Human Embryogenesis: Modern Science vis-à-vis Śaṃkara's view as reflected in *Prapañcasāra*

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[**Abstract:** Life is a fascinating field of study. According to Indian spiritual tradition life (*prāṇa*) is a link between matter and consciousness. Ācārya Śaṃkara, even being propounder of Advaita Vedānta, expounded the biological process of human reproduction and evolution of embryo in his renowned treatise *Prapañcasāra*. Arguably the observation of Śaṃkara has striking similarity with the conclusions of biological sciences.]

1.0. Introduction:

1.1. *Brahma satyam jagan mithyā*– the cardinal tenet projected by Ācārya Śaṃkara in course of time almost appeared to be the identity of the entire Indian philosophy and culture. In spite of conceiving that deep rooted impression regarding the falsity of the phenomenal world, neither Indian heritage nor even Śaṃkara himself neglected the same. Therefore, besides composing commentaries on *Upaniṣad*s, *Brahmasūtra* and *Śrīmadbhagavadgītā* and authoring a few authoritative texts on Advaita Vedānta, Ācārya Śaṃkara also wrote an amazing compendium named *Prapañcasāra*, on the basics of the manifest universe, which is an interplay of life and matter.

1.2. Life and its pulsation in matter has been a fascinating field of study since the dawn of civilization. Life is a puzzle in itself and the endeavour to demystify it is a very common feature of human mind. Physics and chemistry do not suffice for the explanation of the conscious behaviour and experience of living systems. Therefore, there exist sufficient reason and rationale to challenge the material explanation of life and the search for a comprehensive theory of life involving both matter and conscious experience has thus become a significant subject of investigation.

1.3. Indian spiritual tradition, which has nurtured human understanding of life and nature, conceives of consciousness as the Absolute Reality and the manifest existence as a superimposition on pure consciousness. Thus sparks of consciousness seen to manifest through the material body of living systems may be interpreted on the basis of the axiomatic consideration of this principle. In this perspective, consciousness reflecting through inanimate matter is termed *prāṇa, life*. This *prāṇa* is a link between the matter and consciousness. Ācārya Śaṃkara, who had been less emphatic about the relative aspects of the Reality, however expounded the biological process of reproduction of one living

system from the other in his renowned *Prapañcasāra* in order to explicate the interplay of matter and life in this grand design of phenomenal existence, which indirectly substantiates the basic proposition of the existence of Consciousness at the fundamental level. Evidently, he was guided by the upaniṣadic principle that the singular consciousness manifests as different layers of existence– namely, *annamaya ātman, prāṇamaya ātman, manomaya ātman, vijñānamaya ātman* and *ānandamaya ātman*– at the relative level. A uniform and harmonious co-ordination between these different layers of phenomenal existence makes for a fine tuned and ordered system of names, forms and diversities.

1.4. The present paper is an analysis of Śamkara's treatment on mammalian embryogenesis as revealed in the *Prapañcasāra* taking into consideration both the gross and subtle aspects of the manifest existence. Arguably, his wonderful exposition has striking similarities with the conclusions of modern biology. Though Śaṃkara's treatment has been lacking somewhere in furnishing the minute details of the gross evolution of the embryo, yet his contribution is unique in the sense that it provides a comprehensive theory which accounts for the life principle that partakes in physiological growth.

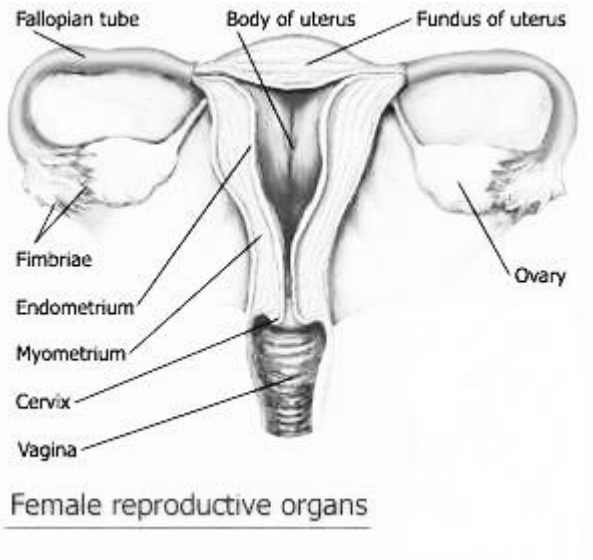
2.0. Egg to Embryo: According to the modern science and *Prapañcasāra*:

