 'The Jain Declaration on Nature' [5] which is based on the Jain tradition which leads to the philosophy of ecological harmony.

## 2) Principle of Interdependence

*Parasparopagraho jīvānām* [6]. This principle is related to the concept of non-violence.

All life is bound together by mutual support and interdependence. Lord Mahāvīra had proclaimed Universal truth that, 'One who neglects or disregards the existence of earth, air, fire, water and vegetation disregards his own existence which is entwined with them'. Jain cosmology recognizes the fundamental natural phenomenon of symbiosis or mutual dependence, which forms the basis of the modern day science of ecology. All aspects of nature belong together and are bound in a physical as well as a metaphysical relationship.

### 3) *Samyaktva* (equanimity)

It gives spiritual strength to practice non-violence. It encourages an attitude of 'live and let live'. Thus it contributes to the preservation of the balance of nature.

### 4) Principle of Six Life Forms

The six life forms include mobile and immobile beings – Not only humans and animals but also earth, water, air, fire and vegetation. Compassion–empathy are positive virtues which have relevance to environmental concerns. The word used by Jains is *Jīva-dayā* which means caring for and sharing with all living beings. Jaina concern for life-forms arises from the concern for environment.

### 5) The Jain code of Conduct

The five vows in the Jain code of Conduct are (*Ācārāṅga Sūtra*):

1. Non-violence in thought, word and deed.
2. To search the Truth.
3. Non-stealing, that is being honest.
4. To practice non-acquisitiveness.
5. To practice restraint and chastity.

Amongst all these, the observance of non-violence is the first and the central one. It must be said that Jain ethics is activist and underlying the Jain code of conduct is the emphatic assertion of individual responsibility towards one and all. The code is profoundly ecological in its practical consequences. It entails:

1. Kindness to all living beings.
2. Vegetarianism.
3. Self-restraint and the avoidance of waste. It implies that misuse or excessive use of any part of nature is forbidden. Jainism declares unequivocally that waste and producing pollution are acts of violence.
4. Charity - generosity.

All the fundamental teachings of Jainism and the Jain code of conduct are outlined in 'The Jain Declaration on Nature', which offers to the world a viable route and plan for holistic environmental protection, peace and harmony in the Universe. It is clear that Jaina code of conduct sets the path for righteousness. People of all faiths can follow it.

In my opinion the main problem confronting man today is liberation from vices. Jaina ethics can provide a system of good acts and attitudes. The basis of the path of purification is non-violence. In recent past, *Ahiṃsā Yātrā* launched by Acārya Mahāprajña, and later continued by his successor Acārya Mahāshramaṇa, which strives for moral revival of society is an auspicious step in the direction of establishing non-violent social order.

Today, in the age of science and technology, living by Jain values can raise the quality of life. It is necessary to understand the significance of values of life to assess man's duties and obligations in society. What is needed is a new dimension of thinking and a new direction in life style. Jaina code of conduct for the layman can play an important part in this respect. It is foundation for a higher life, it aims at Right conduct- *Samyak Cāritra* which in general means abstaining from doing what is harmful and doing what is beneficial to all.

Now, let us further analyze the three unique basic concepts of Non-violence, Self-control and Penance [1], which can lead to Right Conduct and are characteristic features of Jaina practical ethics. The entire *Aṇuvrata* Movement was meant to change the personality and orient the behaviour and thinking towards the basic ideal of non-violence. The rationale underlying Jaina ethics is the doctrine of universality and scientific nature of non-violence. The doctrine has played an important part in molding the life of people in India.

Jainas have made non-violence a concrete way of life. It has been pointed out that the 'Consequences of violating the principle of non-violence are misery in this world and the next.' Hence 'not to kill' is the good deed par excellence.

*“Jayam Care jayam ciṭṭhe, Jayamāse Jayam sae*

*Jayam bhuñjanto bhāsanto Pāvakammam na bandhai”*[8]



In Jainism, observance of carefulness '*yatna*' is an important part of practices. In *Daśavaikālika Sūtra-14-8*, it is said, “walk with care, sit carefully, sleep with care and eat with care so as not to commit sinful acts”. A careless person is called violent and a person who acts carefully in all his activities is called non-violent. It has been said “Observance of mindfulness and self-control while behaving towards all living beings is non-violence rightly understood [9]”. It is renunciation of desire to injure anyone and the freedom from hostile thoughts, speech and acts. Positively, it is compassion. No wonder “Non-violence does good to all [10]”. Evil cannot dwell in the man with compassion. Violence is categorized into two kinds: (1) *Dravya Himṣā* – the external violence – the harmful acts. (2) *Bhāva Himṣā* – the intention to hurt – the mere thought of violence.

“A truly moral person is one who has got victory over passions. It has been rightly said that, “The non-emergence of attachment etc. on the surface of self is non-violence [11]”. Thus appearance of any kind of passion is violence. In this context vow of non-possession deserves mention – The root of violence is attachment and wish for possessions. *Aparigraha* – implies an attitude of mind. It is contentment. It is also related to self-control. One whose conduct is uncontrolled and unmindful, definitely indulges in violence. Attachment to possession leads to vices. Self-control is the basis of non-possession. An attitudinal change is a must – hence importance of internal penance, like meditation, self-study, and staying in the state of equanimity etc., is emphasized. One has to give up inauspicious meditation (*Ārta dhyāna*, *Raudra dhyāna*) and concentrate on auspicious meditation like *prekṣadhyāna*, *dharmadhyāna* etc. Restraint called *Sāmāyika* is important in which for a certain period of time one takes the vow not to perform any evil act whatsoever.

## 2. Biodiversity, Ecocentrism, Biocentrism

Biocentrism is an ethical view point that extends inherent values to non-human species. It promotes preservation of biodiversity, animal rights and environment protection. Environmentalists exhort us to respect nature. This concept of 'Respect Nature' is inherent in Jain ideology. Jain scientists believe that we do have responsibilities and duties to wild species and ecosystems. It follows that achieving sustainability is an ethical imperative for science and society in this century- hence, the need for Environmental Ethics. Environmental ethics is a branch of applied

philosophy which studies the conceptual foundations of environmental values as well as more concrete issues surrounding attitudes, actions and policies to protect and sustain biodiversity and ecological systems. Jain perspective is non-anthropocentric. Jain science argues for promotion of nature's intrinsic values. Man is a product of nature and hence he should not harm nature. He must think ethically about the environment. Human beings should consider totality of existence that includes other forms of life and the Jain perspective on environmental problems provides a sound environmental ethics – How should we live? And why should we care? Thus a scientific understanding for environmental protection is provided which gives rise to responsible personal conduct. Jainism is against anthropocentric view in which nature is viewed as a mere store house of raw materials for human use. Jainism preaches that nature is not to be exploited. As a consequence, Jainism embraces the model of biocentrism which views the planet earth as living system of interdependent species. It takes a holistic view in which ethical and environmental considerations enter into *all* decisions. It sees the planet as a community of life-forms in which each contributes and depends upon all others. It signifies interconnectedness and it is eco-centric.

This idea underlies the ecological self, which highlights spirituality.

Jain biocentrism highlights -

1. Reduction of unnecessary consumption
2. Relation of friendliness with the nature

The ecological aspect of Jainism is illustrated in the story of the six travelers and their thought dispositions and the six types of *Leśyās* (the psychic-coloration). This story is narrated below:

Six men are hungry and are standing in front of a mango tree in the forest. The first one suggests, 'Let us cut down the tree and eat mangoes'; the second says, 'No, let us cut only the big branches'; the third says, 'No, let us cut only the small branches'; the fourth says, 'No, let us take only the bunches of fruits'; the fifth says, 'Let us only pluck the mangoes' whereas the sixth says, 'Let us collect only the mangoes that have ripened and fallen on the ground. There is no need to harm and destroy the whole tree'. The attitudes of the six men as revealed here correspond to the six psychic coloration, i.e. *Leśyās*: *kṛṣṇa* (black), *nīla* (blue), *kāpota* (ash), *pīta-tejo*

(orange), *padma* (golden-yellow) and *śukla* (white) *leśyās*. The first man is cruel and harmful whereas the last one is kind and compassionate. He reflects a non-violent, eco-friendly lifestyle, based on auspicious thinking.

### 3. Jain Environmental Ethics

Environmental ethics is a system of ethical values, human reasoning and knowledge of nature. It refers to a set of principles, which governs human behaviour. It concerns itself with the relationship between human beings as well as the world around us and not limited only to the relationship amongst people. The emphasis is on human obligations or responsibilities to other species or nature in general.

Jainism has developed its own unique environmental ethics inspired by Jain values. There is a close relationship between Jain world view and environmental protection. I propose to set out some outstanding characteristics of the Jain practical ethics. The basic principle is equality of all souls and sentient beings.

1. All species are equal.
2. Human beings should not be considered as superior to other species.
3. Human welfare and welfare of non-human nature is interdependent and cannot be distinguished or treated in isolation.

If we analyze these principles and act accordingly, the result is preservation of biodiversity. Thus Jainism subscribes to the view that all lives are intrinsically and equally valuable. Jain moralists consistently carry out this thesis. Consequently, aggressive actions or harmful actions are not permissible as animals or plants should not be killed and ecosystems should not be destroyed. Jain principles are ecocentric and biocentric and not 'human centric'. With this ethics we can set all things right. The solution consists in realizing that man should exercise self-control while dealing with nature and greedy and wasteful life style should be changed. An alternative model of non-violent life-style should be adopted. It is manifested in a practical way of living in harmony with nature. The basis of this ethics is the non-violence - the greatest spiritual force.

Every creature has its place in the environment with its own specific role to play. Eco-centric ethics is Bio-centric. Its principal rule is that everything is connected to every other thing for mutual benefit and sustenance. This sense of interconnectedness or interrelationship is the hallmark of Jainism. All life is bound together by mutual support. It implies harmonious coexistence of life forms. This is the fundamental principle of environmental philosophy. The Jain tradition subscribes to peaceful coexistence of all life forms. We have to amend our unsustainable life-style. The path consists of commitment to harmlessness to all life forms and focuses on the following principles:

1. Freedom from passions like greed etc.,
2. Avoidance of excessive materialism, egoism and misuse of nature. Behave with mind-fullness. Avoid wastage of water etc.
3. Adopting a more caring attitude towards animals, vegetation and other things as a way of life.
4. Recognition of biodiversity. Your existence is intrinsically bound with existence of other living beings.
5. Leave nature to itself.
6. Practice of non-violence.
7. All life is sacred. All living beings have right to life.

Jainism can thus generate a liberal outlook in life situations which can help in taking practical decisions that can protect environment. Thus a synthesis of spirituality, religion, science and philosophy can be achieved.

### **4. Jain Values – Jain Way of Life**

Right vision can give strength to practice right conduct. The conduct of the person cannot be isolated from his way of life. Concept of ecology may be related to Jain way of living. The values of Jain religion based on Jain ethics can be translated into actions. The virtue of nonviolence is scientifically integrated with Jain doctrine. Sustainability can be obtained by adopting eco-friendly life style. Ecosophy is putting values into action. It is wisdom of living in harmony with nature. It involves a shift from mere science to wisdom. Jain science offers the following guidelines:

1. Attitude of friendliness
2. Minimum requirement – abandonment and consumerism
3. Self-restraint
4. Carefulness in all actions
5. Awareness in all deeds
6. Practical morality
7. Prayer for well being of all living beings, spirituality, yoga and meditation.

## 5. Conclusion

To sum up, it is Jain belief that not only human and animal beings but also earth, water, fire, air and vegetation are sentient and livings. Hence, polluting the environment to harm or to destroy their vitality amounts to committing violence.

The view that protection of all species can pave the way for protection of environment is scientific. Jains make various restrictions on the use of water, vegetables etc., Again Jainism has laid much emphasis on protection of wild life and plants; it is significant to note that hunting is listed as a serious offence among the seven vices mentioned in Jainism. Meat eating is prohibited. Even leaf or flower from tree should not be plucked. Jains are conscious about the pollution of air, water etc., and cutting of the forest is prohibited. Certain types of industries which lead to violence and certain kinds of business practices for the householders which are related to ecological imbalance, pollution of environment and destruction of bio-diversity are prohibited. To save the world from evil effects of degradation, Jain preceptors had declared millennia ago, '*Jīvāṇām Rakṣhaṇam Dhammo*'. The term Dharma is interpreted to mean, 'that which sustains life and preserves it'. Our spiritual self who is also the ecological self should give us the strength not to exploit nature for our self-chosen ends. 'The principle of non-violence is perennial ideology transcending the powerful forces of space and time and as such it can be called a scientific principle' [12]. Jainism has spiritual heritage to its credit.

Jain science is science of balanced nature. It may be a new branch

of knowledge today, but in Jain tradition, it is there from ancient times. Science and spirituality cannot be separated in Jain tradition of respecting the sacredness of life. Jainism is the hope of mankind with its philosophy of eco-harmony and equilibrium. Not surprisingly Jainism, with its rich heritage, can guide the world in solving the problems of the 21<sup>st</sup> Century.

In the end—

“Let us express a wish for welfare of all.

Let the whole universe be blessed.

Let all beings be engaged in one another's well being.

Let all evils be vanished.

Let everyone everywhere be happy and blissful.”

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## SECTION VII: Mathematics

### 34. Jaina Mathematics in the Context of Modern Mathematics

*Ratnakumar Shah<sup>1</sup>*

#### Abstract

The contribution of ancient Jaina saint-scholars to mathematics is immense. They made serious inroads in the areas of Arithmetic, Number Theory, Geometry of circles, a crude theory of Transcendental Numbers, Combinatorics, Summation of series, Logarithms, pre-calculus notions of Infinite and infinitesimal, Partition of integers etc. The earliest written evidence of zero with decimal place value is found in Jaina works of the early centuries of Christian Era. This paper attempts to give account of these contributions with special emphasis on some advanced concepts of modern mathematics.

#### 1. Introduction

Mathematics has a special place in Jainism. Their canonical literature is divided in 4 divisions, one of which is called *Gaṇitānuyoga* (mathematical exposition). A monk or even the laity is required to contemplate on the nature of the universe and the elements forming it. Lot of mathematics is involved in this, especially the geometry of circle, and trapeziums, which the Jaina scholar-saints developed to considerable extent with their value of  $\pi = \sqrt{10}$  came to be referred as Jaina value of  $\pi$ . Their karma theory is very intricate where inward or outward flux of

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karma particles behaves exponentially, and to express them quantitatively, some rudimentary concepts of calculus were evolved. Their fascination for large numbers made them evolve a crude theory of hierarchy of infinities which has great resemblance with Cantor's theory of transfinite numbers. As a byproduct of all these, they stumbled upon concepts such as laws of indices, logarithms, partition of numbers, binomial theorem, Fibonacci numbers, sort of continued fractions, infinitesimals etc. Their unique theory of *Anekantavāda* (doctrine of non-absolutism or relativism) and *Syādvāda* (doctrine of conditional dialectics or qualified assertion) made them use permutations and combinations on a large scale and handle the problems of combinatorics such as occupancy problem etc. First evidence of use in the world of zero with place value is available in Jaina sources. Finally, the first attempt in India towards algebraic symbolism is found in Jaina sacred literature. My attempt in this paper is to bring out the fact that some of the ideas of modern mathematics which were very advanced for their times were conceived some 1000 to 1500 years back or may be even earlier by Jaina saint-scholars.

## 2. Decimal Place Value System with Zero

It is generally accepted by Indologists that by 3<sup>rd</sup> or 4<sup>th</sup> century CE decimal place value system with zero having place value must have come in common usage [WIKI].

There is, however, an indirect evidence of zero with place value in *Anuyogadvārasūtra* (ADS), where it is stated that the minimum number of physical bodies (*audārika śarīra*) in the human world, *H* say, is such that: (1) it is several *koṭṭākoṭṭī*, (2) it is greater than *tiyamalapaya* (a 24 digit number) and less than *cauyamalapaya* (a 32-digit number), (3) it is product of 5<sup>th</sup> successive square of 2 and 6<sup>th</sup> successive square of 2, i.e.  $H = 2^{2^5} \times 2^{2^6} = 2^{32} \times 2^{64}$ , (4) it is divisible successively by 2 as many as 96 times, i.e.  $H = 2^{96}$ , and (5) it is a 29 digit number. If we expand  $2^{96}$ , we will find  $H = 79228162514264337593543950336$ . This shows that even if there would have been no symbol for zero then, they at least knew that the 1000's place is empty. [5; Sū. 490, p.273-274, 285-286].

Prakṛita LV by Sarvanandi was composed in 458 CE in which there is umpteen numbers of *sūtras* reading the numbers, from left to right or right to left, digit-wise. Such as the number 13107200000 is stated as “serially (*kramataḥ*) five voids (zeros), two, seven, sky (zero), one and three” (reading the number from right to left).[6;4, 6, 79]. Similarly, in BKS of Jinabhadragani (5/6 century CE), there are several examples of small and large numbers read digit-wise as well as place value-

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1. See bibliography for abbreviations.



wise. e.g. (1) circumference of human world with diameter 4500000 *joyaṇa* (*j*) is stated as equal to 14230249 *j* and stated in words as “*ega* (1) *koḍī, bāyāla* (42) *lakkha, tise*(30) *sahassa, do* (2) *saya, auṇapaṇṇā* (49)”, reading the number from left to right *place-wise*. [7; I, 5, p.37] (2) Square of chord of *Bharaha* = 75600000000 *j* is read as “seventy-five, six and eight zeros (*sunṇaṭṭha*)” from left to right. [7; I, 69, p.133] (3) Square of chord of Mt. *Mahāhimavanta* = 1050000000000 is stated in words as “one hundred five followed by ten zeros (*dasasunṇam*)” (a mix of place-wise and digit-wise representation) [7; I, 70, p.134].

### 3. Laws of Indices for Integral and Fractional Indices

ADS and some other *Āgamic* works as also some non-canonical works show proficiency with laws of indices. We have seen above that while discussing minimum number of physical bodies, ADS uses the relation  $2^{32} \times 2^{64} = 2^{96}$ . So also it states the number of transformational bodies as the product of first and second square-roots of space points in an *aṅgula* and further states that it is 3<sup>rd</sup> power of second square root of space points in an *aṅgula*. In modern notation, this is equivalent to the notation  $\sqrt{a} \times \sqrt{a} = (\sqrt{a})^2$ , where *a* is the number of space points in an *aṅgula*, a linear measure equal to about 0.76 cm. The above is equivalent to saying that  $a^{\frac{1}{2}} \times a^{\frac{1}{2}} = a^{\frac{3}{4}} = (a^{\frac{1}{4}})^3$ . [5; sū.463, p.269, 284]. This shows clear familiarity with rules of indices, viz.  $a^m \times a^n = a^{m+n}$  and  $(a^m)^n = a^{mn}$ , for both integral or fractional indices.

### 4. Combinatorics

As an outcome of its supreme principle of non-violence arose the philosophies of *Anekāntavāda* (a thing has uncountable modes) and *syādvāda* (and can be described in many ways). This gave rise to mathematical development of combinatorics which has an apt name as *bhaṅgasamukkittaṇa* in Jainism. BS and ADS are full of such examples. Some examples are cited below:

**4.1. 26 Bhāvas:** ADS enumerates the combinations of 2, 3, 4, 5 *bhāvas* (dispositions) out of 5 basic *bhāvas* as  $\binom{5}{2} + \binom{5}{3} + \binom{5}{4} + \binom{5}{5} = 10 + 10 + 5 + 1 = 26$ . [5; sū.289, p.169, 170].

**4.2. Permutations:** Number of possible arrangements of 6 things excluding the serial order and reverse order is stated as  $1 \times 2 \times 3 \times 4 \times 5 \times 6 - 2 = 718$  and this formula:  $P_n = n!$  is stated and applied in numerous examples. [5; sū.237, p.145].

**4.3. Number of words in Āgamas:** SK quotes an ancient *karaṇasūtra* (formula) which is equivalent to:  $\binom{n}{1} + \binom{n}{2} + \binom{n}{3} + \dots + \binom{n}{n} = 2^n - 1$ . [2; XIII, 5,5,43].

*Vīrasena* applies this to calculate the number of words in *Āgamas* arguing thus. There are 64 vowels, consonants, colophons in Prakrit/ Sanskrit and words can be formed by combinations of 1, 2, 3, ..., 64 letters out of them. Thus maximum number of words can be:

$\binom{64}{1} + \binom{64}{2} + \binom{64}{3} + \dots + \binom{64}{64} = 2^{64} - 1 = 18\,446\,744\,073\,709\,551\,615$ . [2; XIII,5,5,45, p.248]. *Vīrasena*, in Dh and JD, demonstrates each of these combinations as:  $\binom{64}{1} = \frac{64}{1}$ ,  $\binom{64}{2} = \frac{64 \times 63}{1 \times 2}$ ,  $\binom{64}{3} = \frac{64 \times 63 \times 62}{1 \times 2 \times 3}$ , ...,  $\binom{64}{63} = \frac{64 \times 63 \times 62 \times \dots \times 2}{1 \times 2 \times 3 \times \dots \times 63}$  etc. *Abhayadeva* gives the formula  $\binom{n}{2} = \frac{n(n-1)}{2}$ , although  $x$  was unnecessary [12; preface, p.xvi]. Commentator *Keśavavarṇī* states the formula in most general terms:  $\binom{n}{r} = \frac{n(n-1)\dots(n-r+1)}{1 \times 2 \times 3 \times \dots \times r}$ . [10 (GSJ); I, p.484].

**4.4. Occupancy problem ( $r$  balls in  $n$  cells):** The general formula for number of ways  $r$  balls can occupy  $n$  cells is  $A_{r,n} = \binom{n+r-1}{r} = \binom{n+r-1}{n-1}$  [13, p.38].

BS considers the problem of  $r = 1, 2, 3, \dots, 10, 11, 12$  souls (*jīvas*) entering 7 hells and finds out the number of ways for doing this. Here 11 represents symbolically as innumerable (*asaṅkhyāta*), and 12 as infinite (*ananta*). The formula above gives these values as:  $A_{1,7} = \binom{7+1-1}{1} = 7$ ,  $A_{2,7} = \binom{7+2-1}{2} = 28$ , 84, 210, 462, 924, 1716, 3003, 5005, 8008, 12376, and 18524. BS enumerates all these combinations manually [4; II, p.461-485]. It appears that the commentator *Abhayadeva* (10/11th century CE) must have known the formula since while considering the similar problem of number of ways  $r$  souls can enter 12 heavens after giving values of  $A_{r,12}$  for  $r = 1, 2, \dots, 7$ , he calculates further values by using the recursion formula:

$$A_{n,r+1} = \binom{n+r+1-1}{r+1} = \binom{n+r}{r+1} = \binom{n+r-1}{r} \frac{n+r}{r+1} = A_{n,r} \binom{n+r}{r+1}.$$

$$\text{Thus, } A_{7,12} = \binom{12+7-1}{7} = \binom{18}{7} = 31824,$$

and then he further calculates the values by using the recursion formula:

$$A_{8,12} = A_{7,12} \times \frac{19}{8} = 75582, \quad A_{9,12} = 75582 \times \frac{20}{9} = 167960, A_{10,12} = 167960 \times \frac{21}{10} = 352716 \text{ etc. [4; II, p.461-485].}$$

This problem assumes great importance in statistical mechanics.

## 5. Partition Function of Number Theory

BS considers the problem of splitting of a molecule composed of 2, 3, ..., enumerable, innumerable and infinite *paramāṇus* (ultimate particles) in ultimate particles and molecules. Such as a molecule with 5 ultimate particles can be split in any of the following manner:

$$5 = 4+1 = 3+2 = 3+1+1 = 2+2+1 = 2+1+1+1 = 1+1+1+1+1,$$

i.e. it can be split into ultimate particles and / or molecules in 6 ways. Here 1 represents ultimate particle and 2, 3, 4 are molecules with as many ultimate particles. If we denote this function by  $m(n)$ , then  $m(5) = 6$ . This is almost the partition function of number theory,  $p(n)$ , which is the number of ways an integer can be split as sum of integers disregarding the order. Only difference is that the original integer is also counted in partition function. Hence,  $p(5) = 7$ . Thus, BS function  $m(n)$  and partition function  $p(n)$  are related by:  $p(n) = m(n) + 1$ . BS calculates the values of  $m(n)$  for  $n = 1, 2, 3, \dots, 10$  and they are 0, 1, 2, 4, 6, 10, 14, 21, 28, 40. Since  $p(10)=42$ ,  $m(10)$  should be 41 instead of 40 given in BS. Probably this must be a mistake on part of the copyist [4; III, p.140-151]. This function has many applications in atomic Physics, Quantum Theory and quite recently in bosonic string theory.

## 6. Binomial Theorem

SK discusses infinitesimal increases in unit quantity, called *kāṇḍaka* (say  $k$ ), per *samaya* (an infinitesimal unit of time). At the end of 1<sup>st</sup> *samaya* the unit quantity will grow to  $1 + k$ ;

at the end of 2<sup>nd</sup> *samaya* it will grow to  $1 + k + k(1 + k) = 1 + 2k + k^2 [= (1 + k)^2]$ ;

at end of 3<sup>rd</sup> *samaya* it will grow to  $1 + 2k + k^2 + k(1 + 2k + k^2) = 1 + 3k + 3k^2 + k^3 [= (1 + k)^3]$ ; at the end of 4<sup>th</sup> *samaya* it will go to  $1 + 4k + 6k^2 + 4k^3 + k^4 [= (1 + k)^4]$ ;

and at the end of 5<sup>th</sup> *samaya* it will be  $1 + 5k + 10k^2 + 10k^3 + 5k^4 + k^5 [= (1 + k)^5]$ .

