

Concept of Genetics in Ayurveda



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Abstract:

Genetics or genesis is the study of genes, heredity and variation in living organisms. The word genetics is derived from the Ancient Greek word *genetikos* meaning 'genitive', 'generative' or 'origin'. It intersects frequently with many of the life sciences and is strongly linked with the study of information systems. Modern embryology is greatly advanced in this field and describes each aspect about formation of Embryo & its development as a full term neonate with the help of Karyotyping. But the main objective of *Garbhasharir* described by Ayurvedic compendia is *Suprajanan*. And this makes the difference between Ayurved and Modern embryology because modern science only deals with structural teratogenesis of bodily organs while Ayurveda states about Structural, Physical and Mental status of a Foetus after its birth. There are several references of *Garbhasharir* which are quoted in *Brihatrayee* and their commentaries as well as in different Ayurveda texts that need to be interpreted in proper way to make them applicable for our science and society too. The concepts of Ayurveda genetic theory are beautifully described in various chapters of *Sharirsthana* of *Samhita*. The Abiogenesis described by Sushruta is one of best in Ayurveda literature. Almost all the topics about genesis are explained in Ayurveda compendia, the need is to comprehend this knowledge on the basis of present theory of Genetics.

Key Words- Genetics, *Garbha*, *Suprajanan*, Foetus, Abiogenesis

Introduction

Ayurveda is based on its eternal and unchangeable principles as well as fundamentals like *Tridosha*, *Triguna* & *Pancha-Mahabhuta* etc. So each and every aspect or Ayurveda principles are based on these fundamentals. The study of genes, heredity and variation in living organisms which is strongly linked with the study of information systems is called as Genetics [1]. No doubt the genetic theory which is described in Ayurveda *Samhita* is also based on above fundamentals. The concept of *Aatma* or soul in Abiogenesis is again unique in itself. The literature

study of *Garbhasharir* in Ayurveda compendia broadly shows two types of factors related to genesis of offspring. Dependent means that can be modified & independent means can't be changed by virtue of parents. There are some behavioral and dietary precautions recommended to parents by Ayurveda texts for formation of healthy foetus i.e. *Suprajanan*. These instructions can be considered as dependent factors for genesis. Some of the factors are beyond the limit of parents in present birth and can't be controlled by precautions or righteous deeds and may be categorized as independent factors for reproduction.

All the attributes appearing in resultant neonate are greatly contributed by these two factors. Other than these characteristics some miscellaneous features like sex determination, foetal anomaly, *Prakruti* etc. are also explained in Ayurveda. Most of the authors had correlated *Prakruti* with Ayurveda genetics. No doubt this correlation is true but there are several other concepts of Ayurveda genetics that need to be elucidated on the basis of present knowledge. So to highlight the hidden core from *Sutras* described in *Garbhasharir* this literary study was undertaken.

Materials & Methods:

Various Ayurveda compendia with their commentaries by different authors, mainly *Brihat-trayee* were referred for the study. Supportive texts of contemporary science were also utilized to comprehend the ancient concepts. References from internet and journals were also considered in this study. While studying *Garbhasharir* in *Sushruta Sharirsthana* it was noticed that, the information described in context of *Garbhasharir* have hidden concepts of Ayurveda Genetics. The commentaries of different Authors were critically studied to elaborate and find the truth in these *Sutras*. Web search and peer reviewed journals were also revised to learn present knowledge on this topic.

Observations & Results:

Independent factors in genesis of foetus are classically described in evolution of universe as per Ayurveda. The concept of Ayurveda genetics begins from *Srushti-utpattikrama* described by ancient *Acharyas* in their respective compendia. It is stated that '*Sharire tu Sushruta Shreha*' so let's begin with *Sushruta Samhita*. The vivid description of Abiogenesis is explained in third stanza of *Sarvabhut-chintasharir* chapter of its *Sharirsthana* as follows.

The unmanifest is causative source of all beings, causeless itself, characterized by *Satva*, *Raja* and *Tama* having eight forms and manifesting cause of the entire universe. The eight forms as per *Sankhya* philosophy are *Avyakta*, *Mahat*, *Ahankara* and five *Bhutas*. From this unmanifest *Mahat* (principle of

intelligence) having the same attributes originates, from such intelligence arises *Ahankara* (egoistic tendency) having the same attributes which is of three types *Vaikarika*, *Taijasa* and *Bhutadi* [2]. Egoistic tendency having the same attributes arises from intelligence which is of three types *Satvik*, *Rajas* and *Tamas*. Depending upon the combination of these three the *Manas-prakruti* (psychic constitution) of an individual is determined which is described as follows.