2.1. Oogenesis and Ovulation:

Under the influence of follicle stimulating hormone (FSH), and luteinizing hormone (LH), the ovaries produce a mature ovum in a process known as ovulation. By about 14 days into the reproductive cycle, an oocyte reaches maturity and is released as an ovum. Although the ovaries begin to mature many oocytes each month, usually only one ovum per cycle is released.

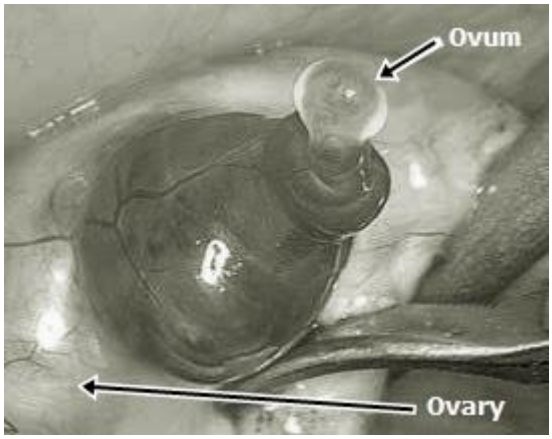
2.2. Fertilization:

Once the mature ovum is released from the ovary, the fimbriae catch the egg and direct it down the fallopian tube to the uterus. It takes about a week for the ovum to travel to the uterus. If a sperm is able to reach and penetrate the ovum, the ovum becomes a fertilized zygote containing a full complement of DNA. After a two week period of rapid cell division known as the germinal period of development, the zygote forms an embryo. The embryo will then implant itself into the uterine wall and develop there during pregnancy. It is noteworthy that generally only one sperm out of thousands is able to fertilize the ovum.



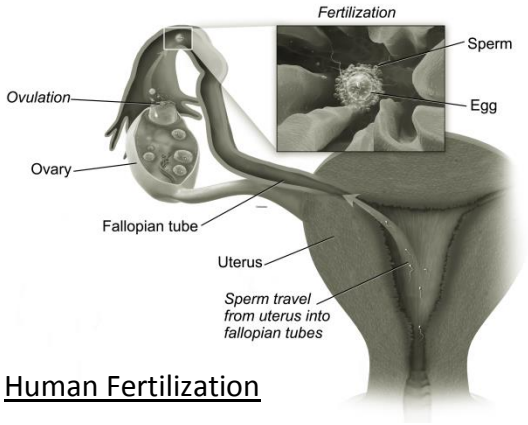
Female reproductive organs

Pic. 1



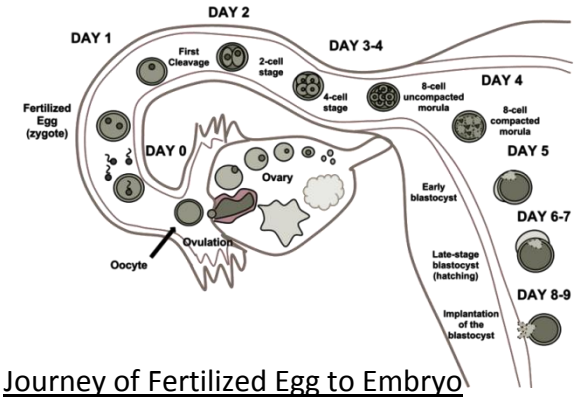
Ovulation

Pic. 2



Human Fertilization

Pic. 3



Journey of Fertilized Egg to Embryo

Pic. 4

2.3. Ancient Indian science perhaps could not make out the minute distinctions among all internal biological organs, although the basic observations are not at all far from the modern clarifications. In *Prapañcasāra*, though accurate divisions of female reproductive organs like fallopian tubes and others are not available, a very precise and comprehensive idea about fertilization of human being as well as mammals has been demonstrated through a few verses–

