JAINA BIOLOGY (1)

- J. C. Sikdar

1. Jaina Biology and the Scientific Method

Biology is the science of living substance (Jivadravya)[1] which is different from non-living substance (ajivadravya)[2]. It is a very old science of living substances for solving the fascinationg riddle of life. The survival of early men required a knowledge of such basic facts as which plants and which animals could be safely taken as food and medicine. In the Jaina Āgamic literature the word 'Jivatthikāya'[3] is used to refer to any living substance, plant or animal, from nigoda[4] (micro-organism) up to the pañcendriya manuṣya[5] (five-sensed human beings), just as the word 'organism'[6] in modern age is used to denote any living thing, plant or animal, from amoeba to man.

The study of Biology began with the Jainas on the basis of the doctrine of animism[7] and ahiṃsā[8] (non-violence) in the hoary past, besides the requirement of food to sustain life with a sense of spiritual value of life of all beings. They kept in view the concepts of living substance as contained in the Vedic[9] and post-Vedic[10] literature, describing the external and internal parts of plants and animals with their nomenclature, classifications, etc.

Biology as an organized science can be said to have begun with the Greeks[11] in the West on the basis of the knowledge of such basic facts as which plants and which animals were useful as food and medicine. "They and the Romans described the many kinds of plants and animals known at the time."[12]

Galen (131-200 A.D),[13] the first experimental physiologist, made experiments to study the functions of nerves and blood vessels. Biology expanded and underwent alteration greately

in the nineteenth century, and it has continued this trend at an accelerated pace in the twentieth century due to the discoveries and techniques of physics and chemistry.

Sources of Scientific Information on Jaina Biology :

The ultimate source of each fact of Jaina Biology contained in the Jaina Āgamic and post-Āgamic works is in some carefully controlled observation made by the Jainācāryas. They have made a discovery in the world of life, plants and animals, by their critical observation on them; they have described their methods in details so that their followers can repeat them, have given the result of their observations, discussed the conclusions to be drawn from them, perhaps formulated a theory to explain them, and indicated the place of these biological facts in the present body of scientific knowledge contained in the Jaina Āgamas.

The Scientific Method :

The facts of Jaina Biology as embodied in the Jaina canons are gained by the application of the scientific method, yet it is difficult to reduce this method to a simple set of rules of modern Biology that can be applied to the Jaina biological science, because the sceptical scientists of modern age want confirmation of the statement by the independent observation of another in any scientific investigation.

"The basis of the scientific method and the ultimate source of all facts of science is careful, close observation and experiment, free of bias, with suitable controls and done as quantitatively as possible."[14] The observations made by the Jainācāryas on the world of life, plants and animals, may be analyzed, or simplified into their constituent parts in the light of modern Biology, so that some sort of order can be brought into the observed phenomena. Then the parts can be synthesized or reassembled and their interaction and interrelations discovered on the scientific basis. A method

has been followed by the Jainas to see through a mass of biological data and they suggest a reason for their interrelations, as science advances only by scientific investigations : hypothesis, observation, revised hypothesis, further observation and so on. In the words of Einstein "In the whole history of science from Greek philosophy to modern physics, there has been constant attempts to reduce the apparent complexity of natural phenomena to some simple, fundamental ideas and relations.[15]

Some of the practical uses of a knowledge of Jaina Biology will become apparent in the fields of medicine and public health, in agriculture and conservation, its basic importance to the social studies, and its contribution to the formulation of a philosophy of life, together with aesthetic values, as it is impossible to describe the forms of life without reference to their habitats, the places in which they live, in a given region, being closely interrelated with each other and with the environment in the closely interwoven tapestry of life.

2. Some Generalizations of Jaina Biological Science

The idea that living systems are distinguised from non-living ones by some mysterious vital force (paryāpti)[16] has gained acceptance in Jaina Biology, while one of the basic tenets of modern Biology is that "the phenomena of life can be explained in terms of chemisyry and physics."[17] The idea that the living systems are not distinguised from non-living ones by some mysterious vital force has only recently gained ground in Biology, only 40 years ago, when the German embryologist, Hans Driesch, postulated the theory of "the existence of transcendent regulative principles, entelechies, which control the phenomena of life and development."[18]

There appear to be no exceptions to the generalization that all life comes only from living things. Like the experiments of Pasteur, Tyndal and others,[19] just century ago finally, the Jainācāryas, provided convincing proof that micro-organism.

such as, nigodas, earth quadrates, etc., i.e. bacteria, are also incapable of originating from non-living material by spontaneous generation. It seems clear that nigodas require the presence of pre-existing nigodas,[20] just as the virus of modern Biology does so. Nigodas (micro-organisms) do not arise de nove from non-nigodas, just as viruses do not do so from non-viral material.[21]

Elements of the idea that all of the many kinds of plants and animals existing at the present time were not created de novo and were eternally exsiting and have descended from previously existing organisms are clearly expressed in the jaina texts,[22] but they have their gradations.[23] The theory of organic evolution that all of the many kinds of plants and animals "have descended from previously existing simpler organisms by graduals modifications which have accumulated in successive generations has gained ground among the modern Biologists as one of the great unifying concepts of Biology. Elements of this were implicit in the writings of certain Greek philosophers before the Christian era, from Thales to Aristotle."[24]

The Jaina studies of the development of many kinds of animals and plants from ferilized egg[25] or embryo[26] to adult leads to the generalization that organisms tend to repeat in the course of their embryonic development, some of the corresponding stages of their evolutionary ancestors. According to the theory of recapitulation, embryos recapitulate some of this embryonic forms of their ancestors,[27] while modern Biology goes a step forward and states that "the human being, at successive stages in development resembles in certain respects a fish embryo, then an amphibian embryo, then a reptilian embryo and so on."[28]

Inter-relations of Organism and Environment :

A careful study of communities of plants and animals

in a given area as described in the Jaina Āgamas leads to the generalization that all living beings in a given region are closely interrelated with one another and with the environment.