Compassion, tendency to proper distribution (of food etc.), forgiveness, truthfulness, righteousness, faith, knowledge, intellect, retentive faculty of mind, memory, restraint and non-attachment are qualities of *Satvika*. Mostly unhappiness, roaming about, impatience, ego, falsehood, cruelty, fraudulence, haughtiness, exhilaration, lust and anger are qualities of *Rajasa*. Sadness, nihilistic attitude, tendency to unrighteousness, blocking of intellect, ignorance, wickedness, inactivity and sleepiness these are qualities *Tamasa* psychic constitution [3]. So the variations caused in intelligence and egoistic tendency can determine the Psychic attributes in neonates and adults then after.

From *Bhutadi* Egoistic tendency with collaboration of *Taijasa*, five *Tanmatras*, having the same attributes (delusion) arise with their perceptible emanations being sound, touch, vision, taste and smell; from these *Tanmatras*, *Bhutas- Akash*, *Vayu*, *Tejas*, *Aap* and *Prithivi* are originated [4]. The properties of these *Mahabhuta* are perceived from respective intelligence and Egoistic tendency of the individual concerned. So the efficiency of structural attributes which will be formed and develops in progeny will vary in different individuals. The attributes facilitated in an individual with the assistance of *Panch-mahabhuta* (five basic elements) are as follows.

Qualities of *Akash* are sound, auditory organ, all orifices and distinctness; those of *Vayu* are touch, tactile organ, all activities, movements in all body parts and lightness; those are of *Tejas* are vision,

visual organ, complexion, heat, splendor, digestion, intolerance, sharpness and valour; those of *Aap* are taste, gustatory organ, all liquidity, heaviness, coldness, unctuousness and semen and those of *Prithivi* are smell, olfactory organ, hardness and heaviness [5].

Sushruta has mentioned soul, *Ashtaprakruti* and *Shodas-vikar* in the formation of embryo.[6] While explaining the cause for certain soul to enter in specific combination of ovum and sperm, it is stated that it depends on righteous and unrighteous acts performed by soul in its previous birth. In a combination of *Agni* (ovum) and *Soma* (sperm) the spirit which is called by various synonyms though imperishable, immutable and incomprehensible, under the impulse of previous deeds along with subtle body and associated with *Satva*, *Rajas*, *Tamas* and other godly demonical or other qualities is impelled by psyche and *Vayu*, reaches the uterus to stay therein [7]. The similar but very important quotation is found in first chapter of Sushruta *Sharirsthana* saying that in Ayurvedic scriptures, souls are not omnipresent but eternal which transmigrate in animals, men and gods according to righteous and unrighteous acts. These are inferable because of too subtleness, conscious and eternal manifesting in combination of ovum and sperm [8]. Formation of parts and subparts of embryo takes place by nature. Whatever merits or defects occur therein should be known as caused by previous righteous or unrighteous deeds of the foetus [9]. When zygote is bifurcated by internal *Vayu* two souls, impelled by unrighteousness occupy them reaching uterus. They are known as twins [10]. The righteous and unrighteous acts performed by the soul in its previous birth are counted as a one of most important factor for the appearance of psychic characters and structural attributes in the foetus.

There are several factors can be called as dependent factors which may alter or change the physical and mental attributes of a progeny in its foetal, neonatal and adult life. Ayurveda recommends some instructions to *Rutumati* (menstruating woman) which is known as *Rutumaticarya*. During menstrual period from the very first day, the woman,

observing celibacy should abstain from day-sleep and many other things which can be enumerated as follows.

By day-sleep she gives birth to the sleepy, by applying collyrium child becomes blind, by weeping ophthalmic disorders take place, by bath and after paste, the child becomes unhappy, by oily massage child is born leprotic, by cutting nails he suffers from bad nails, by running the born child is unsteady; by laughing his teeth, lips, palate and tongue becomes blackish; by talking too much the child become talkative; by excessive hearing he becomes deaf, by combing he is born bald and by exposure to wind and exertion the child becomes insane. So these activities should be avoided by menstruating woman. The woman sleeping on mat of *Darbha* (type of grass) and taking food of rice with ghee by palm, earthen saucer or leaf should be kept aloof from the husband for three days. Thereafter on the fourth day having taken purificatory bath, having worn new and attractive cloth and having chanted auspicious hymns, she should be brought before the husband. Because the woman having taken bath after menstruation sees whomever man first she gives birth to the son similar to that [11]. As ovum is significant for healthy genesis the other *Garbhotpadak* factors are equally important and stated below.