जरायुजस्तु ग्राम्यातः क्रियातः स्रुतिसंभवः।
स जायते चतुर्विंशत्तत्त्वसंयुक्तदेहवान्।।

jarāyujas tu grāmyātaḥ kriyātaḥ srutisaṃbhavaḥ/
sa jāyate caturviṃśattattvasaṃyuktadehavān//

स्वस्थानतश्च्युताच्छुक्राद्बिन्दुमादाय मारुतः।

svasthānataś cyutāc chukrād bindum ādāya mārutaḥ/

गर्भाशयं प्र विशति यदा तुल्यं तदापरः।।

आर्तवात्परमं बीजमादायास्याश्च मूलतः।
यदा गर्भाशयं नेष्यत्यथ सं मिश्रयेन्मरुत्।।

मायीयं नाम योषोत्थं पौरुषं कार्मणं मलम्।
आणवं नाम संपृक्तं मिलितं तन्मलद्वयम्।।
(प्र.सा. १/७०–७३)

garbhāśayaṃ pra viśati yadā tulyaṃ tadāparaḥ//

ārtavāt paramaṃ bījam ādāyāsyāś ca mūlataḥ/
yadā garbhāśayaṃ neṣyaty atha saṃ miśrayen marut//

māyīyaṃ nāma yoṣotthaṃ pauruṣaṃ kārmaṇaṃ malam
āṇavaṃ nāma saṃpṛktaṃ militaṃ tanmaladvayam//

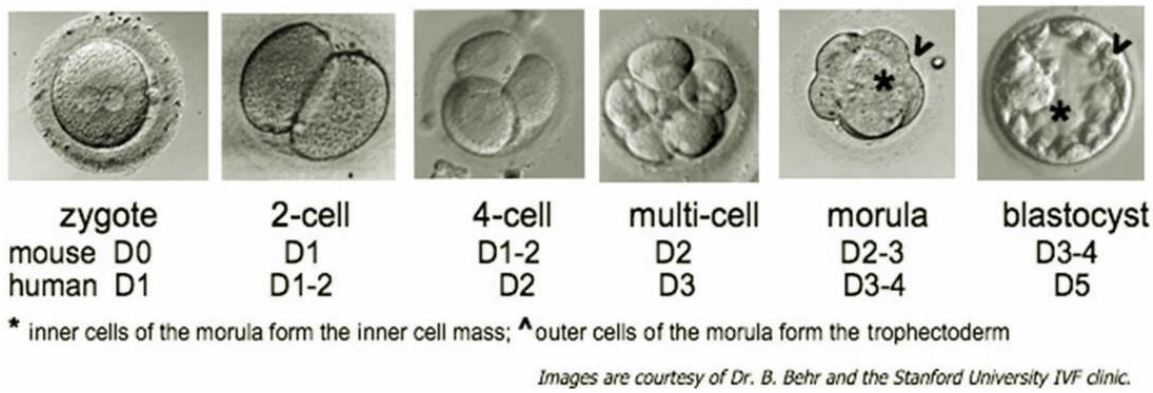
(PS 1/70-73)

- The abovementioned verses deliver the message that ancient scriptures could at least apprehend the movement of both the male sperm and female ovum towards each other and they were supposed to be driven by two currents of air (*mārutaḥ…aparaḥ*).
- *svasthānataś cyutāc chukrād bindum ādāya*– That only a small particle of sperm is taken for fertilization is documented in this portion. It resembles the actual science of penetration of the egg by a single sperm out of many.
- The ovum (*paramaṃ bījam*) is referred as *māyīya* perhaps because of the amazing attractive nature of the ovum and the sperm as *kārmaṇa* because of its very fast and active movement towards the egg. In fact, even in absence of intercourse ovum goes through a regular and relaxed course of journey from ovary to uterus. But sperms, immediately after entering the female body actively make a very rapid ride towards the competent egg as if being subjugated by the same.
- A fertilized egg is also called a "zygote", a "1 cell embryo" or a "2 pronuclear embryo". That zygote which is proved to contain a full complement of DNA in *Prapañcasāra* is designated as *āṇava*, which also indicates the same as a germ containing all the attributes of the final manifestation.