It includes the idea that particular kinds of plants and animals are not found at random over the earth but occur in interdependent communities of producer, consumer and decomposer-organisms together with certain non-living components. These communities can be organized and characterized by certain dominant members of the group, usually plants, which provide both food[29] and shelter for many other forms. This eco-system is one of the major unifying generalizations of Biology. These few biological principles given here are intended to emphasize the fundamental unity of Jaina biological science and the many ways in which living substances are interrelated and interdependent.

Like all ancient people, the Jainas lived in close association with nature and made a scintific study of the world of life, plants and animals, by careful observations on their lives, activities and properties, etc., over a long period of time. The result of their discoveries as embodied in the Āgamas is conducive to further studies of the problems and mysteries of the world of life on the basis of new information and further revisions of some of these principles.

Foot-notes

1. Bhagavati Sūtra, śataka 25, uddeśaka 2. sūtra 720; Sthānāṅga Sūtra. 2, 95, p.86; Paṇṇavaṇā Sutta 1.3, p, 4.
2. Bhagavati Sūtra, 25.2.720.; Paṇṇavaṇā Sutta, 1.3. p.4.; Jivābhigama Sutta, P.5
3. Bhagavatī Sūtra, 20,2, 665. 4. Ibid., 25.5, 749. 5.Ibid, 33, 1. 844.
6. Biology, C. A. Valiee, p.16.
7. "Se bemi saṁtime tasā pāṇa, taṁjahā-aṁdayā poyayā jnrāua rasaā saṁseyayā/saṁmucchimā ubbiyayā esa saṁsāretti pavuccai" Acārāṇga Sūtra, adhyayana 1, uddeśaka 6, sūtra 48, etc.
"Se hu muṇi poriṇṇāyakamme" (54).. Ibid; See SBE Vol. XXII, Pt. I, p, 11, Book 1. Lecture 1. 6th lesson; Sūtrakṛtāṅga 1, Adhyayana 7.

Pudhavi ya āū agaṇi ya vāū, taṇa rukkha biya ya tasā pāṇā/Je aṁḍvya je ya jarāuipāṇa, saṁseyayā je resayābhihāṇa (1)" etc.... up to "Nidhūya kammaṁ ṇa pavaṁcuvci, akkhakkhae vā sagaḍaṁ ti bemi"-30. See SBE XLV, Pt. II, pp. 293, 302, Sūtrakṛtāṅga, Book I, Lecture 7.

8. Bhagavatī Sūtra, 2.1.92, 95; 8.5.328; 11.9. 417; 11.22. 435.
9. See the Indian Journal of History of Science, Vol. 5,No.1, 1970, Biology in Ancient and Medieval Indian, Dr. R.N. Kapil, pp. 125-132.
10. Ibid.
11. Biology, p.1.
12. Ibid.
13. Ibid, p.3.
14.
15. Ibid, p.4.
16. Paryāpti (Vital force), Navatattva prakaraṇam, V. 6, p.12;
17. Lokapraksas, Vinayavijayaji, Pt. I, 3rd Sarga, VV. 15 ff. Biology, p.9.
18. Biology, p.9.
19. Ibid.
20. Bhagavatī Sūtra, 25.5. 749
    Nigodas are of two kinds, viz. Nigodakā and Nigodajiva (fine and gross nigodas). They are the collections of infinite number of beings, making minute group, having common breathing-in and out (respiration), sense-feeling. They, longing for development, continue evolution of life through the successive Jivaparyāyas (modes of beings of soul) and they provide the supply of beings in the place of those who have attained liberation. Thus the universe does not become and will not become empty of living beings (Bhagavatī, 12. 2. 443).
21. Biology, p. 9.
22. Bhagavatī Sūtra, 12.2. 443; Tattvārtha Sūtra, 5.3. (Nityāvasthitānyarūpāṇi ca)
23. Bhagavatī Sūtra, 12.2.443.
24. Biology, p. 10.
    See A History of Greek Philosophy, Vol.I, II and III, by W. K. C. Guthrie; Aristotle by Ross.
25. Bhagavatī Sūtra, 7. 5. 282.
26. Bhagavatī Sūtra, 7. 7. 283.
27. Ibid, 1. 7. 61.; Tandulaveyālya, 6. p.10.
28. Biology, p. 11.
    According to the Bhagavatī Sūtra (1. 7. 62), the foetus in the mother's womb remains like an umbrella or the side ribs of human body; the embryo appears to be like a humpbacked mango (ambakhujjae).
29. Bhagavatī Sūtra, 6. 7. 246; 6. 6. 330; 7. 3. 227; 8. 3. 324; 8. 5. 330; 21. 2. 691. 22. 6. 692; 23. 1. 993; etc.; Sūtrakṛtaṅga II, 3.