As sprout comes out by the aggregate of season, soil, water and seed, conception takes place positively if these four factors are combined properly. Thus born worthy sons are handsome, having predominance of *Satva* and long life span, free (father) from three debts and thus prove benefactors to their father [12]. This is one of the most important sutra explained by Sushruta in regard of genesis. Unless all the above four factors are normal, the healthy progeny will not be born. The great importance is also given to other harmonizing *Garbhotpadak* factors in Ayurveda.

Woman and man sexually contact with whatever diet, behavior and activities their progeny is also like that [13]. Here are the verses Those who are devoted to Gods and *Brahmanas*, engaged in

cleanliness, good conduct and benevolence deliver child with great qualities otherwise devoid of qualities [14]. The person attains the same act in rebirth by which he was impelled (in previous life). He also acquires the same qualities which were frequently used in the previous life. Persons who in previous lives were engaged constantly in study of scriptures become predominant in *Satva* and recollect previous birth [15] These above sutra represents the role of dietary and behavioral factors in characteristics of individuals.

Excluding above two, several other factors for development of structural, physical & psychic attributes in foetus are also elucidated in ancient literature. The role of five basic elements in the formation of various bodily organs is stated earlier, similarly these elements also contribute to form complexion of foetus. Similarly *Shadbhava* are inevitable concept of Ayurveda genetics. These factors are also known as *Garbhot-padak* factors.

Tejas element is the causative factor of complexion when at the time of conception, it is predominantly associated with *Aap* element, it makes the foetus fair-complexioned; predominance in *Prithivi* element causes black one. That in *Prithivi* and *Aakash* elements gives rise to black-sky complexion while predominance in *Aap* and *Aakash* elements makes fair-sky complexion of foetus. Some say that diet of whatever colour is used by the pregnant woman, the progeny becomes of the similar complexion. If *Tejas* does not reach the visual organ, it makes the foetus born blind; the same associated with blood makes red-eyed; that associated with *Pitta* and *Kapha* makes yellow-eyed and white-eyed respectively, if associated with *Vata* it causes deformity in eye [16].

The parts of the foetal body originating from father, mother, *rasa* (nutrition), soul, psyche and suitability are described as *Shadbhava*. The hard parts, head-hair, beard and moustache, body hair, bone, nail, teeth, blood vessels, ligaments, *Dhamani*, semen etc originate from father; the soft parts muscles, blood, fat, marrow, heart, umbilicus, liver, spleen, intestines, anus etc are of maternal origin;

physical development, strength, complexion, maintenance and decrease originate from *Rasa* (nutrition); sensory and motor organs, knowledge, wisdom life-span, pleasure, pain etc originate from soul; entities originates from psyche would be mentioned later; energy, health, strength, complexion and intelligence originate from suitability [17]. Structural arrangement of body parts, falling and reappearing of teeth and absence of hair on palm and soles these are due to nature [18].

The vivid description of Neonatal anomalies is also traced in Ayurveda *Samhita*. Charak in one of its famous quotation in view of foetal anomaly explains that, during fertilization in the seed (sperm or ovum), the part of the body which is damaged in its genetic source gets abnormality otherwise not. [19] The Stein-Leventhal syndrome which is characterized by mild hirsutism, deep voice, secondary amenorrhora and cystic enlargement of both the ovaries, [20] is a condition described in contemporary science and can be correlated with *Kalala* (semisolid mass like sputum), which is illustrated by Sushruta as, If a woman has took purificatory bath after menstruation and performs coitus in dream, *Vayu* taking the ovum forms embryo in uterus. This develops from month to month producing features of pregnancy in the woman but remains as semisolid mass like sputum, only devoid of paternal qualities [21]. From this *Sutra* it is certain that without proper paternal genetic information normal embryo could not exist. Similarly the cause and effect concept for manifestation of anomalies in foetus is also explained. Unrighteous acts performed by parents may result in foetus of shape like snake, scorpion and pumpkin etc. On the contrary *Kubja* (humped), *Kuni* (deformed hand), *Pangu* (lame), *Mook* (dumb) and *Minmin* (muffled voice) neonates are formed either by vitiated *Vata* or ignoring craving of pregnant woman [22]. Charak has also quoted the unrighteous acts which again can be comprehended as chromosomal defects during fertilization. Due to defects of genes, the self past deeds, uterus, time and mothers food and behavior, the vitiated *Doshas* produce various abnormalities in shape, complexion

and sense organs. As in the rainy season wood, stone pieces and water current cause derangement in a tree situated in the river stream, *Doshas* cause abnormalities in foetus situated in the womb [23].