2.4. Development of fetus:

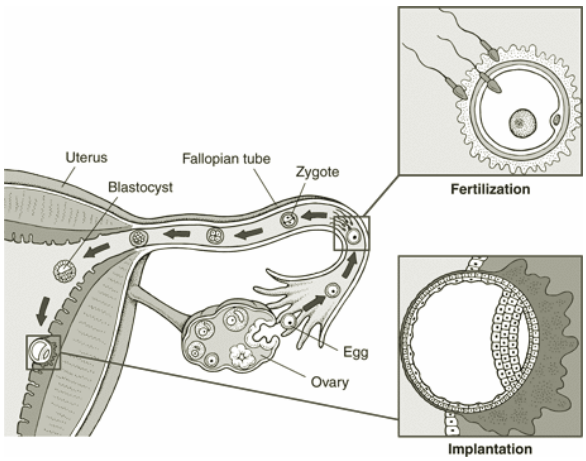
According to modern medical science the fertilized egg (zygote) divides repeatedly as it moves down the fallopian tube to the uterus. First, the zygote becomes a solid ball of cells. Then it becomes a hollow ball of cells called a blastocyst.[1]

Inside the uterus, the blastocyst implants in the wall of the uterus, where it develops into an embryo attached to a placenta and surrounded by fluid-filled membranes. Between 5 and 8 days after fertilization, the blastocyst attaches to the lining of the uterus, usually near the top. This process, called implantation, is completed by day 9 or 10.[2]



Zygote to blastocyst/ Development of fetus

Pic. 5



Implantation of fetus

Pic. 6

2.5. Ancient Indian scientific investigations in spite of many limitations reached at least a convincing model regarding the journey of a fetus. *Prapañcasāra* illustrates–

खगाभिर्मरुदग्न्यद्भिः क्लेद्यते काथ्यते च तत्।
सान्द्रीभूतं तदह्नैव मातुरङ्गुष्ठसंमितम्।।

आयामि बुद्बुदाकारं परेऽहनि वि जृम्भते।
पक्षेण चतुरस्रं स्यान्मातुर्भुक्तरसात्मवत्।।

मिलितादपि तस्मात्तु पृथगेव मलद्वयात्।
किट्टभूतद्वयं पूर्वं बीजयुग्मं समुन्नमेत्।।
(प्र.सा. १/७६–७८)

khagābhir marudanyadbhiḥ kledyate kāthyate ca tat
sāndrībhūtaṃ tadahnaiva mātur aṅguṣṭhasaṃmitam

āyāmi budbudākāraṃ pare'hani vi jṛmbhate/
pakṣeṇa caturasraṃ syān mātur bhūktarasātmavat//

militād api tasmāt tu pṛthag eva maladvayāt/
kiṭṭabhūtadvayaṃ pūrvaṃ bījayugmaṃ sam un namet// (PS 1/76-78)