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JAIN BIOLOGY (2)

CELL STRUCTURES AND FUNCTIONS

1. The Fabric of Life

As defined, Biology is the science of living substances (jivadravayas). The field of Jaina Biology deffentiates the living from the non-living by using the word 'Jivattikāya'[1] (organism) to refer to any living things, plant or animal, just as modern Biology does. So it is relatively easy to see that a man,[2] a Sāla tree[3], a creeper[4] and an earthworm[5] are living, whereas pieces of matter (pudgala),[6] e.g. earth, stones, etc., are not so. But according to modern Biology, "it is more difficult to decide whether such things as viruses are alive."[7]

Jaina Biology, states that the fabric of life of all plants and animals is paryāpti[8] (Śakti=Vital force) or Prāṇa (life force) in another way, i. e. paryāpti appears to be the actual living material of all plants and animals. There are stated to be six kinds of paryāpti[10], viz. āhāraparyāpti (vital force by which beings take, digest, absorb and transform molecules of food paricles into khala (waste producs) and rasa (chyle=molecules of nutrients or energy)[11], śarīraparyāpti (vital force) by which chyle or molecules of nutrients (=rasibhūtamāhāraṁ) are utilized by beings for the release of energy, the building of blood, tissue, fat, bone, marrow, semen, etc.,[12] indriyaparyāpti[13] (vital force by which molecules of nutrients or chyles suitable for building senses are taken in and provided to the proper place so that beings can have the perceptual knowledge of the desired sense-objects by the sense-organs)[14] acchvāsaparyāpti[15] (Vital force by which particles of respitation are taken in, oxidized for energy and left out (as carbon dioxide and water), bhāṣāparyāpti[16] (vital force by which beings, having taken proper particles of speech,

emit them as speech) and manaḥparyāpti (vital force by which beings, having taken particles [or dusts] of mind, transform them by the mental process and give vent to them as the mental force, i. e. thought).

It appears that this paryāpti (vital force) is not a single substance but varies considerably form organism to organism (i.e. one-sensed to five-sensed being), among the various parts of a single animal or plant, and from one time to another[18] within a single organ or part of an animal or plant. There are six paryāptis, but they share certain fundamental physical and chemical characteristics.[19]

It is stated that there are ten kinds of prāṇa[20] (living material or life force), viz. five indriyaprāṇas (life force of five senses), ucchvāsaprāṇa (life force of respiration), āyuprāṇa (life force of length of life), manovāk-kāyaprāṇas (life forces of mind, speech and body).

Actually speaking, these ten prāṇas are almost contained in six paryāptis, e. g. indriyaparyāpti contains five indriyaprāṇas, ānaprāṇaparyāpti = ucchvāsaprāṇa, śarīraparyāpti = kāyaprāṇa, bhāṣāparyāpti = Vākprāṇa, manaḥaparyāpti = manaḥaprāna, only āyuprāṇa appears to be an addition.

Thus it is found that most of the paryāptis and the prāṇas have common names. So the question is whether there is any difference between them. The Gommaṭasāra explains the diffrence in this way that paryāpti is attainment of the capacity of developing body, mind, speech and five senses, while prāṇa is the activity of those funtionaries.[21]

It is further explained that one-sensed beings possess four prāṇas or balas (life-forces), viz. sense of tough, respiration, length of life and body; two-sensed beings have six prāṇas, viz. senses of touch and taste, respiration, length of life, body and speech, three-sensed being have seven prāṇas, viz.

senses of touch, taste and smell, respiration length of life, body and speech; four-sensed beings have eight prāṇas viz. senses of touch, taste, smell and sight, respiration, length of life body and speech. In asaṁjñi pañcendriya jīvas (five-sensed beings having no physical mind) but psychical mind there are nine prāṇas viz. sense of touch, taste, smell, sight and hearing, respiration, length of life body and speech, while there are ten prāṇas in Saṁjñi pañcendriya Jīvas (five-sensed beings having physical mind and psychical mind) viz. senses of touch, taste, smell, sight and hearing, respiration, length of life, body, speech and mind.[22]

According to the Cārvākas, life (as well as consciousness) is result of peculiar chemical combinations of non-living matter or the four elements, in organic forms as the intoxicating property of spirituous liquor is the result of the fermentation of unintoxicating rice and molasses.[23] Similarly, the instintive movements and expression of new born babies (sucking, joy, grief, fear, etc.) take place mechanically a result of external stimuli as much as the opening and closing of the lotus and other flowers at different times of the day or night[24], or the movement of iron under the influence of loadstone.[25] In the same way, the spontaneous reproduction of living organisms frequently occurs, e.g. animalcules develop "in moisture or infusions, especially under the influence of gentle warmth (Svedaja, Uṣṇaja, daṁśamaśakādayaḥ)"[26] or the maggots or other worms originate in the rainy season due to the atmospheric moisture in the constituent particles of curds and the like and begin to live and move in so short a time.[27]

Āchārya Haribhadra Sūri has refuted Bhūtacaitanyavāda of the Materialists long before the Sāṁkhya in the following manner. It is the doctrine of the Materialists that this world is formed of only five great elements (mahābhūtas), viz.

earth, etc. and there is no existence of soul nor the unseen force anywhere in the world.[28]

The other Marerialists maintain the view on the contrary that elements are non-conscious (acetana). Consciousness is not the character of elements nor the result of elements, while soul is the name of that tattva (reality) with which (soul) consciousness is related (as character or result).[29]

If conciousness would have been the character (quality) of elements, then it should have been found in all elements at all times, just like that the existence (existentiality), etc. (general character) and hardness, etc. (particular character) are found in the elements at all times in which they are found.[30]

Now Haribhadra Sūri refutes Bhūtacaitanyavāda in this way that consciousness exists in elements as force (śakti), for this reason it is not perceptible, but consciousness existing in elements as force cannot be said to be non-existing in elements.[31]