The various factors are explained for sex determination of individual; few quotations from Sushruta Samhita are estimated here because this is again a very informative topic. Predominance of semen produces male child and that of *Aartava* (ovum) creates female child while equality of both give rise to hermaphrodite [24]. One of contrast concept compared to contemporary science is *Punsavan-vidhi*- If conceived in these days three or four drops of one of the plants- *Lakshmana*, *Vata* (leaf bud), *Sahadeva* and *Vishvadeva*-pounded with milk should be put into the right nostril of the woman desiring male child and it should not be spitted.[25] The sexual intercourse on even and odd days may change the sex of foetus is also explained by Sushruta. By sexual contact in even days male child otherwise (in odd days) female child is born; hence the man desirous of requisite progeny should intercourse with the woman (*Rutusnata*) accordingly during the period (*Rutukala*) [26].

Ayurveda is incomplete without the study of *Prakruti*. Most of the Authors have centered *Prakruti* with concept of Ayurveda genetics, but it is a part of it. In short *Prakruti* is a homogenous combination of maternal and paternal chromosomes which decides the structural, functional and mental attributes of the offspring. The same is described by Sushruta on the basis of *Tridosha*. Natural constitution is designed by the *Dosha* which stays predominant during fertilization; its features are estimated on the basis of homogenous combination of contributing *Dosha*. [27] Some researches on *Prakruti* are recently done with collaboration of contemporary science. One of such Study showed correlations between CYP2C19 genotypes and *Prakruti* with fast and slow metabolism being one of the major distinguishing characteristics and suggested significant impact on phenotype-genotype correlation, drug discovery, pharmacogenomics and personalized medicine [28].

Discussion:

The unmanifest which is a manifesting cause of whole universe consists of *Triguna* but these are in equal proportion and inactive stage before abiogenesis. As principle of intelligence appears, the differentiation in *Triguna* takes place and process of Structural, physiological and mental variation begins in the processing of an individual. If this theory of Universe manifestation is compared with previous atomic theory, some inferences can be drawn here. Let's consider *Satva*, *Raja*, *Tama* as proton, electron and neutron respectively. It is known that the construction of each atom is depends upon variations in numbers of its proton, electron & neutron. This entire universe is composed of atoms. Ayurveda proposes unmanifest as a manifesting cause of the entire universe. So there is need to think our ancient concept of abiogenesis in regard of present Knowledge.

Trigunas not only deals with physical appearance but also depending upon the combination of this triad the *Manas-Prakruti* (psychic constitution) of an individual is determined. So the variations caused in intelligence and egoistic tendency determines the psychic attributes in individuals.

The five basic elements also contribute structural and physical features. The properties of these five basic elements are perceived from respective intelligence and Egoistic tendency of the individual concerned. So the efficiency of structural attributes which will be formed and develops in progeny will vary in different individuals. It is everlasting truth about each and every body part that their efficiency varies from person to person. In such sense the role of *Triguna* and five basic elements can be understood in the genesis of foetus and individuals.

As it is known that every individual is unique as well as different from one another in the universe. Then what makes the difference between them? Ayurveda believes in soul without which there is no existence of life. The soul is different in every living being and depending upon its qualities or we can say

some type of stored information the developmental process progresses in the embryo. From then the differentiation takes place from person to person. Most of the references while explaining the cause for certain soul to enter in specific combination of ovum and sperm, it is stated that it depends on righteous and unrighteous acts performed by soul in its previous birth.

Righteous and unrighteous acts related to genesis are the type of information stored which is helpful for rebirth of an individual. Depending upon a type of stored information soul enters in the combination of ovum and sperm. If the stored information is compared with fundamentals of existing science, it is comparable with chromosomes of modern science. As we know the number of chromosomes is unique for any species and takes part in process of reproduction [29]. The zygote which is composed of specific number of chromosomes will form the foetus of certain species, so the number of chromosomes is important to reproduce the individual of same species. The appearance of merit and defects in development of organ is depends upon chromosome which in Ayurveda is a results of righteous and unrighteous deeds of a soul. So the term *Dharmadharm-Nimitta* may be comprehended as genetic information.