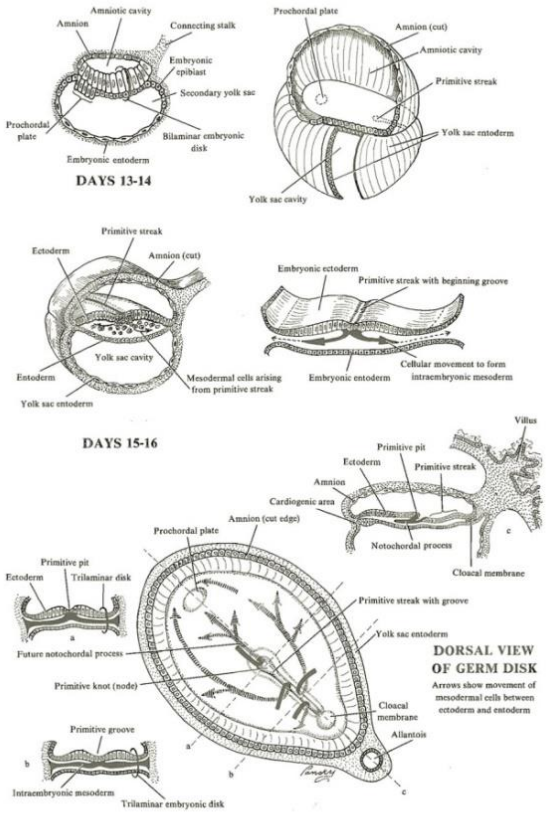
- The thickening of the egg as zygote after fertilization as demonstrated through the pictures above is supposed to be anticipated also by ancient Indian scientists. *Prapañcaśāra* illustrates– *khagābhir marudagnyadbhiḥ kledyate kāthyate ca tat/ sāndrībhūtaṃ tadahnaiva mātur aṅguṣṭhasaṃmitam//* This verse states that the combined seeds in that very day of fertilization solidify into a condensed germ having the size of the other's thumb by the action of the five basic elements, namely *ākāśa*, *vāyu*, *tejas*, *ap* and *pṛthivī*.

- In the next day the zygote is apprehended to take the form of a bubble (*budbudākāra*) in the next verse. The first picture in the series of development of fetus (Pic. 5), offered by modern scientists, seems to be the pictorial demonstration of the said observation.

- It is already noted earlier that a fertilized zygote is also named as "2 pronuclear embryo". Male and female genetic material (DNA) is visible in the 2 pronuclei (circular structures) in the center of the picture in the series of development of fetus (Pic. 5). Śaṃkara perhaps in his *Prapañcasāra* hinted about that 2 pronuclear embryo by the idiom *kiṭṭabhūtadvayam* (*Cf. Supra*, Verse 1/78).

- Although *Prapañcasāra* does not provide a proper step by step development of a fetus, it could at least assume a mature formation of the same within 2 weeks/15 days (*pakṣeṇa*) from the day of fertilization (*Cf. Supra*, PS 1/77). In the text the mature embryo is qualified by the word *caturasra*, which suggests symmetry in shape. Biologically, the embryo assumes a concrete shape after 15 -16 days of fertilization and the primitive streak, which is a narrow midline in the embryo, starts to form giving rise to a bilateral symmetry[3]. The development of the primitive streak is a significant feature in the course of evolution of the embryo.

  However, Saṃkara also records that the embryo after a fortnight of fertilization attains a significant stage of its development which is remarkably in consonance with the findings of modern science.



Formation of primitive streak

Pic. 7

3.0. Evolution of major cords/nerves in fetus: According to the modern science and *Prapañcasāra*:

3.1. Formation of Spinal Cord:

The primitive streak appeared from the trilaminar germ disk of the embryo (*Cf. Supra* Pic.7) in course of time develops into neural tube which gives rise to the brain and spinal cord in vertebrates.

3.2. The process of the said development has been recorded in the modern science with minute details. Parallel views are also available in the technical literature of ancient India. Regarding the formation of Suṣumnā *nāḍī*, Ācārya Śaṃkara in *Prapañcasāra* states–

ऊर्ध्वं तु मरुता नुन्नं तस्मादपि फलद्वयात्।	ūrdhvaṃ tu marutā nunnaṃ tasmād api phaladvayāt/
उभयात्मिक्यधोवृत्ता नाडी दीर्घा भवेदृजुः।।	ubhayātmiky adhovṛttā nāḍī dīrghā bhaved ṛjuḥ//
अवाङ्मुखी सा तस्याश्च भवेत्पक्षद्वये द्वयम्।	avāṅmukhī sā tasyāś ca bhavet pakṣadvaye dvayam/