SK goes upto 5<sup>th</sup> power of  $1 + k$ , but the process outlined was most general, and they would have easily gone further. In this process they evolved the binomial coefficients [2; IV, p.378].

## 7. Six-fold Increase/Decrease (*ṣaṣtsthānavṛddhī/hānī*)

SK, BS, many other *Āgamic* works and scriptures on karma theory refer to six-fold exponential increase or decrease in quantities of bondage of karma particles, intensities of bondages, intensities of passions etc. Six types of increases are: (1) Infinite part increase (*anantabhāgavṛddhī*): This is an increase of  $1/I$  over a unit quantity in one *samaya* say when the unit quantity will become  $1 + \frac{1}{I}$ . (2) When infinite-part increase will take place infinite times, it will result in innumerable-part increase (*asaṅkhyātabhāgavṛddhī*) i.e.  $(1 + \frac{1}{I})^I = 1 + \frac{1}{A}$ . (3) When the innumerable-part increase takes place, ab initio, innumerable times, it will result in enumerable-part increase (*saṅkhyatabhāgavṛddhī*) once. i.e.  $(1 + \frac{1}{A})^A = 1 + \frac{1}{S}$ . (4) When enumerable-part increase takes place enumerable times, it will result in *enumerable-times increase* (*saṅkhyātaguṇavṛddhī*), i.e.  $(1 + \frac{1}{S})^S = \dot{S}$ . (5) When enumerable times increase takes place enumerable-times, it will result in innumerable-times increase (*asaṅkhyātaguṇavṛddhī*), i.e.  $\dot{S}^{\dot{S}} = A$ . (6) Similarly, infinite-times increase (*anantaguṇavṛddhī*) will result when innumerable times increase results innumerable times, i.e.  $A^A = I$ . Now, first 2 increases amount to the modern famous limit  $\lim_{n \rightarrow \infty} (1 + \frac{1}{n})^n = e$ , where  $e = 2.71828...$ . Thus, although prescriptions stated in these Jaina works were rigorously not correct, it can be seen that there was a valiant attempt to visualize exponential function which they just missed [2; XII, p.202-228].

### 7.1. Logarithms (with base 2)

We have seen earlier (Sec. 3) that ADS mentions  $H = 2^{96}$  and further states that H is divisible by 2 as many as 96 times. This amounts to saying  $\log_2 H = 96$ . This theme was fully developed further by Vīrasena (8/9th century) and *Nemicandra* (10/11th century). Vīrasena considers  $\log_2$  (*ardhaccheda*),  $\log_2 \log_2$  (*vargaśalākā*),  $\log_2 \log_2 \log_2 \log_2$  (*vargaśalākā* of *vargaśalākā*) of the number of deluded souls. Vīrasena tries to calculate  $\ln 2$  (natural logarithm of 2) by considering equation

$$(1 + \frac{1}{56})^{41} = 2 [\text{actually } 2.066 \dots] = (1 + \frac{1}{56})^{56 \frac{41}{56}} \approx e^{\frac{41}{56}} = e^{\ln 2},$$

and hence  $\ln 2 \approx 41/56 = 0.732...$ , while actual value is 0.693.... Similarly he attempts to calculate  $\ln 3$  by considering the equation:

$$(1 + \frac{1}{56})^{61.5} = 3 [\text{actually } 2.9699 \dots] = (1 + \frac{1}{56})^{56 \frac{61.5}{56}} \approx e^{\frac{61.5}{56}} = e^{\ln 3},$$

and hence  $\ln 3 \approx 61.5/56 = 1.1518...$  (actually 1.098...). Also, he shows  $\ln 4 \approx 79/56 = 1.4107...$  (actually 1.3862...) [2 (Dh); XII, p.162-188].

## 7.2. Binomial expansion

To calculate  $\ln 2$ , Vīrasena considers 14 terms of binomial expansion:

$$\begin{aligned} \left(1 + \frac{1}{56}\right)^{41} &= 1 + 41.\Delta + \frac{41 \times 40}{1 \times 2}.\Delta^2 + \frac{41 \times 40 \times 39}{1 \times 2 \times 3}.\Delta^3 + \dots \\ &\quad + \frac{41 \times 40 \times \dots \times 29}{1 \times 2 \times \dots \times 13}.\Delta^{13} + \dots \end{aligned}$$

Here we have put  $41/56$  as  $\Delta$  for convenience. Vīrasena even has different names for the fractions  $\Delta, \Delta^2, \dots, \Delta^{13}$ , namely *prakṣepa, piśula, piśulāpiśula, cūrṇikā, cūrṇācūrṇi, bhinna, bhinnābhinna, china, chinnāchinna, truṣṭita, truṣṭitātruṣṭita, dalita* and *dalitādalita* and he tries to interpret geometrically each and every term. [2 (Dh); XII, p.208-214].

## 7.3. Rules of logarithms

Vīrasena employs following formulas and Nemicandra states them specifically:

- i)  $\log(x.y) = \log x + \log y$  [11; G.105, p.101].
- ii)  $\log\left(\frac{x}{y}\right) = \log x - \log y$  [11; G.106, p.102].
- iii)  $\log x^y = y \log x$  [11; G.107, p.102].
- iv)  $\log_2 2^x = x$  [11; G.110, p. 106].
- v)  $\log_2 2 = 1$ .
- vi)  $\log(x.y.z) = \log x + \log y + \log z$
- vii)  $\log_2 (x^x)^2 = 2 \log_2 (x^x) = 2x \log_2 x$  [2 (Dh); III, p.1].
- viii)  $\log_2 (x^x)^{x^x} = x^x \log_2 x^x = x^{x+1} \log_2 x$  [2 (Dh); III, p.24].
- ix)  $\log_2 \log_2 (x^x)^{(x^x)} = (x+1) \log_2 x + \log_2 \log_2 x = \log_2 x + x \log_2 x + \log_2 \log_2 x$  [Ibid].

Further, Vīrasena indicates that logarithm can be with any base and gives

$$\log_2(32) = 5 \text{ and } \log_3(32) \approx 3 \text{ (actually } = 3.15\dots).$$

He also talks of  $\log_4, \log_5$  etc.

## 8. Number Theory: Number Field $Z^+$

The positive integers number field is divided in 3 classes: 1) Enumerable numbers (*sañkhejja*), 2) Innumerable or uncountable or incalculable numbers (*asañkhejja*), and 3) Infinite numbers (*añanta*). Number 1 is not treated as number in Jaina number theory as when squared, cubed, or raised to any power it remains same. Also when any number is multiplied by 1, the number remains unaltered. Thus the *sañkhejja* numbers begin with 2, regarded as minimum of enumerable numbers. The maximum of *sañkhejja* numbers is unimaginably large numbers and is defined as 1 less than minimum of innumerable (*asañkhejja*),  $\omega$ . Similarly, maximum of innumerable is 1 less than minimum of infinities. Thus, the number-line can be schematically represented as:

### Enumerables:

{2 (min), 3, 4, ...,  $\omega - 3$ ,  $\omega - 2$ ,  $\omega - 1$  (max)}. [5; sū.231, p.144][4; I, p.552, 553].

### Innumerable:

{ $\omega$  (min),  $\omega+1$ ,  $\omega...$ ,  $2\omega$ , ...,  $3\omega$ , ...,  $\omega^2$ , ...,  $\omega^3$ , ...,  $\omega^\omega-1$  (max)}.

{ $\omega^\omega$  (min) =  $\Omega$ ,  $\Omega+1$ ,  $\Omega...$ ,  $\Omega^\Omega-1$  (max)}. { $\Omega^\Omega = \delta$  (min),  $\delta+1$ ,  $\delta+2$ , ...,  $2\delta$ , ...,  $3\delta$ , ...  $\delta^2$ , ...,  $\delta^3$ , ...,  $\delta^\delta-1$  (max)}. [4; I, p.56] [5; sū.587-595, p. ....].

### Infinities:

{ $\Omega^\Omega = \Delta$  (min),  $\Delta+1$ ,  $\Delta+2$ , ...,  $2\Delta$ , ...,  $3\Delta$ , ...,  $\Delta^2$ , ...,  $\Delta^3$ , ...,  $\Delta^\Delta-1$  (max)}. { $\Delta^\Delta = \sigma$  (min),  $\sigma+1$ ,  $\sigma+2$ , ...,  $2\sigma$ , ...,  $3\sigma$ , ...,  $\sigma^2$ , ...,  $2\sigma^2$ , ...,  $\sigma^\sigma-1$  (max)}. { $\sigma^\sigma = \Sigma$ ,  $\Sigma+1$ ,  $\Sigma+2$ , ...,  $2\Sigma$ , ...,  $3\Sigma$ , ...,  $\Sigma^2$ , ...,  $\Sigma^3$ , ...,  $\Sigma^\Sigma$ , ...}.

Here, BS and ADS say that there is no maximum for higher order infinity, indicating that this forms an infinite sequence, since however unimaginably large the numbers  $\omega$ ,  $\Omega$ ,  $\delta$ ,  $\Delta$ ,  $\sigma$ ,  $\Sigma$  are, they are not infinite. [4; I, p.56] [5; sū. p. 596-603].

### 8.1. How large is $\omega$ ?

The minimum of innumerable,  $\omega$ , as described in scriptures is the sum of series:  $N_0 + N_1 + N_2 + \dots + N_{N_0}$ , where the recursion formulas  $N_0^{N_0} = N_1$ ,  $N_1^{N_1} = N_2$ , ...,  $N_k^{N_k} = N_{k+1}$ , etc. hold and it was estimated that  $N_0 \approx 10^{45}$ . Then, it can be

shown that  $N_1 \approx 10^{10^{45}}$ ,  $N_2 = 10^{10^{10^{45}}}$ ,  $N_3 = 10^{10^{10^{10^{45}}}}$  etc. and  $N_{N_0} = 10^{10^{10^{45}}}$ , where the height of tower of 10 is  $2N_0 - 1$ , and we know that  $N_0 = 10^{45}$ . Further it can

be seen that the numbers  $N_k$  grow so fast that  $N_0 + N_1 + \dots + N_{N_0-1} + N_{N_0} \approx N_{N_0}$ , and hence  $\omega = N_{N_0}$  [15; p.91] [16; p.14]. Even the number  $N_1$  is so large that assuming that we have a super computer printing 1000 zeros per second, it will take about 310 billion billion billion million years to print the number non-stop, when, in comparison, the estimated future life of our Universe is only 15 billion years [17; p.59].

## 8.2. Cantor's hierarchy of infinities

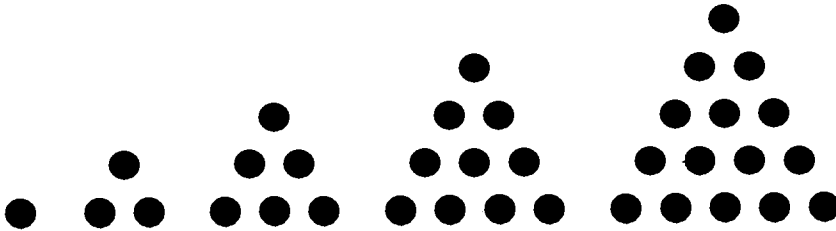
Towards the end of 19<sup>th</sup> century and in early 20<sup>th</sup> century, Cantor developed a beautiful theory of transfinite numbers. He proposed 2 types of infinities: 1) infinities of ordinals (where ordering of numbers is important), and 2) infinities of cardinals (where only size is considered). In the infinities of ordinals, our counting numbers 1, 2, 3, ... will have the infinity, say  $\omega$ . Then all  $\omega+1$ ,  $\omega+2$ , ...,  $2\omega$ , ...,  $3\omega$ , ...,  $\omega^2$ , ...,  $\omega^3$ , ..., etc. are infinities of same order as that of  $\omega$ , until we reach  $\omega^\omega$ , which is a higher order infinity. Similarly,  $\omega^{\omega^\omega}$  will be infinity of higher order still. Thus there can be infinity of ordinal infinities. You can immediately see the similarity in the treatment of *asaṅkhejjas* and *aṇantas* with this. True, the *asaṅkhejjas* and *anantas* of Jaina *Āgamas* are not infinities in real sense but they are so uncountably large that they were regarded as infinities by Jaina saint-scholars. Similarly the treatment in sec. 8.1 above of numbers  $N_0, N_1, N_2, \dots$  is very much similar to Cantor's infinities of cardinal numbers, viz.  $\aleph_0, \aleph_1, \aleph_2, \dots$  which also obey relations such as  $\aleph_0^{\aleph_0} = \aleph_1, \aleph_1^{\aleph_1} = \aleph_2, \dots$ .

## 9. Figurate Numbers

In BS [4; IV, p.302-304] and other *Āgamic* works, the number field is divided in 2 classes: odd numbers (*oja*) and even numbers (*jumma*). There is an attempt to represent certain shapes of things by certain number of points which is very much similar to modern treatment of figurate numbers. The Canon identifies mainly 5 planar (and 5 solid) shapes: 1) *parimaṇḍala* (annular ring or torus), 2) *vatta* (circular disc or sphere), 3) *taṁsa* (triangle or tetrahedron), 4) *cauraṁsa* (square or cube or rhombus or rhomboid), and 5) *āyata* (rectangle or parallelepiped). It is stated as to the minimum number of odd and even points required to represent these shapes. Of course, one point is ruled out as no shape can be configured by one point. The representation is as follows.

1) A straight line is represented by a minimum of 3 (odd) points or 2 (even) points. 2) A triangle (*tarīṣapayara*) is represented by minimum of 3 (odd points) and 6 (even) points. We know that triangular figurate numbers represented by  $T_n = \frac{1}{2}n(n+1)$  are 1, 3, 6, 10, 15, ... . 3) A tetrahedron (*Ghana tarīṣa*) is represented by a minimum of 4 (even) and 35 (odd) points. The tetrahedral numbers are given by  $(TH)_n = \sum (T_n) = \frac{1}{6}n(n+1)(n+2)$  and first few are 1, 4, 10, 20, 35, 56, ... . 4) A square (*cauraṣapayara*) is represented by a minimum of 4 (even) and 9 (odd) points as these numbers are given by  $S_n = n^2$ , e.g. 1, 4, 9, 16, 25, ... . 5) A cube (*Ghana*) is represented by a minimum of 8 (even) points or 27 (odd) points, for  $C_n = n^3 \equiv \{1, 8, 27, 64, 125, \dots\}$ . 6) Rectangular numbers are of two types: i) by taking  $(R_1)_n = n(n+1) \equiv \{2, 6, 12, 20, \dots\}$  generating only even numbers, and ii) by taking  $(R_2)_n = n(n+2) \equiv \{3, 8, 15, 24, \dots\}$ ; and hence it is stated that a rectangle (*āyata*) is represented by a minimum of 6 (even) points and 15 (odd) points. 7) A ring (*parimaṇḍala*) is representable by a minimum of 4 (even) points, and there is no odd number representation. There is no parallel to this in figurate numbers, but we can denote these numbers as simply  $(Pa)_n = 4n \equiv \{4, 8, 12, 16, 20, \dots\}$ . 8) A disc (*payaravṛtta*) is represented by a minimum of 5 (odd) points and 12 (even) points. This is probably parallel to pentagonal numbers  $(P)_n = (1/2)(3n^2 - n) \equiv \{1, 5, 12, 22, 35, \dots\}$ . 9) A hemisphere is represented by a minimum of 6 (even) points and 31 (odd) points. The corresponding figurate numbers are centered pentagonal numbers  $(CP)_n = (1/2)(5n^2 + 5n + 2) \equiv \{6, 16, 31, 51, \dots\}$ . We do not know as to how they arrived at these numbers. By adding one more point to above they tried to represent a sphere with a minimum of 7 (odd) points and 32 (even) points.

For tetrahedral numbers, Malayagiri explains as to how the minimum 35 (odd) number of points is required by drawing this diagram:



1 + 3 + 6 + 10 + 15 = 35, showing that he was aware of the formula:  $(TH)_n = \sum T_n$ .



## 10. Fibonacci Numbers

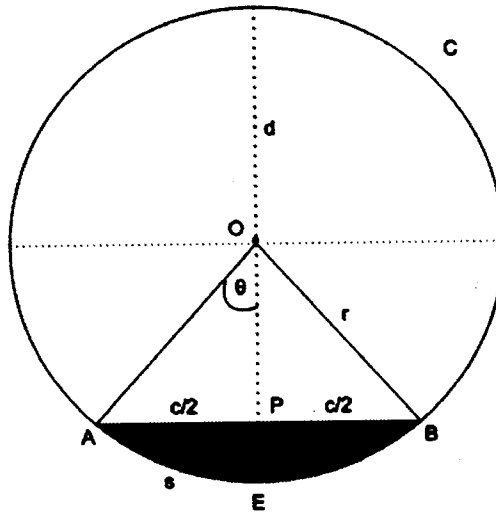
This is the famous sequence of number theory given by recurrence relation:  $f_n = f_{n-1} + f_{n-2} \equiv \{1, 1, 2, 3, 5, 8, 13, 21, 34, 55, 89, 144, 233, 377, \dots\}$ . Some scholars claim that this was known to *Piṅgala* (2<sup>nd</sup> century BCE) but was definitely developed by *Virahāṅka* (7<sup>th</sup> century) as quoted by *Gopāla* (12<sup>th</sup> century). It was first deduced logically by *Hemacandra* (12<sup>th</sup> century) in his *Chandānuśāna*. Hemacandra proves with very cogent arguments that there are  $f_n$  arrangements of short syllables (each 1 unit) and long syllables (each 2 units) in a line of poetics with  $n$  units, then  $f_n = f_{n-1} + f_{n-2}$  [18; WIKI].

## 11. Rhetorical Algebra

The evolution and development of algebra is due to need felt for generalization. The *Āgamic* literature is interspersed with statements of many formulas (*karāṇasūtras*). BKS, TP, BH, JD, GSS, and TS contain statements of formulas for perimeter, area/ volume of triangle, square, rectangle, rhombus, trapezoid, cone, frustum of cone, circle, annulus, ellipse, cube, parallelepiped, tetrahedron, sphere etc. Some examples are given here.

### (A) Geometry of circle

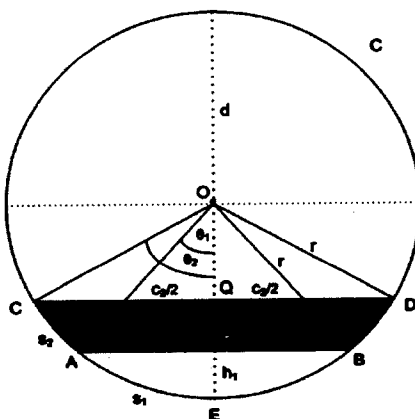
We come across full-fledged geometry of circle in JDP as the very subject matter is *Jambuddhīva*, our earth, which is described to be a circular flat disc with 6 mountain ranges occupying east-west running parallel chords. There are calculations of length of chords, arcs, areas etc. in many of scriptural works, especially in LV, BKS, TP, TS etc. They contain calculations of extraction of square roots of very large numbers. As the diameter of *Jambuddhīva* is 100000 *joyaṇa*, the circumference is given as 316227 *joyaṇa* 3 *kosa* 128 *dhaṇus* and a little over 13½ *aṅgulas*. Dividing this by 100000 *joyaṇa* and converting to *joyaṇa* the smaller units we get for  $\pi = 3.162277601757\dots$  which is  $\sqrt{10}$  as is clear from calculations of chords etc. where the Jaina scholar-saints took  $\pi^2 = 10$ . This is known as Jaina value of  $\pi$  and was even used by Brahmagupta in his calculations. The correct value of  $\sqrt{10}$  is 3.1622776601683... from which it is clear that the Jaina value of  $\sqrt{10}$  is correct to 9 decimal places, and can be termed as an amazing feat. Amongst all ancient civilizations, this is the nearest value for those days (the actual value being 3.14159...).



All the works mentioned above contain the use following formulas in respect of a circle. Suppose, diameter of the circle is  $d$ , length of chord is  $c$ , length of circumference is  $C$ , height of the segment formed by the chord is  $h$ , length of the arc of segment is  $s$ , then

- (i)  $C = \sqrt{10}d$ , [8; I, p.143].
- (ii) area of circle  $A = \frac{1}{4}C \cdot d = \frac{1}{4}\sqrt{10}d^2$ , [ibid].
- (ii)  $\left(\frac{c}{2}\right)^2 = \sqrt{\left(\frac{d}{2}\right)^2 - \left(\frac{d}{2} - h\right)^2}$ , [8; I, p.163].
- (iv)  $c^2 = 4h(d-h)$ , [7; I, p.91].
- (v)  $s = \sqrt{c^2 + 6h^2}$ , [7; I, p.95].

These formulas were specifically stated in TP and TS. Formula at (v) appears to have been arrived at empirically, but the maximum error in calculations of arcs of various continents never exceeds 1.3%. Jinabhadra gives the formula for area  $A$  between 2 parallel chords  $c_1$  and  $c_2$ , ( $c_2 > c_1$ ), i.e. areas of 7 continents and 6 dividing mountains, with heights of respective segments  $h_1$  and  $h_2$  as:  $A = \sqrt{\frac{c_1^2 + c_2^2}{2}} \times (h_2 - h_1)$  [7; I, p.130]. This formula was probably arrived at empirically gives results with high accuracy. Jinabhadra then proceeds to calculate the volumes of these dividing mountains.



### (B) Geometry of annuli

Our Earth, *Jambuddīva*, regarded as a flat circular disc, is supposed to be surrounded by innumerable annular seas and islands, with width of each going on doubling. TP gives 18 formulas relating to their widths ( $w_n$ ), diameters ( $d_n$ ) and areas as number of times the area of *Jambuddīva* ( $N_n$ ). We give 3 of these formulas as specimen:

$$(8) \quad w_{2n-1} - w_{2n-3} = \frac{(3w_{2n-1}-1) - \left(\frac{3w_{2n-1}-3}{2}\right)}{2} [8; \text{II, p.571}].$$

$$(11) \quad w_{2n-1} - 2 \sum_{k=1}^{n-1} w_{2k-1} = \frac{w_{2n-1}-1}{3} + 2 = \frac{w_{2n-1}+5}{3} [8; \text{II, p.573}].$$

$$(15) \quad N_n = 3(w_n - 1) \times 4w_n [8; \text{II, p.576}].$$

It will be a good exercise for readers to derive these formulas from following 4 basic formulas: (A)  $w_n = 2w_{n-1}$  in the unit of 10000 *joyana*, (B)  $w_n = 2^{n-1}$ ,

$$(C) \quad d_n = 1 + 2(1 + 2 + 4 + \dots + 2^{n-1}) = (2^{n+1} - 3),$$

$$(D) \quad d_n - d_{n-1} = 2w_n.$$

After this, TP gives 13 formulas for areas of seas and islands.

**11.2. Syncopated algebra:** Use of alphabets or numerals to denote certain quantities or mathematical operations began with commentators of TP, GSJ, GSK from 11<sup>th</sup> C onwards. E.g. प or 1 for paliovama, स or 2 for sāgarovama, सू or 3 for sūcyaṅgula (linear finger), प्र or 4 for pratarāṅgula (planar finger), घ or 5 for ghanāṅgula (cubic finger), ज or 6 or — for jagaśreṇi (world-line) which is equal to 7 rājus and written as

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7 र, लोप्र or 7 or = for lokapayara (world-plane), लो or 8 or ≡ for loka (universe), यो for joyana etc. With this they could write the equation:  $\tau = \frac{\overline{\phantom{x}}}{7} = \frac{\overline{\phantom{x}}}{49} = \frac{\overline{\phantom{x}}}{343}$ , which is equivalent in modern notation to:  $R = \frac{L}{7} = \frac{P}{49} = \frac{U}{343}$ , where  $R = rāju$ ,  $L = 7R$  is measure of length of world-line,  $P = 49R^2$  is measure of area of world-plane, and  $U = 343R^3$  is measure of volume of the universe. Also note that in ancient notation fractions were written without the separating horizontal line.  $1\frac{1}{2}R$  less 100000 *yojana* was shown symbolically as  $\frac{3}{14} \text{ रि यो } 100000$ , where रि is the symbol for ‘minus’, and the volume of nether world  $\frac{4}{7} \times 343R^3$  is represented by  $\frac{\overline{\phantom{x}}}{7} 4$ . [8; I, p.11, 16, 19-21]. After 11<sup>th</sup> C. we find symbols such as; केमू for  $\sqrt{kevalajnāna}$ , केमूर for  $\sqrt{\sqrt{kevalajnāna}}$  etc.,  $\frac{2}{3}$  means 3+2,  $\frac{2}{3}$  means 3-2,  $2 \times 3$  is represented as 2|3 or 2 गु 3, and  $3 \div 2$  as  $\frac{3}{2}$  or 3 भा 2. Further, we find even shorter symbols, e.g. *ardhaccheda* of *Palya*, i.e.  $\log_2 P$  is denoted by छे,  $\log_2 \log_2 P$  as व. Hence the relation  $\log_2 a = \log_2 (P^{\log_2 P}) = (\log_2 P)^2$  is shown as छेछे.