There are several Factors which are under control of parents and may alter the physical and mental attributes of a progeny in its foetal, neonatal and adult life. Ayurveda recommends some instructions to menstruating woman which is described as *Rutumatcharya*. The ovum which is developed from primary oocyte is in the prophase of the first meiotic division before its maturation. With each menstrual cycle about 5 to 30 primary oocytes begin to mature and complete the first meiotic division shortly before ovulation.[30] In pachytene and diplotene stages of prophase the exchange of genetic material between central chromatids of a chromosome pair takes place and unwanted chromosomes are get rid through the formation of First polar body [31]. So there may be any relation between maturation of oocyte and *Rutumatcharya*,

since ancient Ayurveda literature coerce of precautions to menstruating woman.

Other dependent factors like *Garbhotpadak* factors, dietary and behavioral factors are explained which may alter the characteristics of individuals. “*Swabhav*” or nature corresponds to the genetic theory. It is known that whenever there is formation of any body part during genesis the whole information regarding its development is stored in concerned GENE. This stored information guides the complete course of development for any organ. So the above stated word “*Swabhav*” can be considered as genetic information.

Without proper paternal genetic information normal embryo could not exist is described in 22th Stanza which is comparable with Stein-Leventhal syndrome of contemporary science. The three causative factors for foetal anomalies i.e. unrighteous deeds, vitiated *Vata* and ignorance of craving in pregnancy are elucidated in Ayurveda. The unrighteous acts again represent chromosomal defects during fertilization.

In context of sex determination why it is said that male child is due to copiousness of semen because menstrual blood is normally more in quantity as said “the quantity of *Aartava* is four *Anjali* while semen is only one *Prasruta*”. It is not so here, *Aartava* means its quantity which is positioned in uterus and is pure and fit for conception or it may mean increase or decrease in the normal quantity of semen and *Aartava*. Semen under excessive exhilaration is discharged copiously while in small quantity under psychological stress. Other compendia however explain like this deficiency, increase and equality of semen and *Aartava* should be taken in term of potency (strength or predominance). Then if it is fixed like this the rite for begetting male child is useless? Not so, for excellent qualities that is purposeful.

Utkattah described in context of *Prakruti* is predominance in normal state and aggravated; predominant *Vata* etc are of two types normal and abnormal of which the former emerging simultaneously with the body are source of natural

constitution while the latter cause abnormality in foetus. *Gayi* however interprets in somewhat different way- he says that if the entire seed is vitiated the embryo would not come forth but when a portion of the same is vitiated by *Dosha* some abnormal features appear in comparison to the healthy one, such as cracks in palm, sole etc.

So from this discussion it can be stated that the concept of Genetics described in Ayurveda compendia is based on philosophy and fundamentals of *Ayu*. The righteous and unrighteous did are given utmost importance for appearance of attributes in individual. Most of such genesis concepts mentioned in Ayurveda should be understood in terms of contemporary science.

Conclusion:

The concepts of Ayurveda in genesis of individual are purely based on its fundamentals i.e. *Tridosha, Triguna & Pancha-mahabhoota* etc. The literature study of *Garbhasharir* in Ayurveda compendia broadly shows two types of factors related to genesis of offspring viz. Dependent and Independent. The Abiogenesis described by Sushruta is one of best in Ayurveda literature. The main aim of Ayurveda embryology is to focus on physical and mental health of individual i.e. *Suprajanan*. Almost all the topics about genesis are explained in Ayurveda compendia, the need is to comprehend this knowledge on the basis of present theory of Genetics.

References:

- [1] <http://en.wikipedia.org/wiki/Genetics> last accessed on Date: 10.09.2014.
- [2] Ghanekar B. G., Sushrut samhita, Sharir sthan Chapter 1 sutra: 2-3, Reprint edition 2009, Meharchand laxman das publication, Page 1-2.
- [3] Anantram Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 1 sutra-18, Edition 2013, Chaukhamba Surbharati publication Varanasi, Page 10.
- [4] P. V. Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 1 sutra-4, Chaukhamba visvabharati Varanasi, Reprint 2005, Page 118.
- [5] Ambikadatta Shashtri, Sushrut samhita Vol-1, Sharir sthan Chapter 1, sutra-26 Chaukhamba Sanskrit Sansthan Varanasi, Reprint 2014, Page 9.
- [6] B. G. Ghanekar, Sushrut samhita, Sharir sthan Chapter