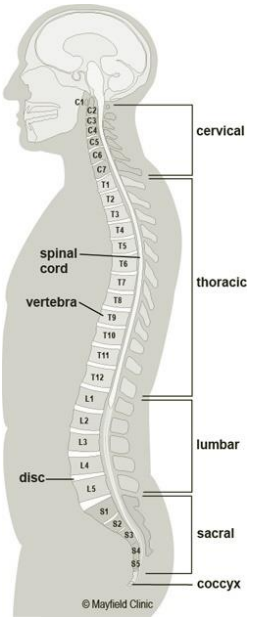
नाड्योस्तत्संधिबन्धाः स्युः सप्तान्या नाड्यो मताः।।

ततो या प्रथमा नाडी सा सुषुम्नेति कथ्यते।
या वामेडेति सा ज्ञेया दक्षिणा पिङ्गला स्मृता।।
(प्र.सा. १/७९–८१)

nāḍyos tatsaṃbandhāḥ syuḥ saptānyā nāḍyo matāḥ//

tato sā prathamā nāḍī sā suṣumneti kathyate/
yā vāmeḍeti sā jñeyā dakṣiṇā piṅgalā smṛtā//
(PS 1/79-81)

- According to Śaṃkara by the stimulation of Marut/ Vāyu right at the top of the uterus a straight long *nāḍī* (cord/ nerve) called Suṣumnā is produced, which is attached to both the maternal and paternal genetic material. The direction of extension of Suṣumnā is stated in the *Prapañcasāra* to be downward perhaps from the perspective of the position of the baby in the mother's womb. The cranium of the baby normally faces downward of the mother's womb and the caudal portion of it is attached to the upper portion of the embryo.
- Besides the central *nāḍī* Suṣumnā about 3,50,000 other nerves, veins and arteries with branches and sub-branches are assumed to be spread all over the body from that central cord having five regions[4]. Amazingly, modern science also demonstrates five regions of the spinal column.

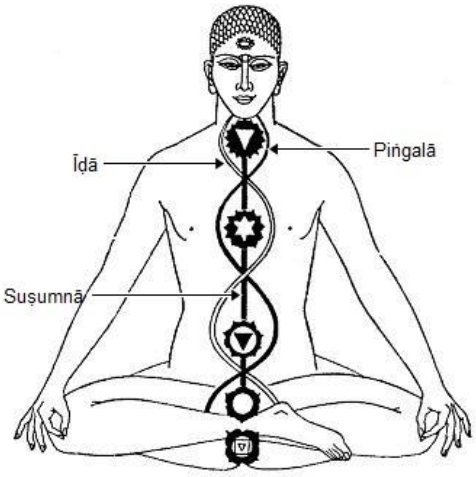


Five regions of spinal column

Pic. 8

- Apart from Suṣumnā, *Prapañcasāra* echoing the Yoga and Tantra tradition asserts the existence of two other main *nāḍī*s namely Īḍā and Piṅgalā. Īḍā, in those literary works is

said to be connected with the left scrotum, encircles Suṣumnā, passes by the right kidney, goes to the heart and then passing by the left shoulder proceeds to the right nostril. Piṅgalā originating from the right scrotum goes in a similar way to the left nostril[5].



Three primary *nāḍī*s

Pic. 9

- It is noteworthy that the concept of Suṣumnā, Īḍā and Piṅgalā has been depicted in the logo of All India Institute of Medical Sciences (AIIMS) and other premier medical organizations of India.