### 11.3. Symbolic Algebra:

Commentator Mādhvacandra Traividya, Keśavavarṇī of GSJ, GSK, KS have further developed the algebraic symbolism while discussing the karma theory in these tomes. We give only one example here. They use a symbol resembling modern  $\sigma$  for saṅkhyāta (enumerable number),  $\partial$  for asaṅkhyāta, व्य is equivalent to sign for minus and स to plus sign.  $2\sigma$  is used to represent an antaramuhutta (a time interval between 2 samayas and a muhutta less 1 samaya)  $\equiv \partial$  represents innumerable times the number of space-points in the universe (U).

The symbols used in 11-13 were somewhat like ones shown in the figure above.

Note that multiplication is denoted by writing the multiplicand and multiplier besides one another as in  $\equiv \partial$  or by putting a vertical line between them as  $\sigma | 2$ .

$$\begin{aligned} & \equiv \partial | 2\sigma\sigma | 2\text{व्य}\equiv\partial | स\equiv\partial | \frac{1}{2\sigma\sigma\sigma | \frac{1}{\sigma | 2}} \\ & 2\sigma\sigma | 2\sigma\sigma | \sigma | 2 \quad 2\sigma\sigma | 2\sigma\sigma | \sigma | 2 \quad 2\sigma\sigma | 2\sigma\sigma | \sigma | 2 \\ & = \equiv \partial | 2\sigma\sigma | 2 \quad स\equiv\partial | \frac{1}{2\sigma\sigma\sigma | \frac{1}{\sigma | 2}} \text{व्य}\equiv\partial | 2 \end{aligned}$$

$$\begin{aligned}
& 2\sigma\sigma\sigma|2\sigma\sigma\sigma|\sigma|2 \quad 2\sigma\sigma\sigma|2\sigma\sigma\sigma|\sigma|2 \quad 2\sigma\sigma\sigma|2\sigma\sigma\sigma|\sigma|2 \\
& \Rightarrow \frac{1}{2\sigma\sigma\sigma|\frac{1}{\sigma|2}}|2 \\
& 2\sigma\sigma\sigma|2\sigma\sigma\sigma|\sigma|2 \quad 2\sigma\sigma\sigma|2\sigma\sigma\sigma|\sigma|2 \\
& \Rightarrow \frac{1^\wedge}{2\sigma\sigma\sigma|\frac{1}{\sigma|2}} \\
& 2\sigma\sigma\sigma|2\sigma\sigma\sigma|\sigma|2[10 \text{ (GSK); II, p.883}].
\end{aligned}$$

## 12. Conclusions

Thus, the above is the story of the ‘beautiful minds’ which reveals that even about 1000-1500 years back the human mind was grappling with certain advanced concepts of modern mathematics although it lacked the rigor and perfection of today.

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## 35. Mathematical Ideas in *Paṇṇavaṇā*

*Samani Vinay Prajna*<sup>1</sup>

### Abstract

Mathematical concepts and their philosophical implications, ascribed to *Bhagawāna* Mahāvīra (~600 BCE), are mentioned in various Jain canons *āgama*, formalized between 500 BCE to 500 CE. In *āgama* we find numerous examples of many mathematical concepts to explain precisely the details of various metaphysical principles, geographical features, cosmos, *Kārmic* theory and various aspects of *jīva* and *ajīva* and many of them surprisingly go with the modern stream of mathematics.

Out of 12 *upāṅga*, *Paṇṇavaṇā* (*Prajñāpanā*) holds the 4<sup>th</sup> place in importance and is revered as significant as BS (*Bhagavatī Sūtra*). *Ārya* (*ācārya*) Śyāma (2<sup>nd</sup> century BCE), the 23<sup>rd</sup> successor of Mahāvīra, authored this text. It basically explains the concept of *jīva* (living beings), *ajīva* (non-living), karma etc. in minute details. The use of mathematical ideas like decimal place value system, large numbers, dyadic system, rule of Indices, concept of numerable, innumerable, and infinite, fraction, maxima and minima (relative size), infinitesimals, geometrical shapes and many more in this text show that the author was quite adept with mathematics around 2000 years ago and was able to tackle the unusually large numbers.

For illustration, this text states that the minimum number of human population can be obtained by multiplication of 6<sup>th</sup> successive square of 2 with 5<sup>th</sup> successive square of 2, i.e.  $2^{64} \times 2^{32} = 2^{96}$ . The resultant number contains one zero which shows their familiarity with decimal place value system and the concept of zero. It also reflects that dyadic system and rules of indices were well established by then. Exponential growth and decay (*ṣaṣṭhānapatita*) to explain the height of hellish beings and more, frequent use of combinatorics to explain *pudgala* in chapter 10

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verifies that the author was well-versed with such mathematical ideas and their applications.

The idea of calculus is also found in its nascent stage. In this paper, my focus is to introduce the mathematical thinking of the *ācārya* of that period articulated through *Paṇṇavaṇā*.

### a. Jain āgama

At present the available doctrines and the canonical texts are based on the preaching of *Bhagawāna* Mahāvīra (~600 BCE), the 24<sup>th</sup> *Tīrthankara*. *Āgama* were preached by *Tīrthankara* and vocalized by *Gaṇadhara*. GaṇadharaGautama compiled them verbally in the form of prose and verse in *ardha-māgadhi* (*prākṛta*) language. Those preachings are known as *āgama* or *aṅga*.

In *Samavāyāṅga*, it is said that *Bhagawāna* Mahāvīra propounded twelve types of *dvādaśāṅga Gaṇipīṭaka*<sup>1</sup> in chapter 1 *sūtra* 2. Later *sūtra* 2 of chapter 14 mentions the name of *Caturdaśapūrva*. *Bhagawāna* Mahāvīra first explained the 14 *pūrva* and then *Gaṇadhara* composed *pūrva*. These *pūrva* were too difficult to understand for a common monk. Therefore, 11 *aṅgas* were explained in simplified form and then formulated. The 12<sup>th</sup> *aṅga* *Drṣṭivāda* has a section called *pūrvagata* which consists of *pūrvas*. These 12 *aṅga* altogether are known as *dvādaśāṅga*.

### 1.1 Mathematics in āgama

Mathematics occupies a special place in Jain religion. Technically, the term *saṅkhyāna* was used for mathematics. The Canonical literature, as per *Śvetāmbara* tradition was divided in 4 streams: 1) *Caraṇa-karaṇānuyoga* (code of conduct), 2) *Dharmakathānuyoga* (ethics), 3) *Gaṇitānuyoga* (mathematics), and 4) *Dravyānuyoga* (metaphysics). *Gaṇitānuyoga* itself expresses that Jain philosophy was explained through mathematics and Jain monks were expected to know it as their regular chore; therefore this classification was made. Cosmology and cosmogony, logic and metaphysics etc. required strong training in mathematics.

There are many instances where decimal place value system is used proficiently. The cosmology required expertise in geometry of circles. Karma theory was instrumental in development of theory of transfinite and infinitesimals. Logic (*Nyāya*), especially the concepts of *Saptabhaṅgī* and *Syādvāda* enabled Jain scholars

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<sup>1</sup>*Samavāo*. Chief Synod- Ācārya Tulsi. (ed.) Yuvācārya Mahāprajña. Ladnun: Jain Vishva Bharati Institute, 1984 pp. 33



to develop theory of permutations and combinations. Its ideas about transmigration of souls based on a unique Karma theory were responsible in enabling them to tackle problems on combinatorics. Therefore, many āgamas have proficiently used mathematical ideas.

## 1.2 Prajñāpanā Sūtra (PS): Subject Matter

There are 12 upāṅgas and Prajñāpanā holds the 4<sup>th</sup> place in order of importance. The text was edited and put into writing in the conference presided over by Devardhigaṇī Kṣamāśramaṇa (450 or 463 CE). It basically explains the concept of jīva, ajīva, karma etc. very minutely and deeply. While dealing with ontology many mathematical ideas like numerable, innumerable, infinite, fraction, time scale, simile-measure, permutation, combination, fraction, geometrical shapes and many more are applied in this text. This āgama contains 7887 verses in the form of questions and answers.

In this paper the salient features of PS from mathematical viewpoint will be introduced.

## 2. Mathematical Contents in PS

**2.1 Decimal Place Value System:** There are clear evidences of use of decimal place value system in PS. Though we do not find the entire measure scale of counting as it is mentioned in Anuyogadvāra Sūtra (ADS) and Bhagvati Sūtra (BS), the counting scale found to measure the numbers show that decimal system was established by that period. The higher counting goes as saḥassāṇam (thousand), sayasahassāṇam (lākh,  $10^5$ ) and kodākodī ( $10^{14}$ ) etc. These are used several times at various places while dealing with the life-span of living beings and explaining the location of the deities etc. Sūtra 196 of chapter 2 mentions the number of planes of vaimānika deities are 84,97,023 (caurāsīya vimāṇāvassayasahassa sattāṇṭhaim ca saḥassatevīsa)<sup>2</sup>. Further the circumference of īṣatprāgbhārā prthvī (the abode of the liberated souls) is explained using decimal place value system as “īṣipabbhārā ṇāmaṁ puḍhavīpaṇṇattā, paṇṭālisaṁ satasahassāṇi āyāma vikkhebhenaṁ egā joyaṇakodī bāyālīsaīm ca satasahassāīm tīsaṁ ca saḥassāīm donṇi ya auṇāpaṇṇe joyaṇa sate kimci viśesāhie parikkheveṇaṁ paṇṇattā” which means it is little more than 1,42,30,249 yojana.

In many sūtras, without mentioning the exact figure, the decimal scale is used to describe the approximate value. As, sūtra 196 mentions that saudhdarm heaven is

<sup>2</sup>Prajñāpanā Sūtra, Chief Ed. Yuvācārya Miśrīmal Madhukar. Translator and annotator. Jñāna muni. with text, Hindi translation & commentary. Shri Agam Prakshan Samiti, Beawar. 1984. vol. I, pp. 172.

located at *bahūim joyaṇstāim bahūim joyaṇasahassāim bahūim joyaṇasaya saḥassāim bahugīo joyaṇakodīo bahugīo joyaṇakodākodīo* (many hundreds *yojana*, many thousands *yojanas*, many *lākhyojanas* and many crore *yojanAs*) above *Ratnaprabhā*, the first hell. It reflects that the place value of tens, hundreds, thousands and the like was known to *ācāryas* in ancient age also.

The number of deities under Camrendra<sup>3</sup>, the king of *Asurakumāra*, are 34 lakh *bhavanāvāsa*, 64 thousand *sāmanika*, 33 *trāyanstirśa*, 4 *lokapāla*, etc. Furthermore, it is mentioned that there are *cauṇhaṃ causatṭhīnaṃ āyarakkhadevasāḥassīnaṃ*. It means  $(4) \times (64)$  thousand = 2,56,000 *ātmarakṣaka deities*. It is the evidence of writing simple multiplication in words like modern mathematics.

### 3. Large Numbers, Concept of Zero, Dyadic scale

#### 3.1 Number of Human Beings:

PS *Sūtra* 12.921.1<sup>4</sup>, while enumerating the human population (*audārika baddha*), makes the statements:

- i) Minimum number of human population can be *saṅkhyātakodākodī* which is equivalent to '*sankheijjāo kodākodīo tijamalpayassa uvarim cauṇamalapayassa heṭṭhā, ahava ṇam caṭṭho vaggo pa camavagga padupaṇṇo, ahava ṇam chaṇṇauīcheyaṇagadāi rāsi*'.
- ii) The *sūtra* says that this number is greater than "*tiyamalapaya*" and less than "*cauyamalapaya*". "*yamalapaya*". It means a number with 8 digits, "*biyamalapaya*" is the number with 16 digits, "*tiyamalapaya*" is the number with 24 digits, "*cauyamalapaya*" is with 32 digits, etc. Hence, statement in (i) says that number of digits lies between 24 and 32 digits.
- iii) "*yamalapaya*" also stands for the second successive square of 2 i.e.  $2^{2^2}$ , "*biyamalapaya*" is the 4th successive square of 2, i.e.  $2^{2^{16}}$ , "*tiyamalapaya*" is 6th successive square of 2, i.e.  $2^{64}$ . *Cauyamalapaya* is the 8<sup>th</sup> successive square of 2, i.e.  $2^{256}$ .

Let us say the number of humans is H. According to the section (i) the number of human beings is  $2^{64} < H < 2^{128}$ . As we will see next, this statement is also fully justified.

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<sup>3</sup>*Prajñāpanā Sūtra*, p.154, 174

<sup>4</sup>*Prajñāpanā Sūtra*, vol.II, p.113

The first successive square =  $2^2 = 4 = 2^{2^1}$

The 2<sup>nd</sup> successive square  $4^2 = 16 = 2^{2^2}$

The 3<sup>rd</sup> successive square =  $16^2 = 256 = 2^8 = 2^{2^3}$

The 4<sup>th</sup> successive square =  $256^2 = 65536 = 2^{16} = 2^{2^4}$

The 5<sup>th</sup> successive square =  $65536^2 = 4,294,967,296 = 2^{32} = 2^{2^5}$

The 6<sup>th</sup> successive square

$$(4,294,967,296)^2 = 18,446,744,073,709,551,616 = 2^{64} = 2^{2^6}$$

- iv) This number can be obtained by multiplication of 6<sup>th</sup> successive square of 2 with 5<sup>th</sup> successive square of 2 (as per section (i) stated in the *sūtra*), i.e.  $2^{64} \times 2^{32} = 2^{96} = 18,446,744,073,709,551,616 \times 4,294,967,296 = 79,228,162,514,264,337,593,543,950,336$  (a number with 29 digits, as per section (ii) which is less than  $2^{32}$  and greater than  $2^{24}$ ).

It shows that *ācāryas* during that period were well-versed with such large calculations and the use of squares. They were also aware of the use of dyadic scale and the relation between dyadic and decimal scale. As in the above example, we see that to get the desired number, they multiply the number in dyadic scale, i.e.  $2^{64} \times 2^{32} = 2^{96}$  and the resulting number has 29 digits in decimal scale. The same concept and figure is also enumerated in ADS [12.921.1].

- v) Again the *sūtra* in section (i) states that this number is divisible (by 2) 96 times (*ahava nam chaṇṇauīcheyaṇagadāī rāsī*) i.e. the number  $2^{96}$  can be divided by 2, for a maximum 96 times, which is true.

This is, therefore, a clear evidence of the fact that decimal place value system was known firmly before 6<sup>th</sup> century CE. (probably as early as 3rd century BCE. or even earlier). This also shows that use of zero as a place-value was quite well known by then. The number of human beings contains one zero at a certain place. The 6<sup>th</sup> square of 2 or  $2^{64} = 18,446,744,073,709,555,616$  and the number  $2^{96}$  given above also contain zero as a digit in a certain place. We may, therefore, conclude that decimal place-value system along with zero must have been in practice for a few centuries earlier. They might have named it differently or used blank space or any other symbol in place of zero. But something equivalent to zero was definitely known to them.

#### 4. *Prthaktva*

A beautiful and unique concept found frequently in Jain *āgamic* canonical texts and other works also is the concept of decimal scale separation or *prthaktva*.

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*Puhatta* (*prthaktva*) means separation. It was defined as any number between 2 to 9 (BS 24.1.96) and not as 1 to 9, as 1 was not regarded as a number.

All the later commentators, scholars and *Ācāryas* defined *dasa-puhatta* (ten-separator) as a number between 10 and 90, *sayapuhatta* (hundred-separator) (BS 25.6.417) as a number between 100 and 900, *sahassapuhatta* (thousand-separator) (BS 25.6.421) between 1000 and 9000, *koḍipuhatta* (BS 25.6.450) ( $10^7$ -separator) as a number between  $1 \times 10^7$  and  $9 \times 10^7$ , *sāgarapuhatta* (PS 18.1284) as a number between 1 *sāgara* to 9 *sāgaras*. *sayasāgarapuhatta* (PS 18.1320), a number between 200-900 *sāgaropama*.

*Puhutta* or *prthakatva* is basically a place separator. It denotes shift of place or value of the number. For example, *prthakatva* means any number between 2 to 9, is a range of the numbers having unit place value. The meaning of *dasapuhatta* is interpreted as 10-90 which needs to be revised. However from etymological considerations *dasapuhatta* should be any number from 10 to 99 (= 100 – 1). It holds the place value of ‘tens’ (10). Because if we consider its range 10-90, then the numbers from 91-99 will be left out. Similarly *sayapuhatta* should be any number from 100 to 999 (= 1000 – 1), the range of the numbers of having place value of ‘hundreds’; *sahassapuhatta*, should be any number from 1000 to 9999 (= 10000 – 1); *koḍipuhatta*, any number from  $10^7$  to  $10^8 - 1$ ; *sāgarapuhatta* is any number between 1 *sāgara* and 10 *sāgara* – 1. This concept of *puhutta* (that *puhutta* separates numbers according to places of multiples of tens) is mentioned everywhere in *Āgamic* literature and *karma granthas*. This brings out the fact that decimal scale was prevalent since ancient times in India.

It is widely used to enumerate the range of time, counting, life-span and height of various objects, living and non-living. How long a living being can stay or take birth in the same form? To describe the time span regarding living beings *prthakatva* is used. A *saṃjñī* (living being with mind) can take birth in the *saṃjñī* form for a maximum *śata* (100) *sāgaropama prthaktva*<sup>5</sup> years which means between 100-999 *sāgaropama*. In the same chapter (*sūtra* 1327) articulates the time-span of a female as a female in various realms of life from many perspectives. She can remain a female for a maximum *pūrva koṭi prthakatva* and 110 *palyopama* or *pūrva koṭi prthakatva* and 18 *palyopama* and the like. Later in chapter 21, it is also used to measure height. Maximum height of flying birds (*khecara*) is *dhanuṣa Prthakatva* (2-9 *dhanuṣa*).

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<sup>5</sup>*Prajñāpanā Sūtra*, 18.1389. p.368.

## 5. Rules of Indices

It is clear from the aforementioned example in 3 (iii) that the author of PS was quite conversant with the rules of indices, which means multiplication of powers, where we see the multiplication of 5<sup>th</sup> and 6<sup>th</sup> successive powers of 2 viz.  $2^{32} \times 2^{64} = 2^{(32+64)} = 2^{96}$ .

Rules of indices are also used for fractions. *Sūtra* 12.911.2<sup>6</sup> shows familiarity with rules of exponentiation in respect of fraction while dealing with the number of bound hellish beings with *vaikriya śarīra* which is equivalent to *asaṅkhyāta śreṇī* (lines). The number of space points in one line is equal to *aṅgulapadhamavaggaṃūlam bīyavaggaṃūlam* i.e. multiplication of first square root and second square root of an *aṅgula*

$$(a) = \sqrt{a} \times \sqrt{\sqrt{a}} = a^{1/2} \times a^{1/4} = a^{3/4}$$

Furthermore, it states that the resultant number is equal to *aṅgulabītiyavaggaṃūlaghaṇappamāṇamettāo seḍhīo* i.e. cube of the second square root of *aṅgula* =  $(\sqrt{\sqrt{a}})^3 = (a^{1/4})^3$

Similarly, *Sūtra* 12.921.1 gives the spatial measure of number of human beings as *khettao aṅgulapadhamavaggaṃūlam tatiyavaggaṃūlapadupaṇṇam* i.e. which equals to multiplication of the space points of the first and the square root of an *aṅgula*

$$= \sqrt{a} \times \sqrt{\sqrt{a}} = a^{1/2} \times a^{1/4} = a^{3/4}$$

It clearly confirms that the rules of indices for integral as well as fractional indices were well established during that period.

## 6. Saṅkhyāta (Numerable), Asaṅkhyāta (Innumerable), Ananta (infinite)

Jains have always been fascinated by large numbers. They calculated various aspects of living, non-living beings, geography and astronomy etc. We find the number system in *āgama* in three forms: i) *saṅkhejjā* (numerable) ii) *asaṅkhejjā*

<sup>6</sup>*Prajñāpanā Sūtra*, p.104.

(innumerable) iii) *ananta* (infinite). In *āgama* (BS and ADS), the countable decimal scale of numeration goes up to *Śīrṣaprahelikā* and thereafter subsequent measures are mentioned as simile measures, innumerable and infinite. Though in PS sub-classification of these scales are not found like in ADS, but these measures are used frequently. For example, it is described that there are *saṅkhyāta* lakh birth-places (*jonippamuha*) of undeveloped (*aparyāptaka*) gross (*bādara*) earth-bodied, water-bodied, and fire-bodied living beings. Similarly, the number of *pratyeka vanaspati* (plants) living is *asankhyāta*. There are *asankhyāta jīva* in the root, stem, skin, branch and leaves of multi-seeds trees (*sūtra* 1.41). The length and width of *saudharma* celestial plane is *asankhyātakoṣākoṭi yojana* (197.1). Chapter 1, *sūtra*<sup>7</sup> 54.10 tells about the existence of *ananta* (infinite) souls in one body of *nigoda*. We cannot see just one body, but infinite bodies' altogether becomes subject of our eyes (*dīsanti sarīrāimṇiyojāivāṇa-aṇantāṇam*).

It's so interesting that while dealing with the material aggregates the number of space-points in an object with various shapes are also mentioned. It says that the objects having the shape of ring are *ananta* in number. Furthermore, the question was asked, 'what are the numbers of space-points (*pradeśa*) in such objects – *saṅkhyāta*, *asankhyāta* or *ananta*?' The answer is, sometimes *saṅkhyāta*, sometimes *asankhyāta* and sometimes it is *ananta* (chapter 10, *sūtra* 792-806).

Chapter 15 deals with the six types of living beings in detail. *Sūtra* 985.5 of this chapter mentions that the numbers of space-points in the body of earth-bodied living beings (*prthvikāya*) are *ananta* and the next *Sūtra* tells that they accommodate in the *saṅkhyāta* space-points.

Though this scale of transfinite numbers do not match with modern counting, yet the attempt made 2000 years ago is praiseworthy. The concept of *ananta* can be compared in some ways with infinity of Cantor.

### 7. *Bhaṅga Samutkirtana* (Combinatorics)

The concept of combinatorics can be said as an outcome of the principle of *Syādvāda*, which accepts the existence of multiple views and aspects of any object. This multiplicity gave rise to multiple combination or choices. Permutations (*vikalpa*) and combinations (*bhaṅga*) are various ways to express the different possibilities.

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<sup>7</sup> *Prajñāpanā Sūtra*, vol.I, p.62

Many examples are found where permutation and combination are applied to explain numerous philosophical concepts about matter and living beings. While explaining non-living, *pudgala*, the idea of permutations and combinations in chapter 10 shows that this notion was quite well known to the author of *Prajñāpanā Sūtra*.

Jain philosophy explains *paramāṇu*, the smallest, indivisible particle of matter and their *skandha* at micro level. When two *paramāṇus* combine, they result in an aggregate and, depending on the number of *paramāṇus*, the aggregate is named. For example, aggregate having two *paramāṇus* is known as *dvi-pradeśīskandha*; aggregate having 3 *paramāṇus* is known as *tri-pradeśī skandha* and so on. When these aggregates accommodate in space, then what is the position of the *paramāṇus* of that aggregate? Does any *paramāṇu* hold the end position (*caram*) or non-end (*acaram*) in their arrangement? If yes, then in one aggregate how many possibilities (*vikalpa*) of *paramāṇus* having end or non-end position are there? As an example, there are two possibilities when the aggregate of two *paramāṇus* occupy space-

1. Both occupy separate space points. Then both are at the end position with respect to each other.



2. When both occupy the same point of space, then the situation is inexpressible. For, there is neither beginning nor end as the object occupies one space point only.



For *tri-pradeśī skandha* there are 4 possibilities and in aggregates having 8 *paramāṇus* or *saṅkhyāta*, *asaṅkhyāta* and *ananta paramāṇus*, there are 18 possibilities. This entire discussion is mentioned in *sūtras* 781-789 of the chapter 10.

## 8. Fractions

In *āgamic* literature, fractions were used very proficiently. Chapter 2, *sūtra* 29, while explaining the height of a liberating soul, states that the height of the liberated soul is equivalent to the  $\frac{2}{3}$ <sup>rd</sup> of the height of the human body at the last moment. The maximum height of a human being can be 500 *dhanuṣya*. Therefore maximum height of the liberated soul can be  $333 \frac{1}{3}$  *dhanuṣya*. The medium height can be  $4 \frac{2}{3}$  *hātha* and the minimum can be 1 *hātha* (hand, a measure-unit) and 8 *q*. There are numerous such examples found in this text.

## 9. *Alpa-bahutva* (Maxima and Minima)

In almost all *āgamic* literatures many aspects are dealt with maximum and minimum values and their comparison. Chapter three of PS is dedicated to sequences of maxima and minima with respect to life-span, height, *leśyā*, *kaṣāya*, knowledge, sense-organs etc. in descending or ascending order.