- 5 sutra-2, Reprint 2012, Meharchand laxmandas publication New Delhi, Page 146.
- [7] P. V. Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 3 sutra-4, Chaukhamba visvabharati Varanasi, Reprint 2005, Page 140.
- [8] Anantram Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 1 sutra-16, Edition 2013, Chaukhamba Surbharati publication Varanasi, Page 9.
- [9] Ambikadatta Shashtri, Sushrut samhita Vol-1, Sharir sthan Chapter 3, sutra-34, Chaukhamba Sanskrit Sansthan Varanasi, Reprint 2014, Page 36.
- [10] Srikantha Murthy, Sushrut samhita Vol-1, Sharir sthan Chapter 2, sutra-37, Chaukhamba Orientalia Varanasi, 2nd Edition 2004, Page 28.
- [11] P. V. Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 2 Sutra-25, Chaukhamba visvabharati Varanasi, Reprint 2005, Page 131.
- [12] B. G. Ghanekar, Sushrut samhita, Sharir sthan Chapter 2 sutra: 34-35, Reprint 2012, Meharchand laxmandas publication New Delhi, Page 38,41.
- [13] Ambikadatta Shashtri, Sushrut samhita Vol-1, Sharir sthan Chapter 2, sutra-49, Chaukhamba Sanskrit Sansthan Varanasi, Reprint 2014, Page 23.
- [14] Anantram Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 3 sutra-35, Edition 2013, Chaukhamba Surbharati publication Varanasi, Page 44.
- [15] P. V. Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 2 Sutra: 57-58, Chaukhamba visvabharati Varanasi, Reprint 2005, Page 139.
- [16] Ambikadatta Shashtri, Sushrut samhita Vol-1, Sharir sthan Chapter 2, sutra: 37-38, Chaukhamba Sanskrit Sansthan Varanasi, Reprint 2014, Page 20.
- [17] B. G. Ghanekar, Sushrut samhita, Sharir sthan Chapter 3 sutra-43, Reprint 2012, Meharchand laxmandas publication New Delhi, Page 101.
- [18] P. V. Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 2 Sutra-56, Chaukhamba visvabharati Varanasi, Reprint 2005, Page 138.
- [19] P. V. Sharma, Charaka Samhita Vol-1, Sharir sthan Chapter 3 sutra-17, Chaukhamba orientalia Varanasi, Reprint edition 2011, Page 426.
- [20] B. D. Chaurasia, Human Anatomy, Vol. 2, CBS Publishers New delhi, 4th Edition (reprint 2006), Page 356.
- [21] B. G. Ghanekar, Sushrut samhita, Sharir sthan Chapter 2 sutra: 50-51, Reprint 2012, Meharchand laxmandas publication New Delhi, Page 54.
- [22] Ambikadatta Shashtri, Sushrut samhita Vol-1, Sharir sthan Chapter 2, sutra: 53-54, Chaukhamba Sanskrit Sansthan Varanasi, Reprint 2014, Page 23.
- [23] P. V. Sharma, Charaka Samhita Vol-1, Sharir sthan

Chapter 2 sutra-29, Chaukamba orientalia Varanasi, Reprint edition 2011, Page 415.
[24] Anantram Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 3 sutra-5, Edition 2013, Chaukhamba Surbharati publication Varanasi, Page 30.
[25] B. G. Ghanekar, Sushrut samhita, Sharir sthan Chapter 2 sutra-33, Reprint 2012, Meharchand laxmandas publication New Delhi, Page 33.
[26] Ambikadatta Shashtri, Sushrut samhita Vol-1, Sharir sthan Chapter 3, sutra-10, Chaukhamba Sanskrit Sansthan Varanasi, Reprint 2014, Page 279.
[27] P. V. Sharma, Sushrut samhita Vol-2, Sharir sthan Chapter 4 Sutra-63, Chaukhamba visvabharati Varanasi,

Reprint 2005, Page 162.

[28] Ghodke Y, Joshi K, Patwardhan B. Traditional Medicine to Modern Pharmacogenomics: Ayurveda Prakriti Type and CYP2C19 Gene Polymorphism Associated with the Metabolic Variability. Evid Based Complement Alternat Med. 2011;2011:249528.
[29] Inderbir singh, Human Embryology, Macmillan Publishers, 8th Edition (reprint 2009), Page 2, 3.
[30] Inderbir singh, Human Embryology, Macmillan Publishers, 8th Edition (reprint 2009), Page 15.
[31] Inderbir singh, Human Embryology, Macmillan Publishers, 8th Edition (reprint 2009), Page 6-7.