This force (śakti) and consciousness are either non-different by all means from each other or different by all means from each other. If they are non-different, then this force becomes consciousness and if they are different, consciousness should be related with something else.[32]

Again, the point of non-manifestation of cetanā (consciousness) does not seem to be logical, because there is no other entity (Vastu), covering consciousness and it is for this reason that the number of realities will go against the doctrine of the Materialists on the admission of the existence of such an entity.[33]

Haribhadra Sūri further advances the argument to refute the contention of the Materialists that this thing is directly proved that the element has got the nature of these two

qualities or characters–hardness and non-livingness and when consciousness is not of the nature of these two characters (i. e., cannot exist with these two), then how can it be accepted that it was born out of elements ?[34]

If cousciousness does not exist in individual (i.e. uncombined elements, then it cannot exist in the combined elements just as (like that) oil cannot exist in sand particle. And if consciousness exists in the combined elements, then it should exist also in individual elements[35] and so on.

In conclusion Haribhadra Sūri maintains the view after refuting the doctrine of Bhūtacaitanyavāda of the Materialists with his cogent arguments that the existence of force (Śakti), etc. in soul and of the unseen force (adṛṣṭa), which makes the possibility of śakti etc. in soul, should be accepted and this unseen force (adṛṣṭa), which is different from soul, is real and of many kinds and comes into relation with soul.[36]

The Sāṁkhya makes the reply to the materialists' view on caitanya in the following manner that "the intoxicating power in liquor is a force, i. e., a tendency to motion. This force is the resultant of the subtle motions present in the particles of the fermented rice, molasses, etc. A motion or a tendency to motion, can in this way be the resultant of several other motions and tendencies."[37] "But caitanya (consciousness) is not a motion, and cannot be the resultant of (unconscious) natural forces or motions. Neither can the consciousness of the Self, or of the organism as a whole, be supposed to be the resultant of innumerable constituent particles of the body. One central abiding intelligence is simpler and therefore more legitimate hypothesis than an assemblage of consciousness latent in different bhūtas or particles."[38]

The Sāṁkhya philosophy maintains the view that Prāṇa (life) is not Vāyu (biomechanical force) nor it is mere mechanical motion generated from the impulsion of Vāyu.[38]

The five vital forces, viz. Prāna, apāṇa, samāna, udāna, and vyāna[39] are stated to be Vāyu in metaphorical way. Prāṇa (life) is in reality a reflex activity, a resultant force of the various concurrent activities of the Antaḥkaraṇa, i. e. "of the sensorimotor (Jñānedriya-Karmendriya), the emotive (manaḥ) and the apperceptive reactions of the organism."[40]

According to Vijñānabhikṣu, this explains the disturbing effect on the vitality of pleasurable or painful emotions (like love = kāma) of mind (manas), one of the internal senses involved in the reactions of the living organism.[41]

Thus Prāṇa of the Sāṁkhya is not a Vāyu nor is it evolved from the inorganic matters (Bhūtas), "but is is only a complex reflex activity (Sambhūyaikā vṛtti) generated from the operations of the psycho-physical forces in the organism."[42]

In agreement with the Sāṁkhya the Vedāntists hold the view that "Prāṇa is neither a vāyu nor the operation of a vāyu."[43] But they differ from the former's view that Prāṇa is a more reflex or resultant of concurrent sensori-motor, emotive and apperceptive reactions of the organism. If eleven birds, put in a cage, concurrently and continually strike against the bars of it in the same direction, it may move on under the impact of concerted action. But the sensory and motor activities cannot in this way produce the vital activity of the organism, because the loss of one or more of the senses does not result in the loss of life. This is above all the radical distinction between them. There is the sameness of kind (Samajātiyatva) between the motions of the individual birds and the resultant motion of the cage, but Prāṇa is not explained by sensations, but it is a separate principle (or force), just as the mind and antaḥkaraṇas generally are regarded in the Sāṁkhya. It is a sort of subtle "ether-principle" (adhyātmavāyu) pervasive of the organism, not gross vāyu, all the same subtilized matter like the mind itself, as everything

other than the soul (ātmā), according to the Vedānta, is material (jaḍa). Prāṇa is prior to the senses, for it regulates the development of the fertilized egg, "which would purify, if it were not living, and the senses with their apparatus originate subsequently from the fertilized agg."[44]

Caraka[45] explains vāyu as the impelling force, the prime-mover, which sets in motion the organism, the organs (including the senses and the mind), arranges the cells and tissues, unfolds or develops the foetal structure out of the fertilized ovum. According to Caraka and Suśruta[46], there are five chief vāyus with different functions for the maintenance of the animal life, viz. prāṇa, udāna, samāna, vyāna and apāna, as mentioned in the Sāṁkhya. Suśruta[47] describes prāṇa as having its course in the mouth and function in deglutition, hiccough, respiration, etc., udāna in articulation and singing, samāna as digesting the food substance in the stomach in conjunction with the animal heat, vyāna as causing the flow of blood and sweat, and apāna with its seat in the intestinal region as throwing out the urinogenital secretions.[48]

In the mediaeval philosophy[49] there is mention of forty nine vāyus among which there are ten chief Vāyus, viz. (1) Prāṇa, (2) Apāna, (3) Vyāna, (4) Samāna, (5) Udāna, (6) Nāga, (7) Kūrma, (8) Kṛkara or Krakaro, (9) Devadatta and (10) Dhanañjaya.[50]