For example, *sūtra* 3 of Chapter 3 explores very beautifully that the number of women is the least of all living beings. Number of men is A (*asamkhyāta*, innumerable) times the number of women; Hellish beings ( $H_0$ ) are A times the number of men, female-animals (*tiryancinī*,  $Fa_0$ ) are A times  $H_0$ ; deities are A times  $Fa_0$ ; female deities ( $Fd_0$ ) are S (*samkhyāta*, numerable) times the number of deities; *siddha* (liberated souls) are I (*ananta*, infinite) times  $Fd_0$  and the entire animal kingdom except females, is I times the number of *siddha*. Many *sūtras* in this text explain this concept.

The second *uddeśaka* of Chapter 17 (*sūtra* 1170-1197)<sup>8</sup> also deals with this concept where *leśyās* are discussed in various living beings like hellish beings, deities and others. For example, the number of souls endowed with *śukla leśyā* ( $S_L$ ) are minimum; that endowed with *padmaleśyā* ( $P_L$ ) are *samkhyāta* times of  $S_L$ ; that endowed with *tejo leśyā* ( $T_L$ ) are *samkhyāta* times of  $P_L$ ; that devoid of *leśyā* ( $Z_L$ ) are *ananta* times of  $T_L$ ; that endowed with *kāpota leśyā* ( $K_L$ ) are *ananta* times of  $Z_L$ ; that endowed with *nīlaleśyā* ( $N_L$ ) are little more of  $K_L$  and with *kṛṣṇaleśyā* are little more of  $N_L$ .

In notation it can be expressed as,

$$P_L = S \times S_L$$

$$T_L = S \times P_L = S^2 \times S_L$$

$$Z_L = I \times T_L = I \times S^2 \times S_L$$

$$K_L = I \times Z_L = I^2 \times S^2 \times S_L$$

$$N_L = K_L^+ = I^2 \times S^2 \times S_L \times (1 + v)$$

$$K_{NL} = N_L^+ = I^2 \times S^2 \times S_L \times (1 + v)^2$$

where, S = *samkhyāta*; A = *asamkhyāta*; I = *ananta*; v is a fractional value ( $0 < v < 1$ )

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<sup>8</sup>*Prajñāpanā Sūtra*, vol.II, p.265



This concept not only shows their comparison ability but it also reflects their knowledge of knowing the number of the beings to make the comparisons.

## 10. *Ṣaṭsthānapatita* (Exponential Growth or Decay)

Many real world phenomena can be modeled by functions that describe how things grow or decay with time. Examples of such phenomena include the studies of populations, bacteria, radioactive substances, electricity, temperature and credit payments, to mention a few.

In Jain *āgama* we find instances of constant growth and decay of many phenomena such as bondage of karma particles, life-span, degree of knowledge, intensity of various qualities such as colour, taste, etc. This exponential growth or decay is described in three-steps (*tristhāna patita*), four-step (*catuṣsthānapatita*) and six-steps (*ṣaṭsthānapatita*).

1. Three-steps (*tristhāna patita*) growth or decay: When the growth or decay takes place in three steps like i) innumerable-th (*asamkhyāta bhāga*), ii) numerable-th (*saṃkhyāta bhāga*) and iii) numerable (*saṃkhyāta guṇa*) times then it is known as *tristhāna patita*.
2. Four-steps (*catuṣsthānapatita*) growth or decay: When the growth or decay takes place in four steps like i) innumerable-th (*asamkhyāta bhāga*), ii) numerable-th (*saṃkhyāta bhāga*), iii) numerable (*saṃkhyāta guṇa*) times and iv), innumerable (*asamkhyāta guṇa*) times then it is known as *catuṣsthānapatita*.
3. Six-steps (*ṣaṭsthānapatita*)- When the growth or decay takes place in six steps like i) infinite-th (*ananta bhāga*), ii) innumerable-th (*asamkhyāta bhāga*), iii) numerable-th (*saṃkhyāta bhāga*), iv) numerable (*saṃkhyāta guṇa*), v) innumerable (*asamkhyāta guṇa*), and vi) infinite (*ananta guṇa*) times, then it is known as *ṣaṭsthānapatita*.

The process of *ṣaṭsthānapatita* or growth can be understood in modern notation as:

- i) **Infinite-th (*ananta bhāga*) growth:** When the infinite-th growth takes place once then it is known as *ananta bhāga* growth. Let's say, I is infinite, then *ananta bhāga vṛddhi* =  $(1 + \frac{1}{I})$  (*ananta bhāga vṛddhi*).

- ii) **Innumerable-th (*asamkhyāta bhāga*) growth:** When step i) (*ananta bhāga vṛddhi*) takes place continuously  $k$  times, then it can be expressed as,  $(1 + \frac{1}{I})^k$ , where  $k = 1, 2, 3, 4, \dots, I$

It is further stated that when such growth ( $k$ ) happens  $I$  number of times then it results in innumerable-th ( $A$ ) part growth, i.e.  $(1 + \frac{1}{I})^I = (1 + \frac{1}{A})$  (*asamkhyāta bhāga vṛddhi*), now the process of growth will go ahead including the previous step.

- iii) **Numerable-th (*samkhyāta bhāga*) growth:** Again with the infinite times  $I^{\text{th}}$  part growth (first step) takes place for  $A$  times. It means when  $(1 + \frac{1}{A})$  happens  $A$  times recursively, then it results in numerable-th ( $s$ ) part growth i.e.  $(1 + \frac{1}{A})^A = (1 + \frac{1}{s})$  (*samkhyāta bhāga vṛddhi*).
- iv) **Numerable (*samkhyāta guṇa*) growth:** When the step iii) repeats  $S$  times recursively, then it results in numerable times growth, say  $\acute{S}$ , i.e.  $(1 + \frac{1}{s})^s = \acute{S}$  (*samkhyāta guṇa vṛddhi*).
- v) **Innumerable (*asamkhyāta guṇa*) growth:** When the step iv), repeats  $\acute{S}$  times recursively, then it results in innumerable times growth, say  $\acute{A}$  then,  $\acute{S}^{\acute{S}} = \acute{A}$  (*asamkhyāta guṇa vṛddhi*).
- vi) **Infinite (*ananta guṇa*) growth:** When the step v) is repeated  $\acute{A}$  times recursively then, infinite growth takes place, which will be expressed as  $\acute{A}^{\acute{A}} = \acute{I}$  (*ananta guṇa vṛddhi*).

This is the process of *ṣaṭsthānapatita* which is used very frequently in *Prajñāpanā*. It reflects that in that period also Jain *ācārya* had the thinking of this exponential growth. Interestingly, this concept of *ṣaṭsthānapatita* seems very similar to the concept of exponential growth in modern mathematics. In the notation of modern mathematics it can be represented as

$$\lim_{n \rightarrow \infty} \left(1 + \frac{1}{n}\right)^n = e$$

Though Jain *ācāryas* went very close to this idea but missed the value of  $e$ , the exponential growth. But conceptually both are the same.

## 11. Infinitesimal

As Jaina *ācaryas* were dealing with very large numbers in terms of innumerable and infinities, they also learned the concepts of very small, i.e. infinitesimals. They came across very small size of the living beings and the space occupied by them, which is very small part of the existing measure-scale.

The term Infinitesimal here is used to count the size of various beings. For an example, *sūtra* 1506.1-1506.7 and 1507.1-1507.3 state that the minimum height of plant-bodied living being (*pariyāpta*, *apariyāpta*, and gross) with *audārika* body is infinite-th<sup>9</sup> part of an *aṅgula* which can be expressed as,  $\frac{1}{A}$  (where A is infinite).

Further PS states in *sūtra* 18.1337 that maximum duration of a soul having *nīla leśyā* (blue aura) is *ukkosenam dasa sāgarovamāim paliovamāsankhejjaibhāgabhiyāim* i.e. 10 *sāgaropama* and *asankhyāta-th* part of *palyopama*.

Minimum and maximum size of all *apariyāpta* beings of two-sensed, three sensed and four sensed beings endowed with *audārika* body is infinitesimal times of an *aṅgula*.

## 12. Conclusions

*Prajñāpanā Sūtra* basically elucidates various aspects of living and non-living beings in detail. Though this text is not completely a mathematical work, but to explain the qualities of these two entities mathematical ideas are used efficiently. *Prajñāpanā Sūtra* was written prior to ADS and here also mathematical ideas were developed and were in use. The strong education system and technology to handle complex calculations higher calculations and counting system developed by the Jain *Ācārya* show their intellect, interest, ability and effort to describe the metaphysical facts.

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<sup>9</sup>*Prajñāpanā Sūtra*, p. 430

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## 36. Concept of *Gaṇitācārya Āryabhata* and Jain Time Cycle

G. C. Jain<sup>1</sup>

### Abstract

This article summarizes the effort to understand the logic put forward by Chandrahari and Shreenadh that Āryabhata was a *Jain*, and the text *Āryabhaṭīya* reflects the Astronomical understanding and *Yuga* system which was followed by the *Jain* community. Jains believe that the universe is not static and there are changes taking place in its modes (*pariyāya*) due to changes in vital *dravyas* on account of biological, chemical, physical and isotopic changes in the time cycle and living conditions in certain areas of the occupied universe (*lokākāśa*). These changes improve and decline at regular intervals within a well defined time frame, resulting in a gradual increase in knowledge, life span, stature, pleasure, morality, and spirituality during the first progressive half of the cycle (*utsarpiṇī*) and a decrease in these parameters in the regressive half cycle (*avasarpiṇī*). These two half cycles together constitute a complete cycle of time (*kalpa*) and last for a long but finite number of years and

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follow each other in unbroken succession. There is nothing like period of complete destruction (*pralaya*) and re-creation at the end of these cycles. However, after an uncountable (*asamkhyāta*) number of progressive and regressive cycles, there is an abnormal regressive cycle called *Huṇḍāvasarpiṇī*, when extraordinary events take place.

## **1. Introduction**

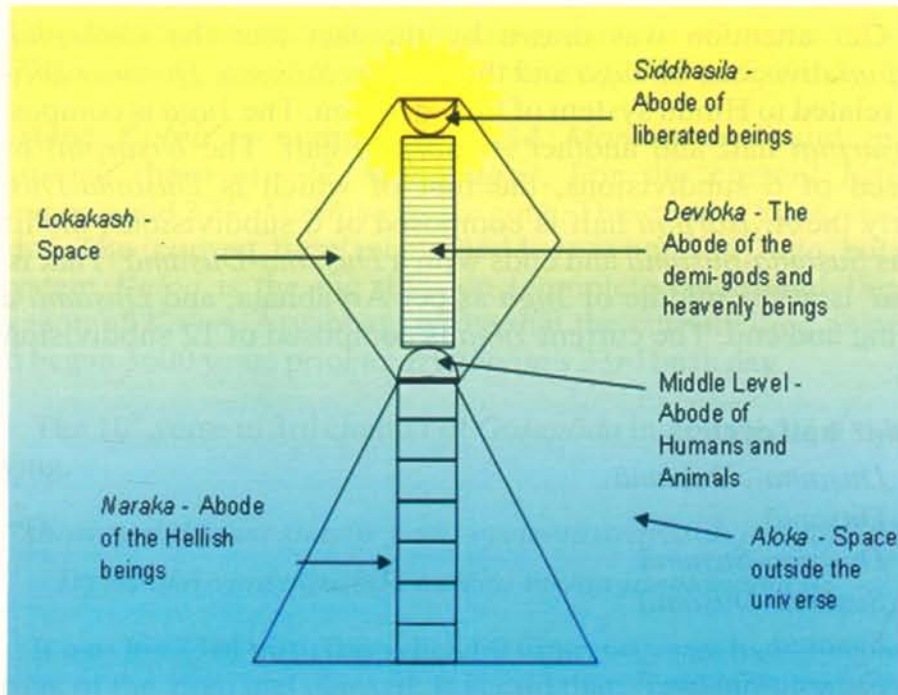
According to the concept of Jain philosophy, the universe (*lokākāśa - alokākāśa*) [1-2] is divided in three regions, the upper (*ūrdhva loka*), middle (*Madhya loka*) and lower (*adho loka*). All events of the universe occur in a *Kālacakra*, the cosmic wheel of time, in ascending-progressive (*utsarpiṇī*) and descending-regressive (*avasarpiṇī*) [3-4] manner, depicted as continuous two half rotations. The *utsarpiṇī* is period of happiness while that of *avasarpiṇī* is of unhappiness. The cosmic wheel of time is further divided in to two halves of six stages: (1) *suṣamā-suṣamā* (extremely happy), (2) *suṣamā* (happy), (3) *suṣama-duṣamā* (more happy than unhappy), (4) *duṣama-suṣamā* (more unhappy than happy), (5) *duṣamā* (unhappy), (6) *duṣama-duṣamā* (extremely unhappy) [5]. These six stages are reversed for the progressive half of the cycle [6]. Liberation (*mokṣa*) is possible only during the third and fourth stages of these half-cycles, when there is no abundance of either happiness or unhappiness.

## **2. Āryabhata**

A similar concept and assertions of Jainism [7] were reflected in the book "*Āryabhatīya*" [8-9] written by the great mathematician Āryabhata who stated that the first half of a *Yuga* is *utsarpiṇī* and the second half is *avasarpiṇī*. *Suṣamā* is the middle of the *Yuga* and *Duṣamā* is the start and end of the *Yuga* as mentioned in the 9<sup>th</sup> verse of the 3rd chapter of *Kālakriyāpāda* in *Āryabhatīya* by Āryabhata.

### **2.1 Time Cycles (*Kālacakra*)**

*Utsarpiṇī Yugārdham Paścādapavsarpiṇī Yugārdham ca/  
Madhye Yugasya suṣamādāvante duṣamenduccāt//"*



The Jain Cosmic Wheel of time

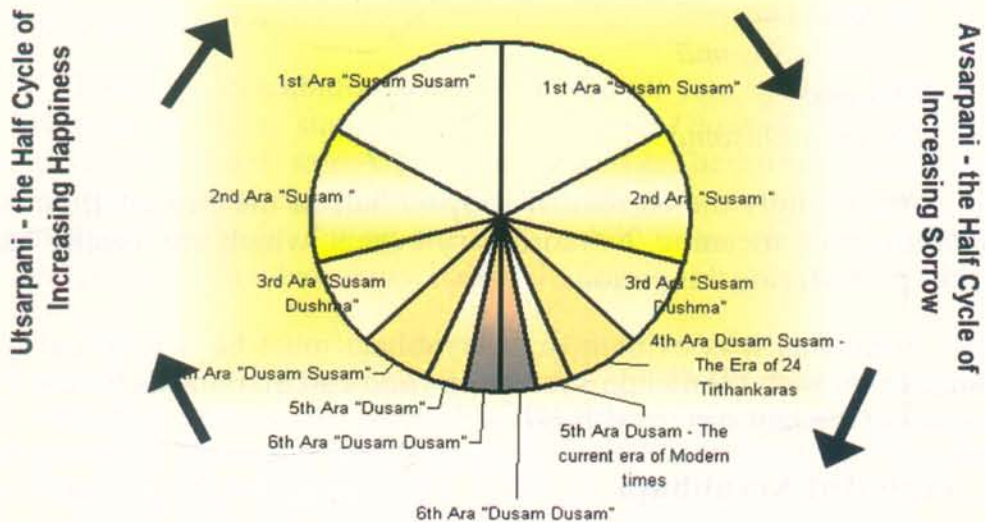


Fig. 1. The Jain concept of *Lokākāśa* and *Alokākāśa* (above) and *Kālacakra* (below) reproduced from [1, 2, 10, 11].

Our attention was drawn by the fact that the *Utsarpiṇī* and *Avasarpiṇī* divisions of *Yuga* and the various *Suṣamā*, *Duṣamā* divisions are not related to Hindu system of time division. The *Yuga* is composed of one *Utsarpiṇī* half and another *Avasarpiṇī* half. The *Utsarpiṇī* half is composed of 6 subdivisions, the first of which is *Duṣama-Duṣamā*. Similarly the *Avasarpiṇī* half is composed of 6 subdivisions, the first of which is *Suṣama-Suṣamā* and ends with a *Duṣama-Duṣamā*. That is why 'Suṣamā' is at the middle of *Yuga* as per Āryabhaṭa, and *Duṣamā* at the beginning and end. The current *Yuga* is composed of 12 subdivisions [6] such as:

***Utsarpiṇī* half cycle:**

*Duṣama – Duṣamā*  
*Duṣamā*  
*Duṣama-Suṣamā*  
*Suṣama-Duṣamā*  
*Suṣamā*  
*Suṣama-Suṣamā*

***Avasarpiṇī* half cycle:**

*Suṣama-Suṣamā*  
*Suṣamā*  
*Suṣama-Duṣamā*  
*Duṣama-Suṣamā*  
*Duṣamā*  
*Duṣama-Duṣamā*

Accordingly the current *Avasarpiṇī* half of the current *Yuga* is a *Huṇḍāutsarpiṇī*, meaning, extraordinary events, which are usually bad, can take place during this period.

From this it is evident that Āryabhaṭa must be a Jain and had nothing to do with the Hindu system of *Yuga* calculations as he used to speak about the Jain system of *Yuga*.

## **2.2. Period of Āryabhaṭa**

Now we look at the following verse present in *Āryabhaṭīya* – 5th verse in Chapter 1 of *Gitikāpada*:



“ *Kāho Manavo dha manuyugāh śkha gatāste ca manuyugā Cnā ca Kalpāderyugapādā ga ca gurudivasācca, Bhāratātpūrvam* ”

One *Kalpa* is composed of 14 *Manvantaras* and in each *Manvantara* there are 72 *Mahāyugas*. For the current *Kalpa*, 6 *Manvantaras* and  $27\frac{3}{4}$  *Mahāyugas* are gone. This current *Yuga*, started on Thursday. The ‘current *Yuga*’ mentioned here is not *Kali Yuga*, but as per Jain system *Kalpa* is the big division (complete cycle) and *Yuga* is a subdivision of *Kalpa*. Āryabhata wrote that the current *Yuga* as per Jain system began 3600 years prior to Āryabhata's 23rd birth day.

The 10<sup>th</sup> verse in 3rd chapter of *Golapāda* in *Āryabhaṭīya* states the following:

“*shashtyabdānam shastir yadā vyeteetāstrayascha yugapādā Tryadhikā vimśatirabda tadeha mama janmanoneetā*”

It was his 23rd birth day when 60 times 60 years had gone, and the 3 quarters of the *Yuga* had elapsed. It is said that *Āryabhaṭīya* was written in 499 CE. It implies that the *Yuga* as per Jain tradition began on 3102 BCE. When 3600 years had elapsed after the beginning of the current *Yuga* (not *Kali yuga*), Āryabhata's age was 23 years and he had written the book in 499 CE that the *Yuga* as per Jain tradition began in BCE 3102 and it was Thursday of *Śuklapakṣa Pratipadā* of the lunar month of *Caitra*.

The *Yuga* calculation is based on the 60 year cycles. "Out of 12 subdivisions of *Yuga* starting with a *Duṣama-Duṣamā* subdivision, 3 quarters have elapsed" said Āryabhata.  $3 \times 4 = 12$ . Therefore 3 quarters had elapsed means, 9 such subdivisions had elapsed (as on CE 499) and Āryabhata was living during the 10th subdivision which is *Duṣama-Suṣamā* period of the *Avasarpiṇī* half of the *Yuga*.

The above quote also helps in finding out the span of a single subdivision such as *Suṣamā* etc. As per Āryabhata [9] such subdivisions had elapsed in 3600 years,  $3600/9 = 400$  years. Thus the span of a *Yuga* (composed of *Utsarpiṇī* and *Avasarpiṇī* half) mentioned by Āryabhata would be  $400 \times 12 = 4800$  years.

Āryabhata himself indicated this in the following words:

*Kāloyamanādyanto grahabhairanumeeyate khetre (Āryabhaṭīya 3/11).*

It was a *Śuklapakṣa Pratipadā* of the lunar month of *Caitra* with the concept that time is endless.

### **3. The Time Scales**

#### **3.1 Jain View**

Two views exist in Jainism [10] with regards to time. First, Time is an imaginary concept, it has no real existence and is without a beginning and eternal whereas the second view is that Time has a real existence consisting of innumerable time atoms and is beginningless and eternal. The changes in living beings and non-living beings are measured in the units of time. However time is not the cause of the changes in living beings and non-living substances.

##### **3.1.1 The Jain Time Scale**

The smallest indivisible portion of time is called *Samaya* [11-12]. Combination of *samayas* are: moment, second, minute, hour, day, month, year, etc.

innumerable *samayas* = one *āvalī* (time required to blink an eye)

16,777,216 *āvalīs* = one *muhūrta* (48 minutes)

30 *muhūrtas* = one day

15 days = one fortnight

2 fortnights = one month

12 months = one year

innumerable years = one *palyopama*

1,000,000,000,000,000 *palyopamas* = one *sāgaropama*

## 3.2 Vedic Time Scales

Unit*	Definition	Equivalent (Approx.)
<i>Truti</i>		0.031 $\mu$ s
<i>Renu</i>	60 <i>Truti</i>	1.86 $\mu$ s
<i>Lava</i>	60 <i>Renu</i>	0.11 ms
<i>Līkaka</i>	60 <i>Lava</i>	6.696 ms
<i>Lipta</i>	60 <i>Līkaka</i>	0.401 s
<i>Vipala</i>		
<i>Pala</i>		
<i>Vighai</i>	60 <i>Lipta</i>	24.1056 s
<i>Vinādī</i>		
<i>Ghai</i>	60 <i>Vighai</i>	24 min
<i>Nādī</i>		
<i>Danda</i>		
<i>Muhūrta</i>	2 <i>Ghāī</i>	48 min
<i>Ahorātram</i>	60 <i>Ghāī</i>	24 h
(Sidereal Day)	30 <i>Muhūrta</i>	24 h

\* Smallest unit is Truti which is equivalent to approximately 0.031  $\mu$ s.

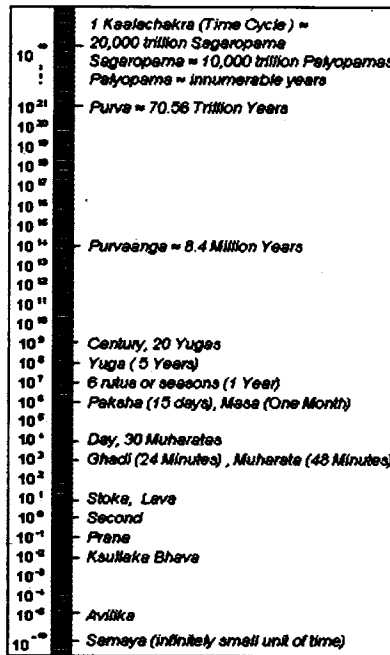


Fig. 2. Jain Time Scale (*Kāla*) reproduced from [11-12].

### **3.3 Comparison of Jain and Hindu Time Scales**

Jain Time unit is <i>Samaya</i> , equivalent to	$10^{-\infty}$ seconds
Hindu (Vedic) Time Unit is <i>Truti</i> , equivalent to	$10^{-4}$ seconds

### **4. Conclusions**

I would like to suggest that it is the right time to review and rewrite the Indian history, particularly the Jain history, pertaining to the actual events that had taken place in India in the past, especially during the *Vedic*, *Mahāvīra* and *Buddha* periods. Many historic personalities such as emperor Candragupta Maurya, Porus, Aśoka, Āryabhata, Khāravēla, Cāṇakya, Lala Lajpatrai and many others are still considered to be non-Jains and their history needs to be set right by incorporating the historical and research evidences. The above mentioned verses written by Āryabhaṭa in "*Āryabhaṭīya*" make us believe that the great ancient mathematician was a Jain scholar.

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## 37. A Mathematical Model of the *Kārmic* Load

Subhash C. Jain<sup>1</sup>

### Abstract

A mathematical model of the karma doctrine is developed to study the functional details of the rebirth process. According to the Jain karma doctrine, the rate of inflow of the *kārmic* load into the *kārmic* body (*kārmaṇa śarīra*) of a living being (*jīva*) is a function of the intensity of *yoga-plus-moha* of the actions of the living being. Based on a hypothesis that the rate of *kārmic* load is an exponential function of the intensity of *yoga* and *moha*, a mathematical expression for the rate of flow of *kārmic* load is developed, and using this expression, a governing equation for the rate of change in *kārmic* load of the *kārmic* body is formulated. This equation is solved to compute the rate of change in *kārmic* load, which, in turn, is used to predict the *jīva* class in the next life. The following hypothesis is used to interpret the solution of the governing equation: “A living being moves up on the ‘ladder’ from one-sensed to five-sensed living being and finally achieves liberation as its *kārmic* load decreases from the maximum in the *nigoda* to zero in the *mokṣa* or liberation”. The variation of the *kārmic* load as a function of time is presented in a graphical form for a few initial and boundary conditions. The solutions of the governing equations are helpful in learning the functional details of the rebirth process. Similar studies will be valuable to unearth the treasures of knowledge buried in the philosophy of the karma doctrine.

### 1. Introduction

According to the Jain karma doctrine, living beings have been wandering in the cycle of life, death, and rebirth, termed *samsāra*, since beginningless time and will continue to do so as long as their *kārmic* load (*karma bhāra*) stays with their *kārmic* body (*kārmaṇa śarīra*).