Logo of AIIMS

Pic. 10

Logo of Indian Medical Association

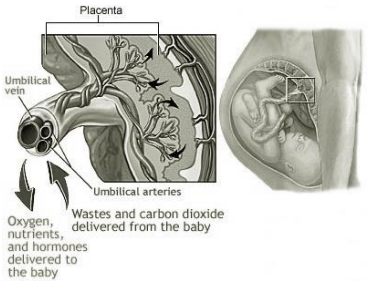
Pic. 11

- Many other *dhamanī*s namely Gāndhārī, Hastijihvā etcetera are said to be ramified all over the body[6].
- Thus Śaṃkara has identified three primary neural channels, namely Suṣumnā, Īḍā and Piṅgalā, among the existing 3,50,000 other channels. In conformity with the scriptural tradition he has termed these channels *nāḍī*s. The word *nāḍī*, which means tubule, refers to the communicational pathway of impulses from one point to the other in human body. These impulses not only refer to the gross nerve currents throughout the body, but also

indicate the subtle flow of energy from one point to the other. The Suṣumnā, Īḍā and Piṅgalā are the primary *nāḍī*s which are related to the flow of impulses connected with the Central Nervous System (CNS). The CNS includes the brain and the spinal cord. According to the Biological sciences, the CNS is the Central Processing Unit of human body and it functions through receiving and transmission of impulses. The afferent impulse (towards the brain) coming from every point of the body is processed in the brain. The efferent impulses (away from the brain) move to every point of the body from the brain through other defined path ways. The spinal cord is so designed that it provides the necessary mechanisms to allow this two-way communication. The Suṣumnā in the ancient texts represents the spinal column which is associated with flow of the afferent (positive) and efferent (negative) nerve currents through it. The pathways of these afferent and efferent impulses are characterized by Īḍā and Piṅgalā respectively.[7] The description of Īḍā and Piṅgalā as given by Śaṃkara perhaps suggests these two *nāḍī*s connect all the organs of the body to the CNS.

3.3. Development of Umbilical cord:

Modern science knows that at 5 weeks the placenta and Umbilical Cord develop. Placenta is the tissue that connects the sac around the unborn baby to the mother's uterus. Umbilical Cord is the tube that connects the baby to the placenta. It brings the baby nourishment and oxygen from the mother's blood and takes away waster products.



Umbilical Cord

Pic. 12

3.4. While stating about several *nāḍī*s, *Prapañcasāra* also mentions about the umbilical cord which is supposed to bring the baby all the nourishments from the mother's body.

…काचिन्नाडी बहिर्वक्त्रा या मातुर्हृदि बध्यते।।

यथा तत्पुष्टिमाप्नोति केदार इव कुल्यया।
मातुराहाररसजैर्धातुभिः पुष्यते क्रमात्।। (प्र.सा. १/८५गघ–८६)

…kācin nāḍī bahir vaktrā yā mātur hṛdi badhyate//

yathā tat puṣṭim āpnoti kedāra iva kulyayā/
mātur āhārarasajair dhātubhiḥ puṣyate kramāt// (PS 1/85cd-86)

4.0. Commencement of life in fetus:

4.1. The question of when human life begins is one of considerable ethical, legal, and political importance, particularly for public policy debates over abortion and embryonic stem cell research. The scientific evidence supports the conclusion that a zygote is a human organism and that the life of a new human being commences at a scientifically well defined "moment of conception." But yet fertilization itself even in modern science is surprisingly difficult to define.[8]

4.2. According to scientists and doctors by the fifth week of the gestation period, the heart starts beating and divides into chambers. Though the beating of the heart is often considered as the infusion of life into the fetus, neither science nor Vedānta tradition accepts such a view. In the scientific perspective, life is a continuous process and the living cell is the basic unit of life. Fertilization is only a landmark which marks the formation of a genetically distinct organism exhibiting the signs of life. However, the beating of the heart in the embryo, detected through non-invasive medical instrumentation, is simply a confirmation of the healthy development of the embryo exhibiting the signs of life.

4.3. As Indian and especially the vedāntic philosophical tradition believes in the omnipresent existence of consciousness it never speaks of the commencement of life, rather it states that as the embryo goes on increasing, the same as a part (*kalā*) of Supreme Light (*paraṃ-jyoti*) manifests the life-force and thus attains the state of a conscious living being (*kṣetrajñatā*). Consequently, the germ comes to be regarded as a living being (*jantu*).