Prāṇa has the function in the ideo-motor verbal mechanism and vocal apparatus, the respiratory system, the muscles in coughing, singing, etc., apāna in ejecting the excretions and wastes, the urine, the faeces, the sperm and germ-cells etc., vyāna in extension, contraction, and felxion of the muscles, tendons, and lingaments, the stored up energy of the muscles, udāna in maintaining the erect posture of the body, nāga in involuntary retching and vomitting, kūrma in the automatic movement of the eyelids, winking, etc., kṛkara in the appetites,

hunger and thirst, devadatta in bringing about yawning, dozing, etc. and dhanañjaya in causing coma, swooning and trance.[51]

The study of the different views on Prāṇa or Vāyu shows that Jaina paryāpti or prāṇa is neither a result of peculiar chemical combinations of non-living matter as advocated by the Cārvākas nor a complex activity of the Sāṁkhya but a sort of separate principle (adhyātma vāyu) pervasive of the organism as defined by the Vedānta, an impelling force, the prime-mover of Caraka and Suśruta. It appears to be the actual living material of all plants and animals like protoplasm of modern Biology. Jaina paryāpti and prāṇa, the two unique forces, not explainable in terms of Physics and Chemistry, are associated with and control life. The concept of these forces may be called vitalism which contains the view that living and non-living systems are basically different and obey different laws. Many of the phenomena of life that appear to be so mysterious in Jaina Biology may be explained by physical and chemical principles with the discovery of future research in this field. So it is reasonable to suppose that paryāpti, a mysterious aspect of life, although not identifiable with protoplasm, comes nearer to the latter because of its unique functions in the organisms.

According to modern Biology, "protoplasm is the actual living material of all plants and animals. This is not a single substance but varies considerably from organism to organism, among the various parts of a single animal or plant, and from one time to another with a single organ or part of an animal or plant. There are many kinds of protoplasm, but they share certain fundamental physical and chemical characteristics."[52]

"The protoplasm of the human body and of all plants and animals exists in discrete portions know as cells. These are the microscopic unit of structure of the body, each of

them is an independent, functional unit, and the processes of the body are the sum of the co-ordinated functions of its cells. These cellular units vary considerably in size, shape and function. Some of the smallest animals have bodies made of a single cell; others such as; a man or an Oak tree are made of countless billions of cells fitted together.[53]

"The major types of organic substances found in protoplasm are carbohydrates, proteins, lipids, nucleic acids and steroids."[54] Some of these are required for the structural integrity of the cell, others to supply energy for its functioning and still others are of prime importance in regulating metabolism within the cell."[55]

"Carbohydrates and fats (lipids) have only a small role in the structure of protoplasm but are important as sources of fuel; Carbohydrates are readily available fuel, fats are more permanently stored supplies of energy. Nucleic acids have a primary role in storing and transmitting information. Proteins are structural and functional constituents of protoplasm, but may serve as fuel after deanimation. The body can convert each of these substances into others to some extent. Protoplasm in a colloidal system, with protein molecules and water forming the two phases, and many of the properties of protoplasm-muscle contraction, ameboid motion, and so on-depend on the repaid change from sol (liquid condition) to gel (solid or semi-solid) state and back."[56]

Foot-notes

1. Bhagavatī Sūtra, 20, 2. 665.
2. Bhagavatī Sūtra, 33. I. 844; Uttarādhyayana Sūtra, 155; Tattvārtha Sūtra, II. 24.
3. Bhagavatī Sūtra, 22. 1. 692.
4. Ibid., 23. 4. 693.
5. Tattvārtha Sūtra, II. 24.
6. Bhagavatī Sūtra, 2.10.118
7. Biology, p. 16, Ville, c. 4.

8. Pajjatti = Paryāpti, Navtattva Prakaraṇa, v. 6; Dharmavijay, p. 12.; Gommaṣṭasāra Jīvakāṇḍa, vv. 118-119; Lokaprakāśa, Vinayavijaya, Pt. I, 3rd Sarga, vv. 15 ff.
9. Jīvavicāra, vv. 42. 43; Gommaṭasāra, Jīvakāṇḍa, v. 129.
10. Navatattvaprakaraṇa, v. 6
Āhāra-sarīra-iṁdiya, pajjati āṇapāṇa bhās-amaṇe /
Cau-paṁca-chappiya, iga-vigala asaṇṇi-saṇṇinam //" 6,
Navatattva Prakaraṇam, Dharmavijaya and also see Lokaprakāśa, Vinayavijaya, Pt. 1, 3rd Sarga, vv. 15 ff; Gommaṭasāra, Jīvakāṇḍa, 119.
11. Tatraiṣāhāraparyāptiryayādāya nijocitaṁ nayet /
Pṛthakkhalarasatvenāhāraṁ parinatiṁ nayet // Lokaprakāsā, 1. 3. 17.
12. Vaikriyāhārā..... yathocitam /
taṁ rasībhutamāhāraṁ yayā śaktyā punarbhavī /
Rasāsṛgmāṁsamedosthimajjāśukrādidhātūtām /
nayedyathāsambhayaṁ sā dehaparyāptirucyate // (19)
Lokaprakāśa, p. 65; Pt. I, 3rd Sarga.
13. Dhātutvena pariṇatādāhārādinidriyocitān /
Ādāya pudgalāṁstāni yathāsthānaṁ pravidhāya // (20)
Iṣṭe tadviṣayajñaptau yayā śaktyā śarīravān
paryāptiḥ sendriyāhvānā darśitā sarvadarśibhiḥ (21) Ibid., pp. 65, 66.
14. According to the Prajñāpanā sūtra (Indriyapada), Jīvābhigama Sūtra, Pravacanasāroddhāra (Com.) etc., the power by which the molecules of nutrients or chyles which are ultilized for building of sense-organs are called indriyaparyāpti, Vide, Ibid., p. 66.
15. Yayocchavāsārhamādaya dalaṁ pariṇamarya ca /
Tattayālambya muñcet so 'accvāsaparyāptirucyate // (22) Ibid., p. 66.
16. Bhāṣārhaṁ dalamādāya gīstvaṁ nītvavalambya ca /
yayā śaktya tyajet prāṇi bhāṣāparyāptiritpasau" // (29) Ibid., p.67.
17. Dalaṁ lātvā manoyogyaṁ tattāṁ nītvāvalambya ca /
yayā mananaśaktaḥ syānmanaḥparyāptiratra sā // (30) Ibid.
18. ', Pajjattipaṭṭhavaṇaṁ jugavaṁ tu kameṇ hodi niṭṭhavaṇaṁ /
aṁtomuhuttakāleṇahiyakamā tattiyālāvā // Gommaṭasāra (Jīvakāṇḍa), 120.
The gaining of the capacities starts simultaniously, but the completion (of each of them) is effected gradually within the period of one antarmuhūrṭa, which increases in the case of each succeeding one. Yet their total period does not exceed one antarmuhūrṭa.
19. Ibid., 121.
20. Dasahā jīvuṇa pāṇā iṁdiusāsāujogabalarūvā /
egiṁdiesu cauro, vigalesu cha satta aṭṭheva // (42)
Asaṇṇi-saṇṇi-paṁclhiṁciṁdiesu nava dasa kameṇa boddhavvā 43,