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The *kārmic* load depends on the nature of actions performed by a living being in its past and present lives. The soul of a living being attains liberation from the clutches of rebirth on annihilating the *kārmic* load. Prior to liberation, the soul keeps transmigrating among the four birth categories (*gatis*): infernal (*naraka*), celestial (*deva*), human (*manuṣya*), and subhuman (*tiryāṇca*) [1].

The statement that auspicious and inauspicious actions in past lives respectively lead in future lives to higher *gatis*, namely, human and celestial *gatis*, and lower *gatis*, namely, infernal and subhuman *gatis*, does not fully address the issue of rebirth, as most human beings perform both auspicious and inauspicious actions. Consider a hypothetical state of a person who has performed equal amounts of auspicious and inauspicious actions in the past and present lives: which *gati* is his soul going to transmigrate to, in the next life? Many tales in scriptures imply that the next *gati* is a consequence of a specific action performed in the previous life, but it is rather impossible to come up with a criterion that allows to single out one specific action among innumerable actions performed in human life for determining the next *gati*. It seems such tales are described just to illustrate the causation between actions and the *gatis*. A more logical parameter for determining the next *gati* is the *kārmic* load of the past *ghātiyā* karmas, instead of an individual action. Though the term *kārmic* load is frequently mentioned in scriptures, any formula to quantify the *kārmic* load does not exist.

## 2. Classification of *Jīvas*

*Jīvas* (living beings) in Jainism are classified into two types: Fine (*sūkṣma*) and gross (*bādhara*) [2]. The fine living beings are only one-sensed living beings that permeate all space in the universe. They are not visible to naked eyes, and have the least developed form of life, called *nigoda*. The gross living beings range from one-sensed to five-sensed living beings. The five-sensed living beings are further divided into two types: *sañjñī* (with mind) and *asañjñī* (without mind). Each of the seven types of living beings (namely, one type of fine-bodied, one-sensed living beings and six types of gross-bodied one-sensed, two sensed, three-sensed, four-sensed, five-sensed *asañjñī*, and five-sensed *sañjñī* living beings) may be *paryāpta* or *aparyāpta* living beings [3]. The five-sensed-*sañjñī*-*paryāpta* beings can be subhuman, human, infernal, or celestial beings. Only *paryāpta* subhuman and human beings are dealt with in this paper. There are eight types of *paryāpta* subhuman and human beings that have *prāṇa* (vitality) that range from four to ten, as shown in Table 1. The *jīvas* in Table 1 are arranged in the increasing number of *prāṇas*. The one-sensed *jīvas* have a minimum number of four *prāṇas* and the five-sensed *sañjñī* *jīvas* have ten *prāṇas*.

**Table 1: Number of *Prāṇa* in Various *Jīva* Classes**

S. No.	<i>Jīva</i> Class	Number of <i>prāṇa</i>
1	<i>Nigoda</i>	4
2	One-sensed subhuman	4
3	Two-sensed subhuman	6
4	Three-sensed subhuman	7
5	Four-sensed subhuman	8
6	Five-sensed <i>asañjñī</i> -subhuman	9
7	Five-sensed <i>sañjñī</i> -subhuman	10
8	Human	10

As mentioned above, the fine-bodied one-sensed living beings have the least developed form of life. It is easy to identify the order of the developed form of life of the gross-bodied *jīvas*, as they are visible to naked eyes. The gross-bodied *jīvas* in the increasing order of the developed form of life are: one-sensed *jīvas* with four *prāṇas*, two-sensed *jīvas* with six *prāṇas*, three-sensed *jīvas* with seven *prāṇas*, four-sensed *jīvas* with eight *prāṇas*, five-sensed *asañjñī* *jīvas* with nine *prāṇas*, and five-sensed *sañjñī* *jīvas* with ten *prāṇas* [4]. The form of life of a subhuman being with a larger number of *prāṇas* is more developed than that of a subhuman being with a smaller number of *prāṇas*. In other words, the form of life of the subhuman beings becomes more developed with the increasing number of *prāṇas*. The mind of human beings is more advanced than that of *sañjñī*-subhuman beings; the life form of human beings is, therefore, more developed than that of *sañjñī* subhuman beings.

### 3. Conceptual Scheme of Evolution

The fundamental tenet of Jainism is the karma principle. The law of karma, similar to physical laws, is a universal law that operates at every moment and everywhere in the universe [5]. The law-of-karma-governed consequences of an action are also universal. The law-of-karma-governed consequences of actions depend on the intensity of *yoga-plus-moha* of actions and do not depend on the time, place, and gender of the doer of actions. Three processes occur simultaneously within each living being: (1) detachment of the old karma of their past actions; (2) execution of new actions; and (3) attachment of the new karma of their new actions. Due to these three processes the modes (*paryāya*) of their soul and physical and *kārmaṇa* bodies keep changing. The mode of the *kārmaṇa* body of a living being at some moment during the final third of its present life span determines the *jīva* class in its



next life. The moment when a living being binds the *āyu* karma of its next life is termed as age-bonding moment. The main parameter of the mode of the *kārmaṇa* body that determines the *jīva* class in the next life is the *kārmic* load of the *ghātiyā* (destructive) karmas accumulated in the *kārmaṇa* body at the age-bonding moment in the present life.

The conceptual scheme of evolution of living beings to the various *jīva* classes is based on the following two presuppositions:

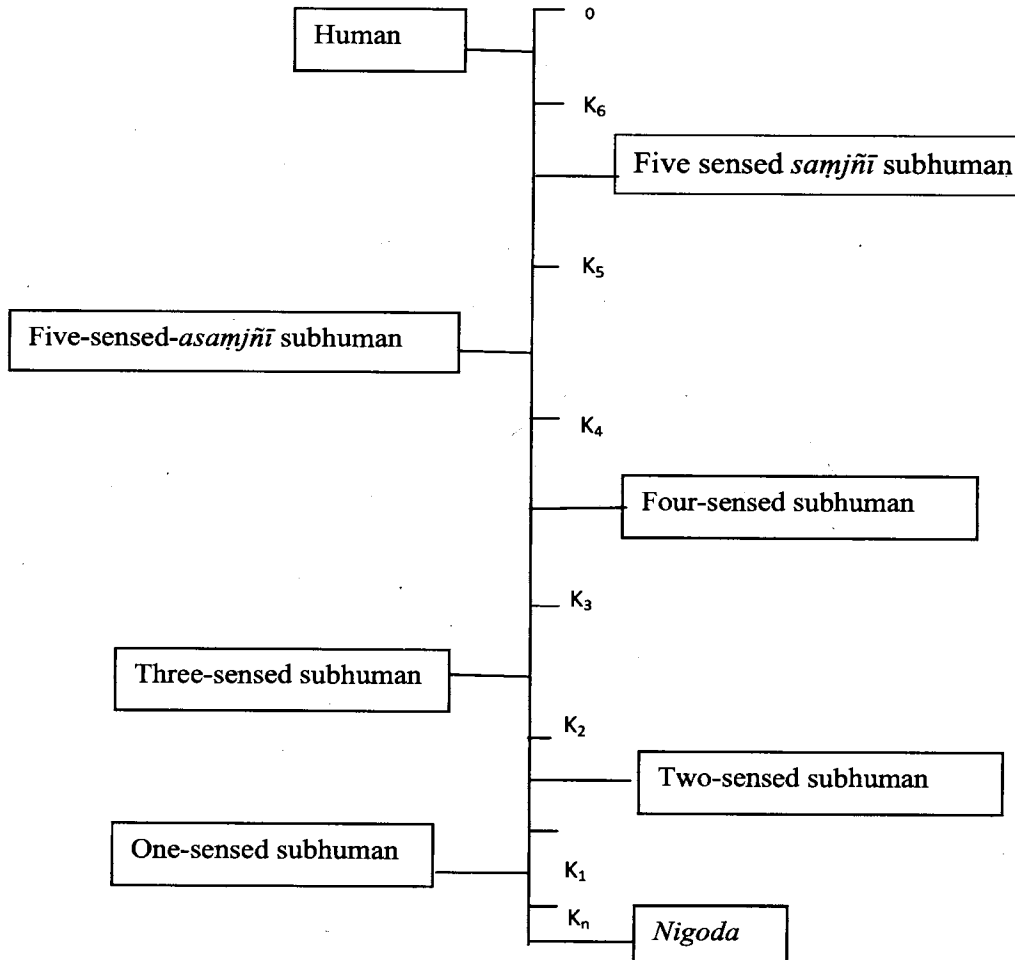


Figure 1: *Jīva* Classes vs *Kārmic* Load

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Presupposition 1: *The jīva class in the next life is determined by the kārmic load of the ghātiyā karmas at the age-bonding moment in the present life.*

Presupposition 2: *The less is the kārmic load at the age-bonding moment of a jīva in the present life, the more developed form of life of that jīva will be in its next life and vice versa.*

**Table 2: Jīva Class in the Next Life**

*Kārmic load K at the age-binding moment*

	Equal to or greater than	Less than
<i>Nigoda</i>	$K_n$	--
One-sensed subhuman	$K_1$	$K_n$
Two-sensed subhuman	$K_2$	$K_1$
Three-sensed subhuman	$K_3$	$K_2$
Four-sensed subhuman	$K_4$	$K_3$
Five-sensed- <i>asañjñī</i> subhuman	$K_5$	$K_4$
Five-sensed- <i>sañjñī</i> subhuman	$K_6$	$K_5$
Human	0	$K_6$

Based on these two presuppositions, the *jīva* class in the next life for the range of *kārmic* load at the age-bonding moment in the present life is given in Figure 1 and Table 2. For example, a *jīva* would be the four-sensed subhuman being in the next life if its *kārmic* load,  $K$ , at the age-binding moment in the present life is greater than or equal to  $K_4$  and less than  $K_3$ , i.e.,  $K_3 > K \geq K_4$ . Note that  $K_n > K_1 > K_2 > K_3 > K_4 > K_5 > K_6 > 0$ . The detailed explanation of Figure 1 and Table 2 can be found elsewhere [6].

In order to use Table 2, numerical values of various *kārmic* loads ranging from  $K_1$  to  $K_6$  are required. Some estimates of various *kārmic* loads can be made with the knowledge of *guṇasthānas* (spiritual stages). The lowest spiritual stage is the *mithyādr̥ṣṭi guṇasthāna*. All *jīvas* have to go through this stage. The *jīva* attaches all 28 subtypes of the *mohanīya* karma at this stage. As the *jīva* climbs the ‘ladder’ of the fourteen spiritual stages, it attaches less number of subtypes of the *mohanīya* karma; and consequently its *kārmic* load decreases. There is bondage-cessation of four subtypes of the *mohanīya* karma at the end of the first stage [7]. In other words, the *jīva* attaches only 24 subtypes of the *mohanīya* karma at the end of the first stage. If

one assumes that the *kārmic* load of the *ghātiyā* karmas is proportional to the number of attached subtypes of the *mohanīya* karma, then the *jīva* carries 24/28, i.e. 86% of its maximum *kārmic* load  $K_n$  at the end of the first stage and loses only 14% of its maximum *kārmic* load in the first stage. Because only five-sensed *sañjñī jīvas* are capable to leave the first stage, they can only lose 14% of their *kārmic* load at the end of the first stage. It implies that *asañjñī jīvas* lose less than 14% as they evolve from one-sensed to five-sensed *sañjñī jīvas*. The following values of the various *kārmic* loads, though arbitrary, illustrate the point:  $K_n = 100\%$ ,  $K_1 = 99\%$ ,  $K_2 = 98\%$ ,  $K_3 = 97\%$ ,  $K_4 = 95\%$ ,  $K_5 = 93\%$ , and  $K_6 = 90\%$ .

#### 4. Kārmic Load

Living beings constantly attach new karmas to, and detach the matured old karma from, their *kārmic* body, as schematically shown in Figure 2. *Kārmic* load is determined by the four parameters: the amount of *kārmic* matter, called *pradeśa bandha*; the species of karma, called *prakṛti bandha*; the time of fruition, called *sthiiti bandha*; and intensity of fruition, called *anubhāga bandha*.

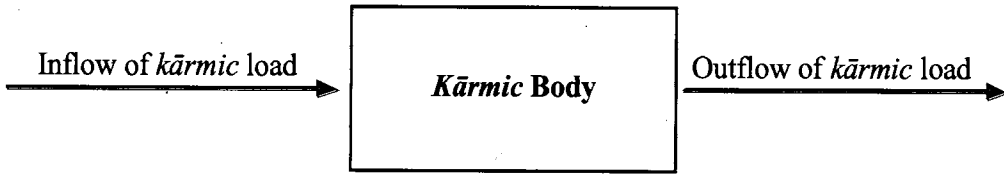


Figure 2. Inflow and outflow of the *kārmic* load from the *kārmic* body.

The first two parameters *pradeśa* & *prakṛti bandha* are determined by intensity of the physical action of mind, speech, and body, called *yoga*. The other two parameters are controlled by the intensity of *moha* (delusion-cum-attachment/aversion) of actions. *Moha* is one of the defiling perversions of the soul and it includes *mithyātva* (delusion), *kaṣāya* (passions), and *nokaṣāya* (emotions). In other words, the intensity of *yoga*-plus-*moha* of actions determines the rate of *kārmic* load of the *ghātiyā* karmas. As a result of the inflow of karma to, and outflow of karma from, the *kārmic* body, the *kārmic* load of the karma attached to the soul increases or decreases. If the inflow rate of *kārmic* load is larger than the outflow rate of *kārmic* load, the *kārmic* load of the *kārmic* body increases and vice versa. This statement about the *kārmic* load can be expressed in the form of a mathematical equation as

$$\Delta K = I_1 \Delta t - I_2 \Delta t \quad (1)$$

where  $\Delta K$  = change in *kārmic* load  $K$  of the *kārmic* body in time  $\Delta t$ ,  $I_1$  = rate of inflow of *kārmic* load, and  $I_2$  = rate of outflow of *kārmic* load.

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As mentioned above, the rate of flow of *kārmic* load is determined by the intensity of *yoga-plus-moha* of the actions of the living beings. It is hypothesized that the rate of flow of *kārmic* load can be expressed as an exponential function of the intensity of *yoga* and *moha*. Based on this hypothesis, the rate of flow of *kārmic* load can be expressed as

$$I = C_1 Y^N M^Q \quad (2)$$

where  $I$  = the rate of flow of *kārmic* load,  $Y$  = the intensity of *yoga*,  $M$  = the intensity of *moha*,  $C_1$  = constant, exponent  $N > 0$  and exponent  $Q > 0$ . To simplify the model, it is further assumed that intensity of *yoga* depends on the intensity of *moha*. Based on this assumption,  $Y$  can be expressed as

$$Y = C_2 M^R \quad (3)$$

where  $C_2$  = constant and exponent  $R > 0$ . Equation 2, on substituting for  $Y$  from Eq. 3, can be written as

$$I = CM^S \quad (4)$$

where  $S = NR + Q > 0$ , and  $C = C_1 C_2$  = constant. Equation 1 on substituting for  $I$  in terms of  $M$  from Eq. 4 can be written as

$$\Delta K = CM_1^S \Delta t - CM_2^S \Delta t \quad (5)$$

It is difficult to determine the units of  $K$  and  $M$ . The problem of units of  $K$  and  $M$  can be circumvented by normalizing  $K$  and  $M$  with the maximum *kārmic* load  $K_n$  at the age-bonding moment of *nigoda jīvas* and the corresponding maximum intensity of *moha*  $M_n$  of *nigoda jīvas*. Moreover, let  $K_n = CM_n^S T$ , where  $T$  is a characteristic time. Equation 5 can be written as

$$\frac{\Delta K}{K_n} = \frac{CM_1^S \Delta t}{CM_n^S T} - \frac{CM_2^S \Delta t}{CM_n^S T} \text{ or } \Delta \bar{K} = \bar{M}_1^S \Delta \bar{t} - \bar{M}_2^S \Delta \bar{t} \quad (6)$$

where the normalized *kārmic* load  $\bar{K} = K/K_n$ ; the normalized inflow rate of the *kārmic* load  $\bar{M}_1^S = M_1^S/M_n^S$ ; the normalized outflow rate of the *kārmic* load  $\bar{M}_2^S = M_2^S/M_n^S$  and the normalized time  $\bar{t} = t/T$ . Equation 6 can be written in the form of a differential equation as

$$d\bar{K}/d\bar{t} = \bar{M}_1^S - \bar{M}_2^S \quad (7)$$

Equation 7 can be further simplified by assuming

$$\overline{M}_2 = \gamma \overline{M}_1 \quad (8)$$

where  $\gamma = \text{constant}$ . Substitution for  $\overline{M}_2$  from Eq. (8) into Eq. (7) yields

$$d\overline{K}/d\overline{t} = -(\gamma - 1)\overline{M}_1^S \quad (9)$$

$\gamma > 1$  means that the intensity of *moha* of the outgoing karmas is more than that of the incoming karmas. This statement implies that rate of outflow of *kārmic* load is more than the rate of inflow of the *kārmic* load, which in turn means that the *kārmic* load should decrease with time. It should be noted that the maximum and the minimum values of each of  $\overline{K}$  and  $\overline{M}_1$  are 1 and 0, respectively. The bar over the variables  $K, M, t$ , etc. is omitted hereinafter for convenience.

## 5. Solution

Equation 9 can be solved for the normalized *kārmic* load  $K$  for the given values of  $M_1$  as a function of normalized time  $t$ . Consider a conceptual case of a *jīva* whose *moha* decreases with time as shown by the dotted curve in Figure 3. The dotted curve is approximated by  $n$  straight-line segments to obtain the analytical solution of Eq. 9. Though Eq. 9 can be solved theoretically for a large value of  $n$ , the solutions are presented for two simple cases with  $n=1$  and  $n=2$  to gain insight in the rebirth process.

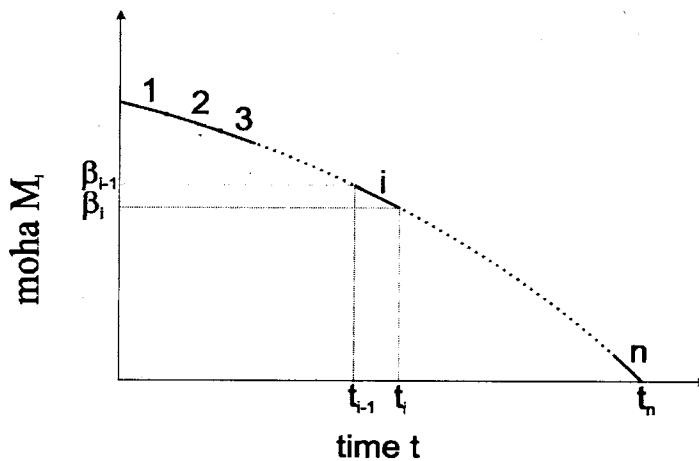


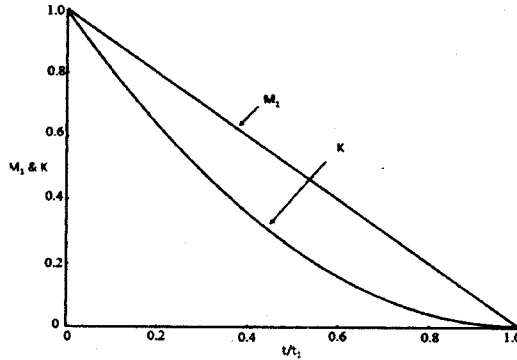
Figure 3: Variation of Moha with Time

Case 1 for  $n=1$ : The intensity of *moha* is assumed to be decreasing at a constant rate as the living being evolves from one-sensed subhuman being to human being and achieves liberation. The intensity of *moha*  $M_1$  is given by the equation

$$M_1 = 1 - t/t_1 \quad (10)$$

Equation 10 is shown in Figure 4 as a straight line. The intensity of *moha* is the maximum of 100% at time  $t/t_1 = 0$  when the living being has the least developed form of life, and the intensity of *moha* is the minimum of zero at time  $t/t_1 = 1$  when the living being has achieved liberation. The solution of Eq. 9 for the intensity of *moha* given by Eq. 10 and for

$$K(0) = M_1(0) = 1; K(t_1) = M_1(t_1) = 0; \gamma > 1 \text{ is}$$



**Figure 4: Kārmic Load for S=1.**

$$K = \left(1 - \frac{t}{t_1}\right)^{S+1} \quad (11)$$

where

$$t_1 = (S + 1)/(\gamma^S - 1) \quad (12)$$

The variation of  $K$  with normalized time given by Eq. 11 is shown in Fig. 4 for  $S=1$ . As *moha* decreases with time, the *kārmic* load also decreases with time as expected. The *kārmic* load is the maximum of 100% at time  $t/t_1 = 0$  for the one-sensed living being as it comes out of (*nitya*) *nigoda* and it is the minimum of zero at time  $t/t_1 = 1$  for the liberated living being. On the assumption that  $K_6/K_n \approx 0.90$ , the value of normalized time for this normalized *kārmic* load from Fig. 4 is about 0.04. It means the *jīva* spends only 4 percent of its time as subhuman being and 96 percent of its time as human being. The probability of such occurrence is negligibly small. It is unlikely that the value of  $\gamma$  remains constant during the evolution of the living being.

Case 2 for  $n=2$ : The variation of *moha*  $M_1$  is represented by two straight-line segments, as shown in Figure 5. The first and second straight-line segments

respectively represent the variation of *moha* of a *jīva* as a subhuman and a human being. The equations of the two straight-line segments are given by

$$M_1 = m_1 t + 1 \text{ for } t_1 \geq t \geq 0 \quad (13)$$

$$M_1 = m_2(t - t_2) \text{ for } t_2 \geq t \geq t_1 \quad (14)$$

where  $m_1 = (\beta_1 - 1)/t_1$  and  $m_2 = \beta_1/(t_1 - t_2)$ . Eqs. 13 and 14 in Fig. 5 are shown for an arbitrary value of  $\beta_1 = 0.95$ . The solution of Eq. 9 for the conditions given by Eqs. 13 and 14 and for  $K(0) = M_1(0) = 1$ ;  $K(t_1) = K_6$ ;  $M_1(t_1) = \beta_1$ ;  $K(t_2) = 0$ ;  $M_1(t_2) = 0$  is given by

$$K = 1 - (\gamma_1 - 1)t \left\{ 1 + \left( \frac{m_1}{2} \right) t \right\} \text{ for } t_1 \geq t \geq 0 \quad (15)$$

$$K = - \left( \frac{m_2}{2} \right) (\gamma_2 - 1)(t - t_2)^2 \text{ for } t_2 \geq t \geq t_1 \quad (16)$$

$$t_1 = \left\{ \frac{2}{\gamma_1 - 1} \right\} \left\{ \frac{1 - K(t_1)}{1 + \beta_1} \right\} \quad (17)$$

$$t_2 = t_1 + 2K(t_1)/\{\beta_1(\gamma_2 - 1)\} \quad (18)$$

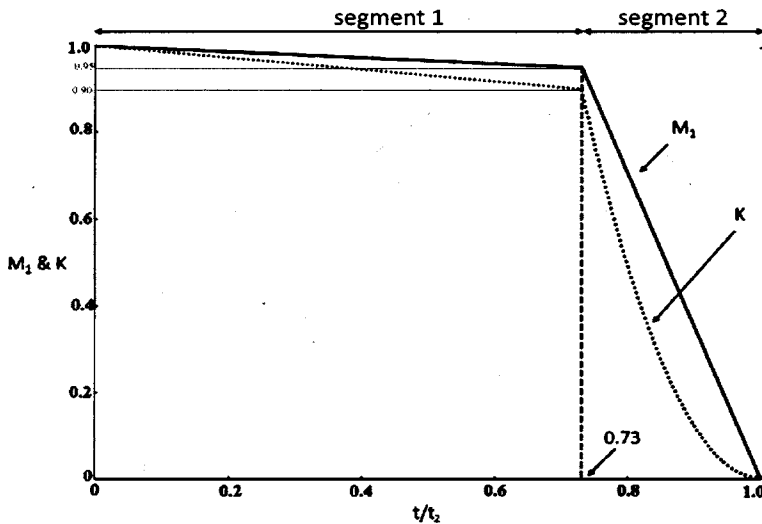


Figure 5: Kārmic Load for  $\beta_1 = 0.95$ ,  $K(t_1) = 0.90$ ,  $\gamma_1 = 1.001$  and  $\gamma_2 = 1.05$

The variations of *kārmic* load given by Eqs. 15 and 16 are shown in Figure 5 for arbitrary values of  $\beta_1 = 0.95$ ,  $K(t_1) = 0.90$ ,  $\gamma_1 = 1.001$ , and  $\gamma_2 = 1.05$ . For these values of the various parameters, the *jīva* spends 73% percent of its time as a subhuman being and the remaining 27% of time as a human being. The value of the parameter  $\gamma$  for the segment 1 is  $\gamma_1 = 1.001$ , which means that the rate of outflow of *kārmic* load is 0.1% larger than the rate of inflow of *kārmic* load. The rate of change of *kārmic* load during the life as a subhuman being is so small that it takes 73% of

time for the *kārmic* load to decrease from 100% to 90%. The value of  $\gamma$  for segment 2 is  $\gamma_2 = 1.05$ , for which the rate of change of *kārmic* load during the life as a human being is relatively large that it takes 27% of time for the *kārmic* load to decrease from 90% to zero. It should be pointed out that the rate of change of the *kārmic* load in Figure 5, decreases with time for both the subhuman and human beings, which is not correct. The model can be improved by selecting an appropriate function for the parameter  $\gamma$ .