क्रमवृद्धौ परंज्योतिष्कला क्षेत्रज्ञतामियात्।
सक्षेत्रज्ञं मलं तत्तु सभूतं सगुणं पुनः।।

सदोषं दुष्यसंपन्नं जन्तुरित्यभि धीयते।
(प्र.सा. १/८७–८८कख)

kramavṛddhau paraṃjyotiṣkalā kṣetrajñatām iyāt/
sakṣetrajñaṃ malaṃ tat tu sabhūtaṃ saguṇaṃ punaḥ

sadoṣaṃ duṣyasaṃpannaṃ jantur ity abhi dhīyate/
(PS 1/87-88ab)

5.0. Conclusion:

5.1. Tantra as science mainly concentrates on method, technique and experience instead of theorizing like philosophers. It is existential and experiential.

Ācārya Śaṃkara is recognized mainly as the champion of the Advaita Vedānta philosophy. But *Prapañcasāra*, one of the most authentic texts of Tantra, explores tantric Śaṃkara instead of philosopher Śaṃkara. In this text we see Śaṃkara primarily and apparently to ponder on the existential knowledge regarding the phenomenal universe. The present paper is a humble attempt to draw mere an outline of his observation regarding the human embryogenesis, which covers a tiny part of *Prapañcasāra*. Although, the text seems to concentrate on several issues related to a human life, the string which is constant throughout the text is the oneness of the Supreme Soul. Śaṃkara here elevates the reader from the domain of scientific and existential observations to that of philosophical revelation of sole Consciousness.

5.2. Advaita Vedānta philosophy although declares the material world to be 'false' never retreats to make out the causes behind the manifestation of worldly lives. Since time immemorial scientists have been aspiring to solve the riddle of life and its nature. But 'life' is yet an unsolved puzzle. Śaṃkara's exposition in *Prapañcasāra* contains the germ of novel thoughts regarding the real nature of life. The paper substantiates that a thorough study of this treatise may shed some new light on the scientific understanding of life.

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Reference:

[1] *Cf*. http://www.msdmanuals.com/home/womenshealthissues/normalpregnancy/stagesofdevelopmentofthefetus

[2] *Cf*. https://en.wikipedia.org/wiki/Human_embryogenesis

[3] *Cf*. https://en.wikipedia.org/wiki/Primitive_streak

[4] मध्यस्थायाः सुषुम्नायाः पर्वपञ्चकसंभवाः।। शाखोपशाखतां प्राप्ताः सिरालक्षत्रयात्परम्/ (प्र.सा. १/८९गघ–९०कख) [madhyasthāyāḥ suṣumnāyāḥ parvapañcakasaṃbhavāḥ// śākhopaśākhatāṃ prāptāḥ sirālakṣatrayāt param/ (PS 1/89cd-90ab)]

[5] या वाममुष्कसंबन्धा सा श्लिष्यन्ती सुषुम्नया। दक्षिणवृक्कमाश्रित्य धनुर्वक्रा हृदि स्थिता।। वामांसजत्रवन्तरगा दक्षिणां नासिकामियात्। तथा दक्षिणमुष्कोत्था नाडी वामरन्ध्रगा।। (प्र.सा. १/८२–८३) [yā vāmamuṣkasaṃbandhā sā śliṣyantī suṣumnayā/ dakṣiṇavṛkkam āśritya dhanur vakrā hṛdi sthitā// vāmāṃsajatrvantaragā dakṣiṇām iyāt/ tathā dakṣiṇamuṣkotthā nāḍī vāmarandhragā// (PS 1/82-83)]

[6] *Cf*. PS 1/84-85.

[7] *Cf*. Swami Vivekananda. "The Psychic Prana" in *The Complete Works of Swami Vivekananda*, Vol. 1, pp. 178-180.

[8] *Cf*. Maureen L. Condic. *When Does Human Life Begin? A Scientific Perspective*, p. 1.

Photos and information about scientific embryogenesis are available from several website links through Google.

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