Jivavicāra, Pamca vi imdiyapānā maṇavaeikāyesu tiāi balapāṇā /

21. Gommaṭasāra, Jīvakāṇḍa, p. 90.
22. Jivavicāra, vv. 42-43.
"Ekendriyeṣu-pṛthivyādiṣu catvāraḥ, prāṇāḥ sparśanendriyocchvasāyuḥkāyabalrūpaḥ dvīndriyeṣu catvārasta eva vāgbalarasanendriyayutaḥ ṣaṭ prāṇā bhavanti tathā trīndriyeṣu ṣaṭ prāṇāsta eva ghrāṇendriyānvitāḥ sapta bhavanti tathā caturindriyeṣu saptaiva cakṣurindriyasahitā aṣtau prāṇā bhavanti/tathā asaṁ ñipañcendriyeṣu aṣtau ta eva śrotrendriyayutā nave prāṇā bhavanti/tathā saṁ ñipañcendriyeṣu ngvata eva manoyuktā daśa prāṇā bhavnti /"

Ibid., (Commentary), p. 2.

23. "Madaśaktivat vijñānaṁ/pṛthivyādīni bhūtāni catvāri tatvāni/tebhya eva dehākārapariṇatebhyaḥ madaśaktivat caitanyamupajāyate /" Nyāyamañjari, Jayanta, Āhnika, 7. p. 437 ff.
24. "Padmādiṣu prabodhasammilanavat tadvikāraḥ /" Sūtra 19, Āhnika I; Chapter III, Gautama's Nyāya Sūtra, p. 169.
25. "Ayaso ayaskāntābhigamanavat tadupasarpaṇaṁ," Ibid., Sūtra 22, p. 171.
26. Positive Sciences of the Ancient Hindus, Dr. B. N. Seal, p. 239.
27. "Varṣāsu ca svedādinā anatidaviyasaiva kālena dadhyādyavayavā eva calantaḥ pūtanādikṛmirūpā upalabhyante/", Nyāyamañjari, Āhnika 7, Bhūta-Caintanypakṣa, p. 440; The positive Sciences of the Ancient Hindus, p. 240.
28. Pṛthivyādimahābhūtakāryamātramidam jagat /
Na cātmādṛṣṭasadbhāvaṁ manyante Bhūtavādinaḥ // Śāstra-Vārtāsamuccaya, Haribhadrasūri, 1st stabaka, v. 30.
29. "Acetanāni bhūtāni na taddharmo na tatphalaṁ /
Cetanā asti ca yasyeyaṁ sa evātmeti cāpare //", Ibid., v. 31.
30. Yadiyaṁ bhūtadharmaḥ syāt pratyekaṁ teṣu sarvadā /
upalabhyeta sattvādikaṭhinatvādayo yathā // Ibid., v. 32.
31. Śakrirupeṇa sā teṣu sadā'to nopalabhyate /
Na ca tenāpi rūpeṇa satyasatyeva cenna tat // Ibid., v. 33.
32. Śakticetanayoraikyaṁ nānātvaṁ vā'tha sarvathā /
Aikye sā cetanaiveti nānātve anyasya sā yutaḥ // Ibid., v. 34.
33. Anabhivyaktirapyasyā nyāyato nopapadyate /
Āvṛtirna yadanyena tattvasaṁkhyāvoridhataḥ / Ibid., v. 35.
34. Kāṭhinyābodharūpāṇi bhūtānyadhyakṣasiddhitah /
Ceṭanā tu na tadrūpā sā kathaṁ tatphalaṁ bhavet // Ibid., v. 43.
35. Pratyekamasati teṣu na syād reṇutailavat /
sati cedupalabhyeta bhinnarūpeṣu sarvadā // Ibid., v. 44.
36. Tasmāt tadātmano bhinnaṁ saccitraṁ cātmayogi ca /

Adṛṣtamavagantavyaṁ tasya śaktyādisādhakaṁ // Ibid., v. 106.