## 6. Conclusion

The development of the life-form of living beings is characterized by the number of the vital powers, which in turn are determined by the *kārmic* load accumulated in their *kārmic* body. The preliminary attempt to develop a mathematical model of the *kārmic* load demonstrates that it is feasible to use mathematical techniques to unearth the “treasure” of knowledge buried in the scriptures on the karma doctrine.

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## 38. Mathematical Research in Jaina Philosophy

*Anupam Jain*<sup>1</sup>

### Abstract

'*Śramaṇa*' (ascetic) and '*Vedic*' (ritualistic) traditions were two main cultures in ancient India. The references made to '*Śramaṇa*' culture in Vedas indicate the antiquity of '*Śramaṇa*' tradition. There are two streams of '*Śramaṇa*' cultures and Jaina being one of them. Ancient Indian scholars held the view that the best use of knowledge is in understanding the religion and philosophy and for performing religious ceremonies.

In Jaina literature, we find not only elementary but quite advanced form of mathematics like set theory, karma quantum system theory, theory of series and sequences, combinatorics, logarithms, number theory, fascination with large numbers, and crude ideas about the multitude of infinities etc. Jaina *Ācāryas* used mathematics as a tool

1. To explain cosmological details and description of the three-fold universe. It is used in determining the length, area and volume of the different sections of this three-fold universe, mainly of different mountains, rivers and parts of our earth (*Jambūdvīpa*).
2. To explain different types and sub-types of karmas, their

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operations of uprising, binding and shedding of karmas and the net effect of their infinitude of combinations.

3. To determine auspicious place and time for religious ceremonies like *dīkṣā* (initiation) and *Pratiṣṭhā* (consecration).
3. To train pupils (householders) in basic Mathematics (*Laukika Gaṇita*) required in daily life and construction of temples, houses, etc.
4. To explain Jaina logic system for establishment of logical facts and reconciliation of diverse views. Modern mathematical logic is available in the texts of Jaina *Nyāya* (Logic).

It is clear that Mathematics is an integral part of Jaina literature. The Jaina canonical and post canonical literature are full of Mathematical knowledge and this is identified as Jaina Mathematics or Jaina School of Mathematics. The term Jaina School of Mathematics was first used by B. B. Datta in 1929. The canonical works *Sūtrakṛtāṅga*, *Sthānāṅga*, *Bhagavatī*, *Jīvābhigama*, *Prajñāpanā*, *Sūryaprajñapti*, *Candraprajñapti*, *Jambūdvīpaprajñapti*, *Anuyogadvārasūtra*, *Tattavārthādhigamasūtra - bhāṣya*, *Viśeṣāvaśyaka-bhāṣya*, and *Karmaprakṛti* of *Śvetāmbara* tradition and *Kaśāyaprābhṛta*, *Ṣaṭkhaṇḍāgama*, *Pañcāstikāya*, *Tiloyapaṇṇattī*, *Dhavalā*, *Jayadhavalā*, *Gommaṭasāra*, *Trilokasāra*, *Jambūdvīpapaṇṇattisaṃgaho*, *Karma Granthas* etc. of *Digambara* tradition are rich in mathematical content.

Texts of *Pāṭīgaṇita* written by Śrīdharācārya, Mahāvīrācārya, Rājāditya, Siṃhatilaka Sūri, Thakkura Pherū and others were composed to train pupils in Mathematics for better understanding of canonical texts and for use by householders.

Broadly we can classify the entire mathematical content found in Jaina Literature in two parts:

1. Worldly Mathematics (*Laukika Gaṇita*)
2. *Parā*<sup>1</sup>-Worldly Mathematics (*Lokottara* or *Alaukika Gaṇita*)

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1. 'Parā' is a Hindi word signifying beyond- or other-worldly matters. In this context *Lokottara Gaṇita* may refer to cosmic or celestial mathematics, which is different from ordinary arithmetic, algebra or geometry, and generally uses very large numbers beyond the countable range.

Unfortunately not much attention has been given by historians of Mathematics on mathematical content in Jaina literature. The study of Jaina Mathematics is essential for History of Mathematics as well as in the field of Jainology or Jaina Philosophy.

The early Svetambara texts used the following terms for mathematics:

Gaṇiya[1], Saṅkhyāna[2], Mithyāśrut[3], Laukika Āgama[4], Gaṇiya Suhume, Bhaṅga Suhume [5].

It indicates that before the Current Era (BCE) or in early centuries (CE), mathematics had place of pride in the Jaina canonical literature. The entire Jaina literature has been classified subject wise in the following manner [6]:

<i>Dharmakathānuyoga</i>		<i>Prathmānuyoga</i>
<i>Caraṇa - Karaṇānuyoga</i>	or	<b><i>Karaṇānuyoga</i></b>
<b><i>Gaṇitānuyoga</i></b>		<i>Caraṇānuyoga</i>
<i>Dravyānuyoga</i>		<b><i>Dravyānuyoga</i></b>

Sections written in bold above are full of Mathematics. Hence for complete and in depth knowledge of Jainism, study of Jaina Mathematics is essential. Even regarding the 72 Arts, a reference of *Gaṇita* (Mathematics) is found in the text *Lehāiyāo Gaṇiyappahāṇāo* [7]

Some important milestones in the research on Jaina Mathematics in recent times prior to 1960 are:

1. In 1929 renowned historian of Mathematics and expert of Indian Mathematics Prof. B. B. Datta wrote his paper on The Jaina School of Mathematics [8].
2. In 1935 a well known editor Dr. H. R. Kapadia wrote an exhaustive introduction of 64 pages to Jaina Mathematics and it appeared in *Gaṇitatilaka* of *Simḥatilaka Sūri* [9],
3. In 1942 Prof. A. N. Singh wrote an article on 'Mathematics of *Dhavalā*', which appeared in *Dhavalā*, book-IV [10].
4. In 1958, the article *Tiloyapaṇṇattī Kā Gaṇita* by Prof. L.C. Jain appeared in *Jambūdīvapaṇṇattisaṃgaho* [11].

A few other articles related with *Gaṇītasāra-saṃgraha*, *Trīśatīkā*, Magic Squares, Astronomy, Geometry and some unknown Mathematics texts were also published during this period [12]. All these attempts established a new school of Indian Mathematics and Jaina School of Mathematics. In the first 3-4 decades of 20<sup>th</sup> Century *Aṅga-Upāṅga* literature of *Śvetāmbara* tradition were available in translated form [13]. In *Digambara* Tradition *Trīlokaśāra* was available but the following texts, although rich in mathematics were published much later:

*Dhavalā*, Vol. 1-16 during 1939-1959.

*Jaya Dhavalā*, Vol. 1-16 during 1944-1988.

*Tiloyapaṇṇattī* Vol. 1-2 during 1943-1944.

*Jambūdvāpapaṇṇattisaṃgaho* in 1958.

*Lokavibhāga* (*Samskṛta*) in 1962.

Because of non-availability of these publications, Prof. B. B. Datta and Prof. A. N. Singh could not give their reference in their book 'History of Hindu Mathematics' [14].

Now we survey the present scenario of Mathematical Research in Jaina Philosophy. For this purpose we use the classification of the following three types of studies in Jaina Philosophy –

1. Cosmology
2. Karma Theory
3. Logic

The importance of studies in Cosmology and Karma Theory has been highlighted in the statement of Prof. M. R. Gelra:

*'Through the mathematical study of karma, the predictions and probabilities could be known about the (events) of the past and future. Just as diseases are traced through genes, similarly there is great possibility that the mathematical study of karma will be useful'* [15].

In modern mathematical language, we make use of the signs  $\cdot, \cdot, \cdot, \cdot$ . In Jaina *Nyāya* (logic) we make use of sentences in place of these symbols.

Very few scholars are engaged in the study of Jaina mathematics. The following references about the current activities in Jaina mathematics may be useful to scholars *Viśva Prahelikā* [16] by Prof. Muni Mahendra Kumarji is a wonderful text. The Enigma of the Universe [17] is not merely a translation of *Viśva Prahelikā* but it is enlarged and improved. The Books by Prof. L.C. Jain are basic and useful in both types of studies.

1. Mathematical Content of *Digambara* Jain Texts of *Karṇāmuyoga* Group, Vol. I and II [18]
2. Exact Sciences in Karma Antiquity, Vol. 1-4 [19].
3. Mathematical Sciences in the Karma Antiquity Vol. I & II [20].
4. System Science in the Karma Antiquity, Vol-I [21].
5. Tao of Jaina Sciences [22].
6. Exact Sciences Through Jaina Sources, Vol. I & II [23].

The following books written by the author provide the basic information about the Jaina School of Mathematics –

1. *Mahāvīrācārya*: A Critical Study (Hindi) [24] [Co-author: Prof. S.C. Agrawal].
2. Philosopher Mathematicians [25] [Co-author: Prof. L.C. Jain].
3. Contribution of Ancient Jaina Scholars to Mathematics [26].
4. Mathematics in *Ardhamāgdhī* Literature (Hindi) [27].

**Appendix-1** gives a list of active researchers in Jaina Mathematics, which may be useful for making personal contacts.

**Appendix-2** gives the List of Ph.D. Dissertations in the field of Jaina Mathematics.

**Appendix-3** gives brief description of *Mahāvīrācārya Jaina Gaṇita* Award instituted for scholars in Jaina mathematics.

## **Acknowledgement**

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**Appendix 1: Active scholars of Jaina Mathematics**

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## Appendix 2. Ph.D. Dissertations in the field of Jaina Mathematics

1. Sabal Singh, *Hindu Mathematics – Śrīdharācārya and his Works*, Agra University, Agra, 1948.
2. Usha Asthana, *Ācārya Śrīdhara and his Trīṣatikā*, Lucknow University, Lucknow, 1960.
3. Mukutbihari Lal Agrawal, *Contribution of Jainācāryas to the Development of Mathematics and Astrology* (Hindi), Agra University, Agra, 1972.
4. Sajjan Singh 'Lishk', *Mathematical Analysis of Pre-Siddhāntic and Post-Vedāṅga Data of Jaina Astronomy*, Punjabi University, Patiala, 1978.
5. H.P. Singh, *A Critical Study of Mathematical Contribution of Mahāvīrācārya*, L.N. Mithila University, Darbhanga (Bihar), 1987.
6. Anupam Jain, *Contribution of Jainācāryas to the Development of Mathematics*, Meerut University, Meerut, 1990.
- 7\*. Mamta Singhal, *Ācārya Śrīdhara and his Mathematical Contribution* (Hindi), C.C.S. University, Meerut, 2001.
8. Chandrashekhar Shukla, *A Detailed and Comparative Study of Śrīdhara's Pāṭigaṇita* (Hindi), R.D. University, Jabalpur, 2001.
9. Omkarlal Shrivastava, *On the Mathematical Contributions of Nemicandra Siddhāntacakravartī*, Barkatullah University, Bhopal, 2004.
- 10\*. Pragati Jain, *Ācārya Vīrasena and his Mathematical Contribution* (Hindi), C.C.S. University, Meerut, 2006.
11. N. Shivkumar, *Ācārya Yativṛṣbha and his Mathematical Contribution*, Mysore University, Mysore, 2007.
12. Ujjawala Dondagaonkar, *On the Scientific Study of Karma Paramāṇu from Jaina Canonical Texts*, Nagpur University, Nagpur, 2011.
- 13\*. Dipak Jadhav, *Mensuration in India from Jaina Sources*, Devi Ahilya University, Indore, 2011.
- 14\*. Jitendra Sharma, *Mathematical Content of Jambūdivapaṇṇatti saṃgaho*, M.P. Bhoj (Open) University, Bhopal, 2012.
- 15\*. Vibha Bansal, *Mathematics in Śourasenī Prākṛta Literature* (Hindi), Shobhit University, Meerut, 2013.
- 16\*. Shaifali Jain, *A Comparative Study between the Mathematical Contributions of Ācārya Śrīdhara and Mahāvīra* (Hindi), Shobhit University, Meerut, 2013.
- 17\*. Seema Jain, *Mathematical Contribution of Paṇḍita Toḍarmala* (Hindi), M.P. Bhoj (Open) University, Bhopal, 2013.
- 18\*. Dhankumar Jain, *A Mathematical Analysis of Moha Karma Prakṛtiin Artha*

*Samdriṣṭi Adhikāra of Toḍarmala*, The Open International University for Complimentary Medicine, Colombo. 2013.

- 19\*. Shrenik Kumar Bandi, *An Analysis of Prākṛta Mathematical Works and their Commentaries*, Devi Ahilya University, Indore, 2015.
- 20\*. Jeevan Prakash Jain, *Analysis of Some Mathematical Content in Philosophical Texts of India*, M.P. Bhoj (Open) University, Bhopal, 2016.
21. Samani Vinay Prajñā, *On the The Theory of Numbers in Jaināgama*, JVBI, Ladnun, 2016.
22. Miss Alessandra Patrocchi, *On the Gaṇitatilaka of Simhatilakasūri*, Cambridge University, London, (work in progress).

In addition to above the following two projects were completed by Anupam Jain:

- 1- Mathematics in *Ardhamagadhī* Literature (Hindi), Published by Jain Vishva Bharati Institute Ladnun, 2008.
- 2- Development of Mathematics through Jaina Literature (Hindi), Major Project - Jain Vishva Bharati Institute Ladnun, 2011-2016.

### **Appendix 3. Mahāvīrācārya Jaina Gaṇita Award**



An annual award has been instituted in 2016 by Dr. Anupam Jain and his family with the inspiration of *Gaṇinī Āryikā Jñānamatī Mātā jī* in the memory of Prof. L.C. Jain, Jabalpur, to promote studies in Jaina Mathematics. It will be given to any scholar working in the field of Jaina School of Mathematics. The Award carries a cash prize of Rs. 25000/- and a citation.

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\* Ph.D. dissertations are written under the supervision of Anupam Jain.

## **Section VIII: Panel and Round Table Discussion Reports**

This section contains summary of deliberations in Panel discussions, Round Table meetings and Workshops conducted during the Conference. In addition, Poster Presentations and highlights of Inaugural and Concluding sessions are included here. International and National Collaboration for Integrating Jainism and Science was the topic of discussion in Panel-1. Panel-2 was devoted to Research Problems and Academic Curriculum in Science and Jain Philosophy. Round Table deliberations were focused on 'Developing Scientific cum Spiritual Methods for Inculcation of Moral values' and 'Development of Emotional Quotient in Global Education'. Experimental results on effects of various meditational and other spiritual practices were presented in Experimental Workshops. Information on papers not published in this proceeding and those presented in Oral Sessions, Young Researchers Sessions, etc. is also briefly summarized.

### **1. Panel Discussions**

#### **Panel 1. International and National Collaboration for Integrating Jainism and Science**

All processes involving living and non-living entities in the universe are governed by certain laws which is the corner stone of Jain philosophy. These basic rules embedded in Jain philosophy also form foundation of modern science, which, of course, deals with only the physical order of existence, besides space and time. The Jain view of these scientifically accepted existences is however very broad and has not been

yet fully explored by science. Jainism has, therefore, much to offer to science in its own domain of perception of the universe, besides describing the living world as a combination of *jīva* (entity having consciousness) and matter in various forms. Synthesis of Jainism and science, therefore, can present a comprehensive view of the world and improve our understanding of the processes and phenomena taking place both in the living and the nonliving realms.

The panel discussion was chaired by Dr. Samani Charitra Prajna (Vice Chancellor, JVBI). Prof. K.P. Mishra, (Director, ICSJP) Co-chair of the Panel provided the background and framework of the panel discussion. He hoped that the discussions would identify possible research areas in science and spirituality especially taking into accounts the Jain traditions and practices. The problem of research and collaborations have to be considered in the light of need to develop science based research projects related to Jain philosophy. Research has to substantiate the beliefs and practices of spirituality. It is to be examined how spirituality should adopt technology to improve life of people. He liked to imagine that “what is invisible today may be imaged in future”. We need entirely new tools and new education system to create new knowledge. He advised to invest in developing some futuristic research which may or may not find use in contemporary time and referred about tele-transportation experiment which may turn into technology to allow faster travel to other planets.

Shri Om Prakash Dubey (Former Director, World Bank) argued that science and spirituality were complementary. He justified and lauded the thoughts of *Tīrthankara Mahāvīra* “live and let live” and advocated that human happiness could be enhanced by inculcating scientific reasoning and spiritual experience.

Dr. Akshai Aggarwal (Vice Chancellor, GTU, Ahmedabad), delivered his talk on Skype. He pointed out that western scientists did not give due regard to Indian religions. West knows little about Jainism but knows adequately about Buddhism propagated not from India but from China and Japan. Generally, in west, most of our beliefs are taken as unscientific. In fact, Indian religion is considered backward. However, there are scientific principles in our religions. He asserted that Jain philosophy is scientific but it is not represented appropriately to western world. We have to have belief in our religion and study our traditions by

scientific methods. He lamented that Jain Chairs abroad are not taken seriously by those who occupy them. The need is to feel proud of our religion and allow open and close scrutiny by criteria of rationality. We have to empower our researchers and professors who can speak or write about our religion on equal basis to western media and talk to western scientists on equal level. He desired that more Chairs for studies on Jain philosophy should be established within the country.

Prof. P. R. Bhat (IIT, Bombay) stated that philosophy of science in the west seemed confused. He urged to discover eternal truth. *Anekāntavāda* has definite clues to find absolute truth. It is advisable to combine virtues of Jain practices with philosophy of science. Dr. Sudhir Jain (BARC, Mumbai) emphasized on harmonizing knowledge. He suggested taking clues from ascetic life styles of monks for scientific research. Unfortunately, science is not integrated with life of people. He talked of quantum entanglement and hypothesized entanglement of humans. There is need to understand the physical basis of intuition, which is related to evolution of consciousness. It is worth learning the art of resource management as emphasized in Jain philosophy.

Dr. Ranjit Nair (Center for Philosophy and Foundation of Science, New Delhi) spoke about the need for world peace. He suggested that philosophy of science and concepts of spirituality have to be integrated to advance our understanding for the ultimate truth. Reality is far from our understanding in terms of sense organs\*.

Many participants suggested that an institute devoted to science and spirituality should be established. Research results should be published in western press as well as in Indian Journals. It would be appropriate to start an international journal for publication of research. It is a curious fact that Jain population is gradually decreasing which should be taken up for research. Taking clue from Jain practices, research should be conducted on resource management in terms of conservation of water and on issues of environment preservation. Research projects should be taken up to study life style of monks and seers in relation to implications on health. Concluding the session, Samani Charitra Prajna exhorted that scientists and philosophers and spiritual practitioners to come together

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\*See full article by these authors in the main text.

and understand human problems and solve these problems by scientific and spiritual approaches. It is a positive step forward to sit together and learn from each discipline. She urged that youth should be involved in teaching and learning process. It looks promising to conduct research if practice of *Prekṣā Dhyāna* could help persons to become better human beings.

## **Panel 2. Research Problems and Academic Curriculum in Science and Jain Philosophy**

The scientific ideas in Jain philosophy extend to the whole range of human knowledge from metaphysics to cosmology, micro and macro, epistemology, physical and biological sciences, ecology and environment, psychology and meditation, and other spiritual practices. Also mathematics in Jain philosophy is of great significance not only for the historians of mathematics, but for comprehensive view of Jainism. Besides Jain philosophy, modern science has also made great advancements in many of these fields. A study of these two streams of knowledge shows that though they have been developed in different ways and have many specialities peculiar to them they also have many ideas in common. Further, there is a great scope for ideas of one stream being useful to understand the view points of the other. It is also found that the ideas expressed in Jain philosophy are, in some respects, more comprehensive and refer to much wider domain of truth as compared to modern science. So, a comparative study can lead to many research areas where a study would be very useful for development of science on one hand and bringing full understanding of the universe and its components on the other.

One problem in studying scientific ideas in Jain philosophy is that the traditional Jain scholars are generally not familiar with science and the scientists have no background of Jain philosophy. The best way to overcome this problem is to teach the basic principles of Jainism to scientists and arranging interaction between Jain scholars and scientists so that the scientists can express the Jain ideas in a scientific way. This would require induction of scientists in a different field of study but this is not difficult as many of the scientists have an open mind and are willing, or rather eager, to learn the ancient traditions.

The panel was chaired by Prof. N. L. Kachhara, who articulated the basic idea behind organizing this panel discussion. He stressed the need and justification of education and research program in Jain philosophy. He said “Jains are more involved in business and neglect religious teaching and research”. He, however, expressed satisfaction that awareness is improving and curiosity of common Jain community to know the deeper aspects of Jain philosophy is found to be increasing. Prof. Kachhara identified four issues for the scope of discussion which included teaching science and technology students the basic principles of Jain philosophy, to develop post graduate courses, identify scientific research problems in Jain philosophy and develop online courses for Indian and overseas students.

Professor A. D. Sawant (Former Vice Chancellor, Rajasthan University, Jaipur) confessed that there was inadequacy of good syllabi and curricula in university education. He stated “knowledge comes from learning and wisdom comes from awakening”. He observed that in IIT Bombay students are taught, apart from technology, the science of philosophy and history of science. By example of defects in crystals, he talked of disturbed minds which need to be converted into better humans.

Prof. P. Sriramamurti (Dayalbagh, Agra) lamented that there was steep decline in morality in society. He pointed out that there was increasing lack of cohesiveness in humans. There is a need to discover inner eye. He informed that at Consciousness Research Centre of DEI effects of consciousness are being measured. He advised that brain-mind interface research is needed. In fact, a paradigm shift is required to conduct research on consciousness. Science has remained silent on ultimate truth and research should be undertaken in that area.

Dr. Samani Āgam Prajnā (JVBI) identified several avenues of research in Jain philosophy. She quoted Ācārya Mahāprajna who used to say that science has given credibility to ancient philosophy. She pointed out that dark matter which is insufficiently known in science was mentioned in Bhagwati Sutra and therefore, she suggested science could find clues from Jain literature for conducting research. In addition, she suggested research programs on Jainism in biology and psychology. She suggested research on mind reading (telepathy) and extrasensory

perception capability of humans. Influence of fasting on health needs to be investigated.

Shri Vidyadhar Danawade raised several questions on cosmology that should become topic of research. For Example, he wanted to know where is *Siddha Śīlā*? Why can we not locate it? He wondered where Meru is and whether planets revolve around it. He felt that a group of scientists should thoroughly plan to conduct research on these problems.

An active participation of the audience took place. Many ideas for research were put forward. It was feared that persons with PG and Ph.D. degrees in Jainology do not find job prospects. A suggestion was made that together with Jainism, studies on Buddhism and *Vedānta* should be included. Prof. Kachhara in his concluding remarks said that Jain education should be imparted to science students for grasping the basic elements of Jain philosophy. He said students of Jain philosophy do not know science and students of science do not know basics of Jain philosophy. This situation creates a barrier of knowledge and therefore Jain education has to be reorganized. He pointed out that research needed human resource and funds but Jain community generally remained indifferent to invest in research endeavors. Dr. Samani Chaitanya Prajna appreciated active participation and constructive suggestions for future research at BMIRC.

## **2. Round Table Discussions**

### **2.1 Developing Scientific cum Spiritual Methods for Inculcation of Moral Values and Development of Emotional Quotient (EQ) in Global Education.**

Moral values help in making the life of an individual, family and the community happy, healthy (holistically), peaceful, and pleasurable. They also cleanse the society of evils like corruption, malpractices, scandals, violence, etc. and enables the nation to make rapid progress in the right direction. It is now seen that moral values are declining world over and this is becoming a cause of concern to educationists, politicians as well as to all members of the society. How to inculcate moral values in students has become a challenging task. It appears that traditional ways of imparting value education need improvement and efforts must be made for developing new methods and ways to address this issue.



In this age of science and communication, new techniques and technology appeal more to young minds. It is therefore imperative that full use of these new means be used to make the moral education program more effective and successful.

Spirituality has been acknowledged to inspire the individuals towards ethical behavior and boosting morality. Spirituality does not belong to any particular religion; it transcends the religious barriers and relates to the inherent goodness in all human beings. Spiritual practices can greatly benefit the humanity in making the life simple, moral and ethical.

Emotions are known to heavily influence the human behavior. Emotional development of students must be a part of education system. Jain philosophy says that passions (*kaṣāyas*) and quasi-passions (*nokaṣāyas*), which govern emotions, introduce perverseness in the soul and removes it away from morality and ethical behavior and obstructs the development of values in life. The attachment (*rāga*) and aversion (*dveṣa*) are the main cause of perversity in life and mental imbalance. Therefore, for purity of conduct and positive emotional development efforts must be made to reduce negative or destructive emotions accruing from attachment and aversion in behavior.

Everyone seeks peace in life. Violence is antidote to peace. We must strive to find non-violent ways to resolve our problems in life as well as in society. Violence is now assuming alarming proportions and posing threat to the civilized society. Recognizing the importance of non-violence, the United Nations, in 2007, declared 2<sup>nd</sup> October, the birth day of Mahatma Gandhi, as ***Non-violence Day***. Scientific -cum -Spiritual techniques for “Training in non violence” is the main solution to mitigate violence.

The discussion group was chaired by Prof. Naresh Chandra, (former Pro Vice Chancellor, Mumbai University). It was stated that *Prekṣā Dhyāna* had the power to reverse cardiac conditions. Dr. S. C. Manchanda (Cardiologist, AIIMS, New Delhi) believed that solutions to problems of mankind lie in coming together of science and spirituality. He talked of importance of moral values in life. He emphasized that EQ was more important than IQ in transforming humans. He expressed his

satisfaction that, in 2015, 21<sup>st</sup> June was declared *International yoga day*. He stressed that education should aim to produce good human beings. Dr. Harshad Thakur (TISS, Mumbai) advocated the basic health services to all irrespective of social and financial status. He suggested the important role of education in programs of prevention and treatment of diseases. Prof. Mrs Rupa Shah (former VC, SNDT University) said Jainism is a way of life. Jainism has role and relevance in the entire globe. We have to spread message of Jainism; the principle of self denial is a very powerful thought which is unique and unparallel. Shri M. P. Lele (former DG, Doordarshan) narrated his experience of *Prekṣā Dhyāna* practiced in government departments and in schools. He quoted Āchārya Mahāprajna who advocated “making of *jan* and not Jains”. Mrs Jyotika Mehta gave an account of her experience of effective change among children of 14-18 in her NGO by *Prekṣā Dhyāna* and found tangible change among attitudes of children. Amazing transformation in children was noted. She described *Prekṣā Dhyāna* as powerful tool for human transformation.

Dr. K.P. Mishra (formerly Head, RB & HSD, BARC, Mumbai) emphasised that we need to focus on what is to be discovered. He speculated that technology is improving fast so that what appears invisible today can be seen in future. Scientists are eager to learn the secrets of spirituality. Presently, there is a gap of knowledge which needs to be bridged. He hoped that practitioners of spirituality would come forward to guide scientists to discover what is unknown and enigmatic today. He agreed with Muni Mahendra Kumar that emotional quality has to be carefully managed for human development. We are trying to infuse emotions in computers. For example, robots have been developed where limited feelings can be expressed. It is hoped that future development will bring complete revolution in robotics.

There was active participation by the audience in Question-Answer sessions. Dr. Patel gave his experience of increasing number of abortions in populations especially among young children. This needs to be tackled urgently and effectively. Dr. N. Chandra concluded the session by making a few observations. He suggested that conflict management had to be tackled. He suggested that research projects had to be taken up to transform people's nobility. He stressed that, through right education, good human beings have to be nourished. He reminded that saints had cautioned “confirm and then believe” and we should follow this principle.

He gave the message of conserving nature. We cannot have peace until we give up prioritising the sense of 'I' and 'my' in our daily life routines.

## **2.2 Developing Scientific-cum-Spiritual Techniques for Inculcation of Moral Values and Development of EQ in Global Education**

The **Round Table** discussion began with address by **Prof. Munishri Mahendra Kumar** which is reproduced below:

*Candesu nimmalayarā, āiccesu ahiyam payāsayarā/  
Sāgarvargambhīrā, Siddhā siddhim mam disantu//*

After paying obeisance to my preceptors and after appreciating the efforts of the organizers here, which include of course Bhagawān Mahāvīra International Research Centre, IIT Mumbai and University of Mumbai, let us start deliberating on the most crucial issue of the modern age which is, 'Developing Scientific-cum-Spiritual Technique for Inculcation of Moral Values and Development of Emotional Quotient in Global Education'. This is our topic. Here we are not going to discuss Jainism as it is, but we shall try to talk about whatever Jainism has given to the world in the form of 'scientific-cum-spiritual' technique. And from anywhere in the world, if you can get any such technique which is tested through 'scientific-cum-spiritual' methodology, let it come forward. We should have no prejudice, no bias for or against any technique. Technique, after all is a part of technology, is a part of science, and is a part of scientific methodology.

First of all I want to share with you that the biggest problem of the world today is management of our emotions, whether it be violence which we see not in war front, but in domestic life, even between life partners, husband and wife. May I tell a joke? Once a wife asked her husband, "Whenever I sing, why do you walk out of the flat and not stay inside?" He said, "I'll tell you, but don't tell other people. I am doing so because if I will be inside and you will be singing, all our neighbours will think that I am beating you! So let me remain outside while you sing. Because whenever you sing, other people think that you are crying." This is not only a joke, but this is the truth of life. Of course, we are monks (ascetics) and we have not seen that life, but we can see around us in what way the domestic life is

going on. There is violence in the relation between spouses, the relations between brothers, the relations between father and progeny, etc. Families are for cordial relations, for helping each other. After all, without family life, how can you conceive of any society? Human society has progressed and come forward to this state where there is organized family life, and in that, this virus of violence has crept in. I don't know whether statisticians have made any survey, but if they do so, they may probably find that 90% families are vitiated by this virus of domestic violence. The situation is the worst in rural areas because there is lack of education on one hand and poverty on the other.

I am talking about these emotions. You will agree with me that this is the most difficult problem and the most efficient cause of all disorder in the world. Starting from violence, we also know about certain other destructive emotions, negative emotions, which are responsible for all kinds of problems. Yesterday, we had a session on 'Environment and Ecology'. *Bhagavāna Mahāvīra* has talked about the problem lying at the root in the First Chapter, 'Renunciation of Weapons' of the *Ācārāṅga Sūtra*. When he talks about weapons, he does not talk about weapons, guns, revolvers, or knives. He said that weapons are of two types – *dravya* and *bhāva*. *Dravya Śāstra* and *Bhāva Śāstra*. *Śāstra Parityāga* means giving up of *Bhāva Śāstra* and *Bhāva Śāstra* means *asamyama* (lack of self-discipline). I hope that all of you will agree that this is at the root of maladies, whether it is in India or Syria or USA. Everywhere, whatever problems are created, in any name, at the root we find this disorder in our emotional system and that's why we are looking forward to such technique which must be strictly scientific.

If we talk about religion, say Jainism, and say that it is the best religion, there may be a person who says that it is good but *Vedānta* or *Vaiṣṇavism* is better. Some other people might come and say that no, we respect your religions but our Christianity is at the top. So let us not get into this dispute. It will be futile. Some people say you teach all religions. What will be the effect? What is needed is that what religion has taught to us should come from our education. We are living in the 21<sup>st</sup> century. We are living in the era when people are trying to break the inter-planetary boundaries. They may be able to penetrate into inter-galactic distances, may be. Our ancient wisdom has evidence that it is not that difficult, people can cross those boundaries and travel inter-galactic distances.

Scientific technique, scientific method, scientific tool – why scientific? Scientific means that it must be measurable. Quantitative measurement is the criterion of scientific method. If I tell that by reciting 'Om' 100 times, your fever will reduce by 1 degree, people will believe it and do it, but will science believe this? Science will say that we will believe it but first let there be a statistical sample of 100 persons, having the same fever, under the same conditions and 100 other people in a Control Room with the same condition. Let the first 100 people recite 'Om' 100 times and let the 100 people in the Control Room not speak 'Om' and give them only Crocin, etc. The difference between these 2 samples of 100 people will be the quantitative result and if it will confirm that effect of reciting 'Om' is that it brings down the temperature by 1 degree, then science will accept it. I have asked Jyotika Mehta to report her live experience. She is from a very well-to-do family and she herself runs the industry. At the same time, due to humanitarian outlook, she is working for slum children and labour children. The children are given discourses. From her voice itself you can make out that she has become successful. It is a one-case study. Science will appreciate it but will not accept. Let there be 100 such industrialists, do this experiment in their factory and let us find through completely objective assessments, what difference comes in the behaviour of those children. If that is confirmed, I don't think that science or the global scientific fraternity will deny it. IIT is here in India, but their research is accepted globally. In the same way, this is not a utopian idea, because we have already tried it. There are so many case studies. Prof. Lele related his experience. These people are not Jains. They have taken interest because they believe that this should work and they work voluntarily and they found that these methods are working. Prof. Manchanda is working on the effect of *yoga*, *prekṣā* meditation life intervention for the last 20 years. He has complete studies of more than 25,000 cases. He has found that heart disease is reversible by this input.

I am hopeful that I have convinced all of you that firstly this is catastrophic, whether it is violence or any other form, all this is created by men because of greed. If we want to narrow down the gaps between the haves and the have nots, then we have to give them not education since it is incomplete, but what is required now is training. There is a lot of difference between education and training. We have got NCERT – National Council of Educational Research and Training. The education

part is going on well in India. They have developed such curriculum that we can compete with any other product of any other academic institute of the world. But what about training? Training, and as I made clear yesterday, through neuro-scientific editors, training means training of the human brain by controlling the limbic system in the frontal lobe or the reptilian brain, sub-conscious, through the intervention of neo-cortex reasoning mind. It is not knowledge that can help, it is wisdom. It is the product of the training which will empower the neo-cortex, wisdom, *prajñā*, *vivek*, even of a child to control his emotions. A child will see another child smoking or chewing tobacco, but if he is trained in *Jeevan Vigyān*, he is given this training of scientific-cum-spiritual technique, he will not imitate the other child.

This thing can be done, and it is only through education that we can do it. Jyotika Mehta gave an example of a child who wanted to become a terrorist. Now ISIS is trying to creature more and more people dedicated to this cult for protecting Islam. What is their motive? They want to protect Islam and make Islam universal. So they said, let the people be trained to dedicate themselves. They are given training in terrorism. And people are ready in France, in Belgium, in Scandinavian countries. They are ready to be trained, they are being trained and after training they have become terrorists. All Islamic people are not terrorists, all Muslims are not terrorists. On the contrary there are only a few people, we don't know how many, who believe in terrorism. Otherwise other people, mauvis, teachers, they believe in true Islam – peace and all these things. Cant they give this type of scientific-cum-spiritual training to their children not to become terrorists and to serve Islam by the right way prescribed in the Qur'an? Is it not possible?

In the same way now let us sum up that we have to create this kind of scientific-cum-spiritual curriculum and a graded course of 10 years or 12 years from the time a student enters school in Grade 5 and leaves after Grade 12. This course should be devised in such a way that gradually we give this training and help them increase their EQ, which is a measurable quantitative factor. It can be measured just as IQ can be measured. And if it definitely improves our EQ or IQ then no scientist in the world can deny that we require such a course. So I humbly request all of you here, there are people from universities, there are people from various institutions, there are people from various religions also, to think about this thing. After that

whosoever the authority may be, it may be NCERT, it may be State Government, it may be UNESCO at the global level, etc., let them do some research on the claims made by any person. If say, Science of Living makes this claim that they can change, then it can be proved. If somebody says it is only by 'Om' that you can change everything, let that claim be proved. If another person says that by doing *Namaz* 5 times, you can change a person, let that claim be proved. After thorough and objective assessment of the method, let there be a common derived method, acceptable to all. Try for all, apply it with the right reasons that are the only solution for violence, including domestic violence up to terrorism, or even corruption as it is in India and elsewhere and it is one of the biggest problems not only in India but everywhere in the world. All this is because of greediness. Environmental pollution, global warming, climate change and all these ecological imbalances are all due to our *asañyama* – lack of discipline. People don't have to make a rule for odd and even number cars. Why? People should be trained that if you can control your travelling willingly, by controlling your activities – self denial as said by *upāsana*—people will automatically do it. There will be no need of such enactment. But unless you give training, how will people do it? They will never do it.

Now everyone should give their suggestions, responses and reactions and the findings should be propagated globally to give the people globally, the right way and then we can hope for something better. And the place like IIT on one hand and Bhagawan Mahavira International Research Centre (which is a part of a deemed university) on the other, let them come together just as we want to club science and spirituality. I have heard that there is some consideration of starting a Chair at IIT for such research. I will welcome this idea if really it is implemented. It will be the first step in this direction of testifying the claims of ancient wisdom in scientific terminology, facts and figures.

So I want to conclude by giving you some information about Science of Living. Ācārya Mahāpragya who was not only a genius, scholar of languages, ancient wisdom etc., through hours of practice at a stretch over 25 years of more, framed the Science of Living, taking help of science and combining it with spirituality. In Science of living, the student has to know in what way endocrine hormones are responsible for my behaviour. If I am over-helped by adrenaline, surely I will lose my temper or I will be a cowardly child because it is either fight or flight. If it is hypo

then he will become a violent person and if it is hyper then he will be a coward, etc. So in this way we can really testify.

Ācārya Tulsi in the last few months of his life, when he had entered 90 years of age, put before the public during the *Maryādā Mahotsava* the plan of 'wisdom world'. He said that through training we can make people better and wiser in every respect and unless we can make the world full of wisdom, we cannot succeed in solving all these problems. So the blueprint of that 'wisdom world' is also lying with me. Ācārya Mahāprajña has passed away in 2010. Now it is 2016. Ācārya Mahashramanji who is his inheritor, is the present Āchārya, and he is also of the opinion that in any scientific, any social, activity, spiritualism must be there. If it is spiritual, I will devote my own inspiration, my own power and energy to that. So in this way the 'wisdom world' concept should be conceptualized and implemented after thorough research. If we jump into it without research, it will not work. First research may take 5 years, such projects may take 10 years. We should get the results of the inputs and see that it works. There are so many kinds of techniques. In *yoga* itself there are 100 kinds of techniques. *Yoga* is not only *āsanas*, it has various other things. In the same way, the spiritual practices prescribed by Mahāvīra, practiced by Mahāvīra, various kinds of *tapas*, not only fasting, but so many types of *tapas* and in the same way meditation and so on. In meditation also, we have so many methods. We have *Vipaśyanā*, *Prekṣā*, *Brahmakumari's* method, Sri Sri Ravi Shankar's method, *Patañjali's* method. Everything should be tested scientifically. Let them all be integrated. Whatever is effective in one, that should be accepted and with an integrated approach a product should be made – not only of one particular religion or one particular kind. I think IIT can play a role in this venture, making it clear that this has got nothing to do with any religion, anything which is not secular. Science and spirituality – both are secular. Spirituality is the science of ancient wisdom and science today is the product of our modern scientists and so on".

### **3. Young Scholar Session and Poster Session**

Young scholar session was a big attraction where young scholars of Jainism and science presented their views and papers. From the beginning, the conference had planned sessions for young scholars to



provide them a forum for free discussions and exchange of views. It was noted that youths were curious and eager to know more about scientific basis of Jain philosophy and doctrines. There were several interesting papers and demonstrations on life style practices and their impact on holistic health. Youths discussed freely and candidly the finer questions of *ahiṃsā*, *anekāntavāda*, *Prekṣā* meditation, in keeping with the increasing reliance on rationality and logic inculcated by modern science. Biological aspects of consciousness and soul appeared to draw attention of many young scholars. Topics such as life styles, *Prekṣā Dhyāna*, *ahiṃsā* and relevance of Jain philosophy in modern science for world peace were discussed. Time constraint for presenters was a common concern which was due to more than expected general registrations. It was a consensus opinion that conferences and symposia should be organized with larger participation of youths who hold the flag for future of society. Awards were given as a mark of recognition of talent to young research scholars based on originality and novelty of contents of presentation.

Opportunity was provided to young as well as senior researchers to present poster papers which could not be accommodated in oral sessions. The posters invited considerable attention of delegates.

## **4. Experimental Workshops**

### **4.1 Workshop - 1**

The experimental workshop was moderated by Dr. Pratap Sanchetee\*, Sanchetee Neurology Research Institute, Jodhpur. He presented his talk on anatomy, physiology and evolution of nervous system including the brain. He stressed on triune theory, prefrontal cortex, limbic system, existence and requirement of two halves of brain, and autonomic nervous system. He talked about types of meditation and their role in changing human mind. Recent studies have challenged the traditionally held view that learning changes only the way the brain functions, but Dr. Sanchetee showed that structural changes at the macroscopic level were also possible. He discussed five areas where effects of meditation on human brain and mind was demonstrated and assessed with structural correlations i.e. psychological, electrophysiological (EEG), neuro-imaging (fMRI, SPECT), hormonal and epigenetics. Scientific experiments have confirmed that during

meditation, mind was disconnected with outer world as observed by the decrease in activity in parietal lobes. Dr. Shailesh Mehta\* (Holistic Science Research Centre, USA) described scientific aspects of *Vītarāga Vijñāna* and its relevance to the human health. He brought out that complete health i.e. physical, mental and social health could be improved by adhering to ancient principles. The relevance of diet, particularly vegetarianism, in improving the physical health and mind was described. In a comparative study on 156 females, Samani Amal Pragya (JVBI) showed that *prekṣā* meditation raised the level of forgiveness. Forgiveness is an active decision to let go resentment and thought of revenge. Studies are warranted for better evaluation of forgiveness and its beneficial effect on mental health and peaceful coexistence.

### 4.2 Workshop -2

Shri Arun Zaveri (Scientific Meditation Organization, Mumbai) chaired this session. Shri Zaveri described that our primal drives were responsible for both pleasurable as well as painful instincts and desires. These can be suitably modified with practice of mediation. This is achieved through reduction in karmic load and reprogramming of mind. Dr. Prakash Sanchetee\* (Kolkata) studied 98 subjects who did fasting for a varying period of 3 to 30 days. Results showed reduction in body weight, body mass index, blood pressure, lipid levels, protein levels and serum cortisol levels. However, no change was observed in pulse rate, hemoglobin and blood sugar levels. Dr. M. P. Lele\* (AIR, New Delhi) described the effects of *Prekṣā* meditation (PM) on holistic health in the modern age. The major detrimental factors of health are environmental degradation, erratic life styles and absence of spirituality. Dr. Vimla Vyas\* (Human Resource Development Centre, University of Allahabad) described the alteration of neurochemistry of meditation in stress. Physiological experiments suggested that there was reduction in stress related autonomic and endocrine measures and neuro-imaging showing strengthening of areas of brain.

### 4.3 Workshop -3

Dr. Ms. Renuka Jain (Avesthagen Limited, Bangalore) described meditation as a simple art of calming down the mind. As is true in Jain religion, the practice of meditation or *Dhyāna* is core of all religious

traditions. Jain scriptures emphatically stress the role of meditation in attaining salvation. It was suggested in discussions that a good literature review and analysis were highly warranted. Dr. Arvind Gelra\* (Dr. S.N. Medical College, Jodhpur) presented his study of 24 patients of bronchial asthma and observed a statistically significant subjective and clinical improvement in three months practice of PM. There was reduction in daily requirement of inhalers and oral tablets required for controlling asthma.

The study is preliminary and experiments are required on larger number of patients for longer period of observation. Dr. Falguni Zaveri (University of Mumbai, Mumbai) reviewed the literature on effects of spiritual practices on mind and brain. She described the changes as noted on Single Photon Examination Computed Tomography (SPECT), positron emission tomography (PET), hormonal changes and on electroencephalography (EEG).

#### **4.4 Workshop- 4**

Dr. S. C. Manchanda (AIIMS, New Delhi) said that cardiovascular diseases were leading cause of death worldwide. The main causes are unhealthy life style, psychosocial stress, tobacco and lack of exercises. In his studies, Dr. Manchanda and his team showed that PM training resulted in regression of risk factors and regression of coronary atherosclerosis. PM was found to detoxify the body, mitigate fatigue, enhance endurance, and improve immune functions. Dr. Anshul Jain (FORTIS Hospital, Delhi) described that through life style modification, we could control major risk factors for non-communicable diseases including cardiac diseases. Several studies have reported the reduction in blood pressure, obesity, blood sugar level, insulin resistance, platelet aggregation and cardiovascular mortality by practicing meditation. Mr. Girish Shah (Carry the Vision, California, USA) described that humans were born with compassion which reduced the stress level. He showed that global compassion movement initiated by his group had a positive effect on the participants. Prof. Seema Ashar (Mulund College of Commerce, Mumbai) described her study on the effect of PM on emotional intelligence of teachers and noted a positive improvement. She speculated that PM would have a significant improvement in emotional health of children. Shri Parasmal Dugar (Mumbai) described effectiveness of various *mūdras* in

different diseases and health which was well appreciated. However, participants suggested that scientific studies were necessary before arriving at any meaningful conclusion. It was considered important to identify and analyze each component of *Prekṣā* Meditation and find out their effect on brain and health employing scientific methods and modern techniques.

## **5. Inaugural and Concluding Sessions**

### **5.1 Inaugural Session**

The Inaugural session of International Conference on Science and Jain Philosophy (ICSJP) began with Namaskar Mantra by Muni Mahendra Kumar ji followed by Mahavir *stuti* and JVBI anthem. Welcome address was given by Samani Charitra Prajna, Vice Chancellor of JVBI. She emphasized the importance of synthesizing science and spirituality for the improvement of quality of life of people. She hoped that the conference would bring connectivity in mind, body, soul and consciousness. She stated the need for value education and sustainable development of the planet. Prof. D. Parthasarthy of IIT Bombay welcomed the delegates and appreciated the efforts of BMIRC to organize ICSJP. He stated the importance of *Anekāntavāda* of Jain philosophy. “IIT Bombay pursues teaching and research in many disciplines and, at the same time, preserves nature, and diversity is respected at the campus”, he said. Ācārya Mahashraman ji addressed the delegates through recorded message because he was traveling in the Eastern part of India at this time. He stated that the goal of science and spirituality were common in certain areas. He pointed out that science could help explain the vision and practices of Jain philosophy. He felt happy that Muni Mahendra Kumar ji who has a deep knowledge of science and Jain philosophy has guided and directed the ICSJP.

Dr. K. P. Mishra explained the purpose and significance of organizing ICSJP. He stated that goal of science and spirituality was to discover truth, though methods of achieving the goal differed. Science endeavors to know what is unknown. However, science has not yet understood the origin and purpose of life. Scientists are eager to learn from methods and approaches of spirituality to discover the ultimate truth and hoped a synergy in creation of new knowledge by integration of science

and spirituality. He particularly recalled the noble thoughts of Ācārya Mahāprajña who advocated equivalence of souls promoting universal friendship.

Prof. Muni Mahendra Kumar explained the purpose of organizing this conference to bring together scientists, philosophers and spiritual leaders to discuss and debate the relevance of Jainism in modern world. Mahavira preached against violence and wished to establish a compassionate and loving society. He exhorted the need of converting knowledge into wisdom for benefit of society and referred to the basics of philosophy of *Anekāntavāda* and wished to bring happiness in the life of people. He said that developing emotional quotient was fundamental to human progress. He recalled the message of Bhagawān Mahāvīra for practicing non-violence to build a peaceful world. Shri Rajiv Mehrotra, representing the Foundation for Universal Responsibilities of HH Dalai Lama, said that The Dalai Lama admired the tenets of Jain philosophy and sought to spread love and compassion. He spoke about the relevance of science in religious philosophy.

The conference was inaugurated by Justice Dalveer Bhandari, a former Judge of Supreme Court of India and presently a Justice in the International Court of Justice, Hague, the Netherlands. In his inaugural address, he stated that entire world was sitting on the volcano of violence. There is a danger of nuclear war wiping out the entire humanity. In this context, Jain philosophy which is most ancient religious philosophy is highly relevant. He said, laws of Jainism are logical and scientific. He pointed out that the theory of karma explained disparity in society and dispensation of justice. Mahāvīra preached non-violence through series of discourses. He quoted Chinese philosopher, Confucius who said "reflection is noblest, imitation is easiest and experience is bitterest".

Hon'ble Dr. Harshvardhan, Minister for Science and Technology, Government of India was the **Chief Guest** and Hon'ble Shri Shripad Naik, Minister of AYUSH and Health & Family Welfare, Government of India was the **Guest of Honor**. Dr. Harshvardhan pointed out "Jain philosophy teaches us to become good human beings and advocates respect for all *jīvas*". He recalled the glorious track record of ancient saints and seekers from India. Indian scientists are not inferior to any one, he asserted. The scriptures narrated supremacy of science to solve problems of the world.

He recalled how in WHO conference on health policy in 2000 in Japan, it was concluded that Āyurvedic system of medicine and positive healing system and *Pātañjala* yoga are relevant in the 21<sup>st</sup> century. Total human genome has been sequenced and a whole lot of revolution is taking place in biological and medical science. Ancient scriptures describe that India possessed knowledge and wisdom. He praised the program of *Jivana Vijñāna* started by Ācārya Mahāprajña and stressed that Jain philosophy had great potential to transform India. He felt that the doctrine of Karma, love, peace and truth was important to the whole mankind. He referred to the contributions of Dr. J.C. Bose and Dr. C.V. Raman who brought pride to our country and emphasized the importance of research in science and spirituality. He wished knowledge be converted into wisdom for betterment of humanity.

Shri B. R. Bhandari, Chancellor, JVBI presided over the function. He believed that theory of Karma was scientific. He reminded “as you sow, so shall you reap”. He said “Jealousy leads to ulcer, anger leads to blood pressure and ambition leads to diabetes.” He exhorted that empirical research by Ācārya Tulsi, Ācārya Mahāprajña and Ācārya Mahashraman taught non-violence and showed the path to happy life.