37. "Mada aktivat cet pratyekapariḍṛṣte sāṁhatye taḍudbhavaḥ" Sāṁkhya Sūtra 22, Chapter III. "Nanu yathā mādakatāśaktiḥ pratyekadravyāvṛttirapi militadravye varttate, evaṁ caitanyamapi syāditi cenna pratyekapariḍṛṣte sati sāṁhatye taḍudbhavḥ sambhavet / Prakṛte tu pratyekapariḍṛṣtatvaṁ nāsti / ..... nanu samuccite caitanyadarśanena pratyekabhūte sūkṣmacaitanyaśaktiranumeyā iti cenna anekabhūteṣu anekacaitanyaśaktikalpanāyāṁ gauraveṇa lāghayādekasyaiva nityacitsvarūpasya kalpanaucityāt / " Sāṁkhyapravacanabhāṣya, Vijñānabhikṣu, p. 18. cf. also "Bhūtagataviśeṣaguṇānāṁ sajātīyakāraṇaguṇajanyatayā kāraṇe caitanyaṁ vinā dehe caitanyāsaṁbhavāt /" Ibid. Madye madaśaktirna guṇaḥ madyārambhakāṇāṁ piṣtaguḍamadhvādīnāṁ yat yasya karma tat karmabhirārabdhaṁ svasvakarmavirodhikarma yaducyate prabhāva iti / Caitanyādikaṁ na karma // Gaṇgādhara's Jalpakalpataru, 1867, Calcutta, Vide Positive Sciences of the Ancient Hindus. Dr. B. N. Seal, p. 241.

38. Vāyuvat sañcārāt vāyavaḥ prasiddhāḥ / asmākaṁ nāyaṁ niyamaḥ yadindṛiyavṛttiḥ krameṇaiva bhavati naikadā jātisāṅkaryasya asmākaṁ adoṣatvāt / sāmagrīsamavadhāne sati anekairapīndriyaiḥ ekadaikavṛttyutpādane bādhakaṁ nāsti", Pravacanabhāṣya, Ch. II, sūtra 31. 32, p. 88.; Manodharmasya kāmādeḥ, prāṇakṣobhatayā sāmānādhikaraṇyenaiva aucityāt", Ibid.

39. Sāmānyakaraṇavṛttiḥ prāṇādyā vāyavaḥ pañca / Sāṁkhyadarśana, chapter II, Sūtra 31; Sāṁkhyakārikā, 29.
Prāṇa, breath, the ordinary inspiration and expiration; apāna, downward breath, the air or vital force acting in the lower parts of the body; samāna, collective breath, so named from conducting equally the food, etc. through the body; udāna ascending breath, the vital force that causes the pulsations of the arteries in the upper portions of the body from the naval to the head, and vyāna separate breath, "by which internal division and diffusion through the body are effected" (Gauḍapāda, Wilson, p. 105).
This is not very intelligible, but as vyāna is connected in the Sāṁkhya-Tattva-Kaumudī with the skin, the subtle nerve-force by which sensibility is given to the skin or outer surface of the body is probably meant. It is also connected with the circulation of the blood along the surface, the great arteries being under the action of udāna (71) (In the Ātmabodha "Knowledge of the soul", a Vedic poem as asigned to the great commentator Śaṇkarāchārya. the soul is said to be enwrapped "in five investing sheaths or coverings" (Kosh cf. Fr. Cosse, Ir Gael Coch-al, a pod or husk). The third of these is called prāṇamaya, i. e. "the sheath composed of

breath, and the other vital airs associated with the organs of action" (Indian Wisdom, p. 123), Vide the Sāṁkhyakārikā of Iśvara Kṛṣṇa, ed. by John Davies, p. 46.

40. Positive Science of Ancient Hindus, p. 241.
41. "Mano dharmasya kāmādeḥ / prānakśobhakatayā sāmānyādhikaranyenaiva aucityāt," Sāṁkhya Pravacanabhāsya, Chapter II, 31, p. 88.
42. "Karaṇāṇi niyatavṛttayaḥ santaḥ sambhūyaikāṁ prāṇākhyāṁ vṛttim pratipadyante (pratilapsynate), Śāṇkarabhāṣya on Brahmasūtra, Ch. II. Pāda 4, Sūtra 9.
"Sāmānyakaraṇavṛttiḥ prāṇādyā vāyavaḥ pañca /" Sāṁkhyakārikā, Iśvaṛakṛṣṇa, 29; see also Sāṁkhyapravacanabhāṣya, chapter II, Sūtras 31, 32.
43. "Na vāyukriye pṛthagupadeśāt /" Brahmasūtra, chapter II. pāda 4, Sūtra 9; see its Bhāṣya,
44. Also Vācaspati Miśra, Bhāmatī Ṭīkā as follows :
"Siddhāntastu na samānendriyavṛttiḥ prāṇaḥ // Sa hi militānāṁ vā vṛttirbhavet pratyekaṁ vā / na tāvat millitānāṁ ekadvitricaturindriyābhāve tadabhāvaprasaṅgāt / na ca bahuviṣṭisādhyaṁ śibikodvahanaṁ dvitriviṣṭisādhyaṁ bhavati / na ca tvagekasādhyaṁ / tathā sati sāmānyavṛttitvānupapatteḥ / api ca yat sambhūya kārakāṇi niṣpādayanti tat pradhānavyāpārānuguṇāvāntaravyāpāreṇaiva / yathā vayasāṁ prātisviko vyāpāraḥ piñjaracālanānuguṇaḥ / iha tu śravaṇādyavāntaravyāpāropetāh prāṇā nasambhūya Prāṇyuriti yuktaṁ pramāṇabhāvādatyantavijātiyatvacca śravaṇādibhyaḥ prāṇānasya / ..... tasmādanyo vāyukriyābhāṁ prāṇaḥ / Vāyurevāyamadhyātmamāpannaḥ, mukhyo, api prānaḥ //". Ibid (Śāṇkarabhāṣya). cf. also Jyeṣthaśca prāṇaḥ śukraniśekakāla-darabhya tasya vṛttilābhāt / na cet tasya tadānīṁ vṛttilābhaḥ syāt yonau niṣiktaṁ śukraṁ pūyeta na sambhaved vā / śroādīnāntu karṇaśaṣkulyādisthānavibhāganiṣpattau vṛttilābhānna jyeṣthatvaṁ /". Śāṁkarabhāṣya, Chapter II, pada 4, Sūtra 9.
45. "Vāyuḥ tantrayantradharaḥ, prānāpānodānasamānavyānātmā pravartakaḥ ceṣtānām, praṇetā māhasaḥ sarvendriyāṇāṁ ydyotakaḥ. sarvaśarīradhātuvyūhakaraḥ, sandhānakaraḥ śarirasya, pravartako vācaḥ, harṣotsāhayoryonih. kṣeptā bahirmalānāṁ. kartā garbhākṛtināṁ prāṇāpānodānasamānavyānātmā /" Caraka. Sūtrasthāna, ch. XII.
46. Caraka, Sūtrasthāna, chapter XII and Suśruta, Nidānasthāna, chapter I.
47. Suśruta-Nidānasthāna, chapter I.
"Teṣām mukhyatamaḥ prāṇaḥ ... /śabdoccāraṇaniḥṣvāsocchvāsakāśādikāraṇaṃt apānaḥ asya mūtrapurīṣādivisargaḥ karma kirttiaṁ/vyānah... prāṇāpanadhṛtityāgagrahaṇādyasya karma ca/samāno'pi vyāpya nikhilaṁ

śarīram vahninā saha / dvisaptati sahasreṣu nāḍīrandhreṣu saṁcaran bhuktapītarasān samyagānayan dehapuṣṭrikṛt / udānaḥ karmāsya dehonnayanotkramaṇādi prakīrttitaṁ // tvagādidhatunāsruya pañcanāgadayaḥ sthitāḥ udgārādi nimeṣādi kṣutpipāsādikaṁ kramāt / tandrāprabhṛti mohādi (sophādi) teṣāṁ karma prakīrtitaṁ /" Saṅgitaratnākara, Sāraṅgadava, vv. 60-67, chapter I. Vol. I. pp. 41-42.
cf. the summary in Raja Sourindra Mohan Tagore's edition of the Saṅgitadarpaṇa. See also Kalyāṇakāra. 3. 3. p. 32.

48. Vide the Positive Sciences of the Ancient Hindus, p. 230.
49. Unapañacādaśadvāyurudite putrāḥ / te sarve apajāḥ indreṇa devatvaṁ prānitāḥ śarīrāntarbāhyabhedena daśadhā /" Bhāgavataṭikāyāṁ Śrīdharasvāmin, Vide Śabdakalpadruma, 4th Kāṇḍa, p. 342.
50. Prāṇāpānau tathā vyānasamānodānasaṁjñakān / Nāgaṁ Kūrmaṁ ca Kṛkaraṁ Devadattaṁ Dhanañjayam // Saṅgitaratnākara, Ch. I. V. 59, p. 41, Vol. I.
"Prāṇāpānau tathā vyānasamānodānasaṁjñakāḥ / Nāgaḥ Kūrmśca Kṛkaro Devadattadhanañjayau //" Saṅgītadarpaṇam of Catura Dāmodara, Ch. I, V. 50.
51. Sangitaratnākara. Vol. I, ch. I, vv. 60-67, pp. 41-42.
"Śabdoccāraṇaṁ (vāṇniṣpattikāraṇaṁ niḥśvāsaḥ ucchvāsaḥ (antarmukhaśvāsaḥ) tandrādināṁ kāraṇaṁ (sādhanam) prāṇavāyuh,/ Vinmūtraśukrādivahatvomapānasya karma, ākuñcanaprasāraṇādi vyānasya karma jñeyaṁ / aśitapītādināṁ samatānayanadvātā śarīrasya poṣaṇaṁ samānasya karma / udānavāyuḥ ūrddhavānayanameva asya karma, nāgādayaḥ nāgakūrmakṛkara-devadattadhanañjayarūpāḥ pañcavāyavaḥ / eteṣāṁ karmāṇi ca yathākramaṁ udgāronmīlanakṣudhā-jananavijṛmbhaṇamoharūpāṇi /" Saṇgītadarpaṇa, chapter I, śloka 43-48.
cf. "Prāṇaḥ prāgvṛttirucchvāsādikarmā / Apānaḥ avāgvṛttirutsargāpikarmā / Vyānaḥ tayoḥ sandhau vartamānaḥ vīryavatkarmahetuḥ / Udānaḥ ūrddhvavṛttiḥ ūtkrāntyādi hetuḥ / samānaḥ samaṁ sarveṣu aṅgeṣu yaḥ annarasān nayati / iti./". Śāṅkarabhāṣya, chapter II, pāda 4, sūtra 2. Vide Positive Science of Ancient Hindus, p. 230-31.
52. Biology, p. 16.
53. Ibid.
54. Ibid. pp. 25-26.
55. Ibid.
56. Ibid., p. 33.