Industrialist Mr Vallabh Bhansali was felicitated during the conference. In his response, he recalled the main goal of preachings of Bhagawān Mahāvīra was to lead to happiness which could be achieved with right kind of conduct. He pointed out that science provided tools for comforts such as car, mobile, microphone etc. which are used by both monks and common people. He referred to statements by Editors of *Lancet* and *New England Journal of Medicine* who talked of limitations of modern science. He praised scientists as they changed their views when new facts became known. This, he called, humility and honesty rather than misconceived imperfection. He hoped that the coming together of science and spirituality might bring new awareness and great knowledge for the benefit of mankind.

## **5.2 Concluding Session**

The Valedictory function was chaired by Shri B.R. Bhandari, Chancellor, JVBI. Dr. Samani Chaitanya Prajna welcomed the guests and audience. Dr. Narendra Bhandari presented highlights of the conference.

He categorized the conference into three parts; theoretical wherein Relativity, Karmic theory, Cosmology etc. were discussed. He said that there existed a gap between science and Jain philosophy. This conference has bridged the gap to some extent, bringing both on the same platform. He pointed out that wave and particle nature of photons can be easily understood on the basis of *Anekāntavāda* and *Saptabhāṅgī*, which states that everything in nature has multiple modes and one or the other mode or both modes may or may not exist, independent of each other, and some modes may even be indescribable. Cosmology was discussed at length at the conference with the invited skype talk of Roger Penrose. Whether the universe is eternal, as Jainism propounds or has originated in the Big Bang, for which overwhelming observational evidence exists, was a point of discussion at the conference. According to the Conformal Cyclic Cosmological model of Penrose, the universe undergoes repeated cycles of expansion, each starting from its own Big Bang, and finally coming to a stage of accelerated expansion. These cycles continue *ad infinitum*. Thus, the universe iterates through infinite cycles, previous iteration being identified with the Big Bang singularity of the next. This model generated lot of interest since it seems to be consistent with the eternal Universe propounded by Jainism. It was felt that the Jain scholars have to write the Jain model in the language of science to enable a meaningful resolution. Second important aspect discussed was science, ethics and society and importance of *aparigraha*, and terrorism. World is getting integrated by knowledge. Jain philosophy preaches self-correction in our mind. Personal ethics, soul, consciousness etc. were discussed. It was suggested that BMIRC should select testable research problems and connect to scientific world.

Dr. K. P. Mishra recalled how the idea of organizing international conference on Science and Jain Philosophy came up at the initiative of Muni Shri Mahendra Kumar, culminating in a very successful conference in which more than 15 countries were represented and more than 25 scientists and about 850 participants gathered at the campus of IIT, Bombay. He claimed that “this is beginning of a big objective”. A momentum has been set in by this conference and our future task will be determined by will of administrative and academic leadership. He said 'we have to learn a lot from spiritual practices'. Education in spirituality is certainly needed. Important scientific institutions like Bhabha Atomic Research Centre, Tata Institute of Fundamental Research, Mumbai

University, SNDT University, Indian Institute of Technology, Bombay, Institute of Chemical Technology and Somaiya College came together for organising this conference which is a source of optimism. It is true that there are gaps in knowledge but new opportunities to cap the gaps also exist. Many new ideas were put forward for future research and Dr. Mishra recalled his discussions with Ācārya Mahāprajña about rebirth, death and consciousness. Jain philosophy has elements of science but is not adequately exposed to scientists in the east as well as in the west.

Muni Abhijit Kumar showed his happiness at IIT and BMIRC coming together in organizing this conference. He referred to Bhagawān Mahāvīra's messages. He referred to the talk of Roger Penrose who spoke of cyclic universe which contains ideas similar to that in Jain philosophy. Shri Anurag Batra (Chairman, Media) who was **Guest of Honor** admired the organization of conference on science and Jain philosophy. We are in an era of technology in which philosophy has much relevance. He referred to the book 'Proof of Heaven' by Alexander wherein experience of visiting another world has been described and recalled how Swami Vivekananda was inspired by Max Mueller. He exhorted that younger generation should be exposed to science and stressed importance of love in life.

Mr. Justice Jasraj Chopra (Former Justice of Rajasthan High Court) appreciated that, in his memory, it is the first time that science has been given appropriate place in congregation of religion. He said science and spirituality are complementary to each other. He described this conference as an example of being completely secular in nature. Mr. Justice Adarsh Goel (Justice of Supreme Court of India), Chief Guest, said that reducing the threat of violence and mitigating poverty are our goals. Science has to be used for welfare of society. He emphasized the importance of EQ in human development. He quoted Albert Einstein, "science without religion is lame and religion without science is blind". Religion has inspired value based life in society. He recalled how more than a century ago Vivekananda spoke for integration of science and religion. He cautioned that "Unscientific religion is unacceptable". Principles of Jainism are relevant to life. He quoted famous thought by Swami Vivekananda 'life is short; they alone live who live for others'.

Munishri Mahendra Kumar reminded that experts from diverse disciplines have gathered and spoken in this conference. A book should be



published compiling their lectures and thoughts. He reminded that scientists - philosophers like Einstein, Heisenberg and others recognized that science and religion have to find solutions to the problems of society. We should be careful because science can act as boon as well as curse. Therefore, scientific progress has to be in pace with spiritual practices. Research at BMIRC has to be focused on removing the suffering of people. Violence and terrorism have to be tackled by compassion and education. He said *santhāra* practice is based on strong spiritual principle. It is not suicide. Also, illegal abortions have to be stopped as they are murders. He suggested that in future such conferences be held biannually. It was felt that essentials of Jain preachings and traditions should be effectively communicated to western philosophers and scientists.

Shri B. R. Bhandari emphasised “Jainism is a way of life”. He said this conference was unique and first of its kind in his memory. Spirituality teaches morality and ethics. Ethics is important in business. A good example is Swaminarayan sect and their message for humanity. He cited a story of visit by the seer of Swaminarayan temple in USA who stated that broken parts are united and not thrown away in accordance with the Indian perception of religion. Shri Bhandari desired that based on ahimsa, peace brigades should be formed to spread the message of establishing peace in society.

Prof. P. R. Bhat of IIT Bombay said this conference is a big success by all standards. The sessions were meticulously planned and speakers were carefully chosen. I have been amazed to witness the continuity of programs from morning till late evenings. Regarding Jain philosophy, he wondered why no *Tīrthaṅkara* after Mahāvīra? It needs to be researched. He said, 'science got separated from church in the west but it did not happen in India'. This is because science and religion grew hand in hand in India in ancient times. A point of consensus emerged that education and research in Jain philosophy needs to be strengthened and BMIRC offers an excellent opportunity to build national and international collaborations for conducting relevant research in various areas of science and spirituality.

The conference ended with National anthem followed by *Maṅgala Pāṭha* by Muni Amrit Kumar, who has worked hard behind the curtain to organise ICSJP2016 with great success and dignity.

## **Appendix 1: Unpublished Papers of Plenary and Invited Speakers**

### **Plenary Talks**

1. Āchārya Nandighosh Suri, nandighoshsuri@yahoo.com, *Prohibition of Abhakshya and Anantakayas : A Scientific view.*
2. Prof. Muni Mahendra Kumar, Emeritus Professor, JVBI, Ladnun. Email: presentvictory@gmail.com ; *Neuroscience and Karma.*
3. Padma Shri Dr. S.C. Manchanda, Deptt. of Cardiology, AIMS, New Delhi, Email: doctormanchanda@yahoo.com; *Preksha Meditation and Heart Health.*

### **Invited Talks**

1. Dr. Ananda Vaidya, Associate Professor, Department of Philosophy, San Jose State University, California, USA, Email: anand.vaidya@sjsu.edu; *Cross Cultural Critical Thinking: The case of Jain Philosophy.*
2. Dr. Laxmi Chandra Jain, Professor of Physics, Government Engineering College, Jabalpur, Email : drjainyop@yahoo.com; *Anekant and Modern Physics.*
3. Dr. Muni Abhijit Kumar, Jain Vishva Bharti Institute, Ladnun, Email: presentvictory@gmail.com; *Celestial and the Extra Terrestrials : A Scientific Study.*
4. Prof. Daya Edirisinghe, Senior Professor of Philosophy and Chair, Department of Philosophy, University of Kelaniya, Srilanka, Email: ambagaha@yahoo.com; *A Critical Examination of Logical Form of Syadavada and its Impact on Scientific Thinking*
5. Prof. Mahendra Kumar Bhandari, Ex. Dean & Head, Faculty of Law, Jai Narayan Vyas University, Jodhpur Email: profmkb.law@gmail.com; *The Socio-psycho and Technical-legal Dimensions of the Practice of Santhara/Sallekhana.*
6. Dr. Jeoraj Jain, Scientist. Email : dr.jeorajjain.38@gmail.com; *Ancient Map of Universe and Modern Science.*
7. Dr. Dipak Jadhav, Lecturer in Mathematics, Govt. School of Excellence, Barwani, MP Email: dipak\_jadhav17@yahoo.com; *The Jaina School of Indian Mathematics*, since published in Indian Journal of History of Science, 52.3, 316-334 (2017).

8. Dr. Rajmal Jain, Dean, Research Cell, Kadi Seva Vishva Vidyalyaya, Ghandhinagar, Email: profrajmaljain@ldrp.ac.in; *Universe: In the Perspective of Jainism and Modern Science.*
9. Prof. Subhash Chandra, Associate Professor (Hon.), Intercultural open University (IOU) Netherlands. Email: schandra101@gmail.com; *Globalization & Nonviolent World Order: Relevance of Gandhi in the 21<sup>st</sup> Century.*
10. Dr. Sudhir V. Shah, Professor & Head of Department of Neurology, Sheth V. S. General Hospital, Ahmedabad, Email: sudhirshah@hotmail.com; *Pursuit of Happiness.*
11. Mr. Arun Zaveri, Promoter, Scientific Meditation Organization, Mumbai, Email: arun.zaveri@hotmail.com; *Transmutation of Primal Drives Through Preksha Meditation.*
12. Dr. Anshul Jain, Sr. Consultant Cardiologist, Fortis Hospital, New Delhi. Email: dranshuljain.com; *Preksha Meditation and Heart Health.*
13. Dr. Priya M Vaidya, Assistant Professor, Department of Philosophy, University of Mumbai, Mumbai. *Role and Relevance of Yoga in the Modern Age: The Jain Perspective.*
14. Mr. Om Prakash Dubey, Ex. Executive Director, World Bank, Email: dubeyvilla@yahoo.co.in; *Spirituality, Science and Consciousness.*
15. Dr. Surendra S. Pokharna, Former Scientist Indian Space Research Organization, Ahmedabad, Email: sspokharna15@yahoo.com; *Exploration of General systems Theory, Quantum Physics, General Theory of Relativity, Neurophysiology and Jainism May Provide New Frontiers of Knowledge, Order and Evolution.*
16. Prof. M.P. Tiwari, Department of Law, A D Constituent College, University of Allahabad, Allahabad, *Jurisprudential Aspect of Santhara Practice in Jainism.*

### **List of Articles Presented in Oral Sessions**

1. Shri Pankaj Sheth, The Science of Divine Living, Mumbai, India, *Mahavira - The Complete Scientific Environmentalist*
2. Dr. Rajesh Kumar Jain, Electronics Division, B.A.R.C, Mumbai, India, *Dream's Mystery - From the Perspective of Science and Religion.*
3. Dr. Laxmikanta Padhi, University of North Bengal, Siliguri, India, *The Relationship between Mind and Body: Descartes, Spinoza, Liebnitz and Jainism.*

## **Jain Philosophy: A Scientific Approach to Reality**

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4. Dr. Mahendra Patel, Bhakti Vedanta Hospital, Mumbai, India (Ex), *Abortion Means Murder*.
5. Dr. Namita Nimbalkar, Dept. of Philosophy, University of Mumbai, Mumbai, India, *The Power of Non-Violence in Jainism's Approach towards Environment and on M. K. Gandhi's Philosophy*.
6. Mr. Sudhir M. Shah, Yale University, North Carolina, USA, *Conflict Resolution - Championing Anekantavaad*.
7. Prof. Sohan Raj Tater, Singhania University, Rajasthan, India, *Self Interaction of Karma and Genes in the Light of Jain Philosophy*.
8. Mr. Rajnikant Patel, Holistic Science Charitable Research Foundation, Pennsylvania, USA, *Biological Laws of Nature and Karma*.
9. Venerable Dr. Sumedh Thero, Ancient Buddh Vihar, Jhansi, India, *Jain and Sraman Perspective of Ecological Balance and Environment Protection*.
10. Mr. Santosh Karkare, Indian Institute of Technology, Kanpur, India, *Novel Findings on the True Nature of Cosmology in View of Ancient and Modern Era*.
11. Dr. Varsha Shah, K. J. Somaiya Centre for Studies in Jainism, Mumbai, India, *The Myth of Space Time - A Comparative Approach within the Scenario of Jain Universe and String Quantum Theory*.
12. Prof. R. K. Chhajlani, Vikram University, Ujjain, India, *Evolution of Decimal Number System and Probability by Jain Mathematicians and Modern Science*.
13. Ms. Ujwala Dongaonkar, G. H. Rasoni College of Engineering, Nagpur, India, *Mathematical Model of Geometric Progression and its analysis by Jain Karmic Theory*.
14. Dr. Shrenik Bandi, Dept. of Mathematics, IPS Academy, Indore, India, *Calendar (Panchang) System in Jaina Tradition*.
15. Mrs. Maithili R Gupte, K J Somaiya Centre for Jainism, Mumbai, India, *Jain Ethics of Non-Violence: Its Relevance in Present Scenario*.

## **Experimental Workshops**

1. Prof. Prabhavati Chowdhary, Department of Sanskrit, Jain Narayan Vyas University, Jodhpur, India, *Prekṣā Meditation and Health*.
2. Dr. Priya M. Vaidya, Dept. of Philosophy, University of Mumbai, *Role and Relevance of Yoga in the Modern Age: The Jaina Perspective*.

3. Dr. Falguni P. Zaveri, University of Mumbai, Mumbai, India, *Effects of Spiritual Practices on Human Mind and Brain*.
4. Dr. Anshul Jain, FORTIS Hospital, Delhi, India, *Prekṣā Meditation and Heart Health*
5. Mr. Girish Shah, Carry the Vision, California, USA, *Science of Compassion (anukampa) and Global Compassion Movement*.
6. Prof. Seema Ashar, Mulund College of Commerce, Mumbai, India, *Impact of Prekṣā Meditation on Emotional Intelligence of Teachers*.
7. Shri Parasmal Dugar, Mumbai, India, *The Science of Mudras and Colour Therapy*.

**List of Articles Presented by Young Researchers**

1. Muni Jagrit Kumar, Jain Vishva Bharati Institute, Ladnun, India, *Effects of Food on Mood*.
2. Muni Siddha Kumar, Jain Vishva Bharati Institute, Ladnun, India, *A Revolution for Evolution- Living with Non Possessiveness*.
3. Khushbu Jain, Bhagwan Mahavira International Research Centre, JVBI, Ladnun, India, *Pyscho-biological Studies on the Effect of Yoga and Prekṣā Dhyāna on Aggressiveness in Primary School Children*.
4. Vivek Maheswari, Jain Vishva Bharati Institute, Ladnun, India, *Prekṣā Meditation and its Importance for Adolescents in Academic Setting: An Experimental Approach*.
5. Hiya Jain, Utpal Shanghvi Global School, Mumbai, India, *Biological Law of Nature and karma*.
6. Ojas Baradiya, National Public School, Bangalore, India, *The Amazing Truth about Time*.
7. Samani Shreyas Prajna, Department of Jainology and Comparative Religion and Philosophy, JVBI, Ladnun, India, *Impact of Prekṣā Meditation on Alpha Brain Waves*.
8. Samani Sulabh Prajna, Department of Jainology and Comparative Religion and Philosophy, JVBI, Ladnun, India, *The Effect of Prekṣā Meditation on Creative Problem Solving Ability*.
9. Akshit Paresh Sethiya, K. J. Somaiya Centre for Studies in Jainism, Mumbai, India, *Scientific Evidence of Negative and Positive Energy in Jain Cosmology*.

10. Shweta Lodha, Jain Vishva Bharati Institute, Ladnun, India, *Parvarish (of Foetus)*.
11. Dr. Shubhada Neel, Divine Sanskar Research Foundation, Navi Mumbai, India, *Integrated Approach in the Management of Expectant Mothers*.
12. Vallary Belsare, K. J. Somaiya Centre for Studies in Jainism, Mumbai, India, *Effect of Sound of OM on Microbial Activity*.
13. Dr. R. C. Mishra, United College of Engineering and Research, *Mathematical Analysis of the dynamic of CO<sub>2</sub> in atomic gases in the environment*.

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1. Dr. Jashwant Shah, AVBMM School, Vapi, India (Ex), *Limitations of Current Knowledge with reference to Jain Logic*.
2. Dr. Madhuchhanda Bhattacharyya (Chatterjee), Department of Philosophy, Maulana Azad College, *Reconciliation between Realism and Relativism: Contribution of Jainism and Hilary Putnam*.
3. Surendra Jain Gogad, Mumbai, India, *Jain ethics including non-violence, self-discipline and its relevance in the present scenario (Ecology, Environmental Science and Social Science, etc.)*.
4. Prof. Devdas Saket, Dept. of Philosophy, Vikram University, Ujjain, India, *Moral Value in Jain Philosophy and its relevance in the present scenario*.
5. Dr. P. C. Kanthaliya, Maharana Pratap University of Agriculture and Technology, Udaipur, India, *Concept of the Time Theory in Jainism as Compared to Other Religions and Science*.
6. Dr. Hemali Sanghavi, Dept. of History, K. J. Somaiya College of Arts & Commerce, Mumbai, India, *Four Bhavanas: Evolving workplace spirituality*.
7. Ashutosh Nirvadyaachari, Udaipur, India, *Veganism: A Study from the Perspective of Philosophy of Jainism*.
8. Samani Amal Pragma, Jain Vishva Bharati Institute, Ladnun, India, *Promoting Forgiveness through Prekṣā Meditation*.
9. Dr. Veerbala Chhajed, Dept. of Philosophy, Vikram University, Ujjain, India, *Non Physical Order of Existence: Concept of Soul in Jain Metaphysics and Concept of Consciousness in Modern Science*.

10. Shibaprasad Parhi, SpARC, Mumbai, India, *Entropy, Disorderliness and Ignorance: An Understanding of Direction of Time.*
11. Dr. Shubhada Neel, *Science & Spirituality – Integrated Approach in the Management of Expectant Mothers.*

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This proceeding is a compilation of the selected Plenary and Invited talks to bring out the salient features of deliberations. An Editorial Board, consisting of Dr. Samani Chaitanya Prajna, Dr. N.L. Kachhara, Dr. Narendra Bhandari, and Dr. K.P. Mishra was constituted for publication of



the Proceedings. Every paper has been reviewed by experts; and some papers, which did not conform to the required format, have not been included. We have also included futuristic Action plan of BMIRC, keeping in view the responses, suggestions and feedbacks from the delegates and dignitaries. Although editors have carefully reviewed the papers, they are not responsible for the contents and copy right issues, which are entirely the responsibility of the authors. We are especially thankful to Ms. Pooja Banthia for careful compilation of the proceeding papers and for assistance in editing the articles. We would like to express our gratitude to the esteemed Donors and Sponsors, listed hereafter, for their generous and vital support and financial help, which made this conference a reality. The invaluable support of Jain Vishva Bharati Institute Supporters is gratefully acknowledged. We are indebted to Rosy Blue for providing support for printing this Proceedings.

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## About the Book

This Proceedings of the *International Conference on Science and Jain philosophy*, held at Indian Institute of Technology, Mumbai, organised by Jain Vishva Bharati Institute, Ladnun in January 2016 brings out important papers presented at the Conference. Such a conference, a brainchild of Pujya Munishri Prof. Mahendra Kumar, was a unique event in the long history of Jainism. The 38 selected papers by a large group of Indian and foreign authors discuss a wide variety of subjects such as Relativism and Jain Logic, Soul and consciousness, Relevance of Jainism in Modern Times, Science, Society and Ethics, Laws of Nature and Karma Theory, Environment and Ecology, Macrocosmology, Universe, cosmography and cosmogony, Mathematics, Microcosmology, and *Paramāṇu* and Atom and are grouped under seven sections: Nature of Reality; Jain Metaphysics and Science; Consciousness and Life; Meditation and Health; Matter, Universe and Cosmology; Environment; and Mathematics. Besides a brief summary of Round Table discussions, Experimental Workshops on Impact of Life style intervention, *Prekṣā* meditation, Yoga and meditation in achieving holistic health is given in the concluding section.

The Proceedings has been edited by **Samani Dr. Chaitanya Prajna**, Professor, Dept. of Jainology and Comparative Religion & Philosophy and former Executive Director, BMIRC, JVBI, **Professor Narayan Lal Kachhara**, B.E., M.E., Ph. D., University of Salford, UK; (Formerly Principal, Motilal Nehru Regional Engineering College, Allahabad and currently Emeritus Professor, JVBI and Advisor, BMIRC); **Dr. Narendra Bhandari**, Ph.D. (Chair, Department of Science and Spirituality, BMIRC and Science and Spirituality Research Institute, Ahmedabad and formerly Senior Professor and Chairman, Planetary Sciences and Exploration Division (PLANEX) at ISRO-Physical Research Laboratory, Ahmedabad) and **Dr. K.P.Mishra** Ph.D. (Former Vice Chancellor, NGB University, Allahabad, Ex. Head, RB&HSD, Bhabha Atomic Research Center, Mumbai and President, Foundation for Education and Research, India).



The Editors hope that this Proceedings will bring out to fore the scientific foundations of Jain Philosophy and its relevance today and will be useful in further research.

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**Bhagawan Mahavira International Research Center (BMIRC) has been established in the Department of Jainology & Comparative Religion & Philosophy of Jain Vishva Bharati Institute (Deemed University), Ladnun, Rajasthan. BMIRC facilitates scholars to undertake research projects in frontier areas of science, societal studies, culture, environment and ecology, spiritual aspects of life, and holistic health, and carry out innovative studies with an aim of evaluating the Jain doctrines and developing them further for their practical applications to personal and social development. Some of the subjects proposed to be studied at BMIRC are Jain scriptures, metaphysics, epistemology and logic, art and science of Jain spiritual practices, physiological and psychological effects of meditation in context of medical sciences, consciousness and cognitive powers, past-life memory, extra-sensory powers, clairvoyance, telepathy, psycho-kinesis, etc., interdisciplinary areas of philosophy and physics, chemistry, biology and mathematics, ethics, environment and ecology, and applications of Jain doctrines and their impact on society**

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**This proceedings containing invited papers on several aspects of Jainism and science is the second initiative of BMIRC, necessary to provide baseline information required for undertaking research activities in this area.**

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# Jain Philosophy and Science

In India, science has never been able to completely subjugate the religious sensitivities unlike the Western countries. Mysticism and Transcendence remain as important as (sometimes even more) rationality, logic and sensible perceptions. Here man's personality is not entirely denatured by the scientific objectivity nor has sacredness been taken away by its rationality. In fact, science, in spite of its spectacular achievements, has never been able to attract religious personalities and never had a chance to become a new religion here, as it did in the West.

"On the other hand, dogmatic beliefs and the very definiteness of the answers given by religious scholars cause scientific-minded modern young men to view them with suspicion and skepticism if not with utter disbelief. It is essential to satisfy the skeptic by scientific methodology and convince them about the superiority of wisdom above superfluous knowledge."

"Science will not, because it cannot, answer all the questions of great interest to human mind and for human welfare. But science has made tremendous progress during the last hundred years. Science can show us methods and methodology for expanding and elucidating the secrets of much ancient wisdom contained in the sacred canons. In other words, the synthesis of ancient wisdom and modern scientific knowledge can help us to integrate the spiritual insight with the scientific approach for creating a spiritual-cum-scientific personality."

Jain philosophy does not swear by mysticism, though it culminates in it. But the mysticism is not the result of dogmatic faith. Philosophical speculation is a necessary discipline of the mind for attenuating doubts. But the ultimate truth cannot be realized by philosophical discipline alone. The terminus of philosophy is the beginning of spiritual career. The plenum of knowledge can be attained by the development of a superior power of vision which is not satisfied with the negative findings of reason and seeks infinite perfection. "The Jains are emphatic that omniscience is the condition as well as the result of perfection and however much we may advance in our philosophical enquiry and scientific pursuit, which are not antagonistic in their aim in spite of their difference in method and lines of approach, it cannot by itself unlock the mystery of ultimate reality and bring about the final consummation."

Eastern mystics in general and Jains in particular emphasize the systematic unity of Reality which does not mean that all things are identical but they are aware that all differences and contrasts are relative (and not absolute) within an all-embracing unity. It is difficult to accept the paradoxical unity of opposites in our normal state of consciousness and even some philosophies either bypass or conceal the problem. Jain philosophers, on the other hand, by their remarkable insight, reveal the relativity and polar relationship of all opposites which not only include unity and multiplicity, motion and rest, but also the fundamental attributes of existence and non-existence."

**Prof. Muni Mahendra Kumar**



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