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**TITLE: DEVELOPMENT OF *DNYANENDRIYA* IN EMBRYO IN RELEVANCE TO
SENSE ORGAN: AN AYURVED REVIEW**

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DEVELOPMENT OF *DNYANENDRIYA* IN EMBRYO IN RELEVANCE TO SENSE ORGAN: AN AYURVED REVIEW

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ABSTRACT:

Being one of the ancient medical sciences, Ayurveda does have detailed explanation of almost every aspect of the human body, its structure, physiology,, pathology, medicine, surgery, gynaecology etc. One of the fundamental subjects is Sharir Rachana in which human anatomy has been studied. In this subject so many topics has been described such as Marma Sharir (Vital Points), Indriya (Sense Organ), Garbhasharir (Concerning the complete development of the fetus). In Sharir Rachana the development of the dnyanendriyas has been described in the monthly development of the fetus in various samhitas. In ancient Indian Upanishada, Garbhopanishada the development of the sense organs has been described too⁵. While studying the modern embryology, it is found that the duration of the formation and the development of the sense organs have a great similarity with the Ayurvedic development of the sense organs (dnyanendriyas) and that in the Upanishada i.e. Garbhopanishad .

The microscopic and macroscopic development of the sense organs along with the other organs in the body is described in Ayurveda in the masanumasik vrudhhi of the garbha (monthly fetal development).In modern embryology the development of the sense organs during the intra uterine life has been described in detail. In this article development of sense organs in human being is been validated as per modern embryology and ayurveda.

Keywords: Akshi, Dnyanendriya, Ghrana, Indriya, Rasan, Shrotra, Twak.

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INTRODUCTION

In *ayurveda* the development of the *dnyanendriyas* have been described in *samhitas* like *Charaksamhita*, *Sushrut samhita*, *Ashtang Hrudya* and *Ashtang*

Sangrah. Upanishada, Garbhopanishada also has discussed the same topic in detail. The duration of this development ranges from first month till fifth month including the microscopic formation and the completion of growth of the *dnyanendriyas*. In modern embryology the duration of development of sense organs starts from fourth week onwards in the intra uterine life. It is found that there is similarity between the two sciences.

REVIEW OF LITERATURE

INDRIYA: The entity which is important to gain knowledge (*Dnyana*) is the *Indriya*. *Ekadashindriyas* (eleven) are there in the body. Out of those, five are the *dnyanendriyas-chakshu* (eye), *shrotra* (ear), *ghrana* (nose), *jivha* (tongue) and *twak* (skin). Five *karmendriyas-vacha* (organ of speech), *hasta* (Hands), *pada* (Legs), *guda* (Anus), *upastha* (Genitals)^{1, 2}.

Development of *indriyas* according to *Ayurveda*

Charaksamhita: The sense organ development starts in first month, i.e. fourth week and gets completed in third month. The *sad* and *asad avayavas* (microscopic and macroscopic) develop in this duration¹.

Sushrutsamhita: *Sukshma* (microscopic) *avayavas* develop in third month².

Ashtangasangrah: All organs and sense organs develop in third month³.

Ashtanghrudya: All organ development takes place in third month in microscopic form⁴.

Garbhopanishada: *Indriyas* (sense organs) development is completed in sixth month⁵.

Table 1: Five *dnyanendriyas* (Five sense organs)^{1,2}

Sr.No.	<i>Indriyadhithana</i> (sense)	<i>Indriya</i> (sense)	<i>Indriyartha</i> (type of)
1	<i>Twak</i> (skin)	<i>Sparshan</i>	<i>Sparsh</i> (touch)
2	<i>Jivha</i> (tongue)	<i>Rasan</i>	<i>Rasa</i> (taste)
3	<i>Nasika</i> (nose)	<i>Ghrana</i>	<i>Gandha</i> (smell)
4	<i>Akshini</i> (eyes)	<i>Darshana</i>	<i>Rupa</i> (vision)
5	<i>Karnau</i> (ears)	<i>Shrotra</i>	<i>Shabda</i> (sound)

The process of sensation- (*Dnyanotpatti*)¹;

The soul comes in contact with activity of the mind, the mind with that of the sense

and the sense with that of its object (through the sense organs) and then the sensation of that particular sense is possible.

Table 2: CHAKSHU (EYE)^{1,2}

Synonym	<i>Akshi, drushti, darshanendriya</i>
Panchabhautikatwa	<i>Teja</i>
Indriya adhisthan	<i>Chakshurendriya</i>
Guna	<i>Rupa</i>
Dosha	<i>Pranavayu, vyan vayu, alochaka Pitta, tarpaka Kapha</i>
Mahabhuta	<i>Pruthvi – Mansa, Rakta – Agni , Vata – Black Portion</i>
Additional Description	<i>Five Mandalas- Pakshma, Vartma, Shuka, Krushna,</i>

Table 3: SHROTRA (EAR)^{1,2}

Synonym	<i>Karna</i>
Panchabhautikatwa	<i>Aakash</i>
Indriya adhisthan	<i>Shrotrendriya</i>
Guna	<i>Shabd</i>
Dosha	<i>Pranavayu</i>
Additional description	<i>Srotas- Barhirmukha</i>

Table 4: RASANA (TOUNGE)^{1,2}

Synonym	<i>Rasanendriya, Jivha</i>
Panchabhautikatwa	<i>Aap</i>
Indriya adhisthan	<i>Rasanendriya</i>
Guna	<i>Rasa (Taste)</i>
Dosha	<i>Pranavayu, udanavayu, bodhaka kapha</i>
Additional description	<i>Srotas- Barhirmukha</i>

Table 5: GHRANA (NOSE)^{1,2}

Synonym	<i>Nasika, Ghranendriya</i>
Panchabhautikatwa	<i>Pruthvi</i>
Indriya adhisthan	<i>Ghranendriya</i>
Guna	<i>Gandha</i>
Dosha	<i>Pranavayu, Kapha</i>
Additional description	<i>Srotas- Barhirmukha</i>

Table 6: TWACHA (SKIN)^{1,2}

Synonym	<i>Twak</i>
Panchabhautikatwa	<i>Vayu</i>
Indriya adhisthan	<i>Sparshanendriya</i>
Guna	<i>Sparsh</i>
Dosha	<i>Prana yavu, bhrajaka pitta</i>
Additional description	<p><i>Twacha Utpatti-</i></p> <ol style="list-style-type: none"> 1. Digestion of <i>Asruk</i> (blood) results in formation of <i>Twacha</i>. 2. The human embryo develops from the union of <i>Shukra, Shonit</i> and in this process, forms skin with seven layers. This skin is like the skin over boiling milk which is separated from the milk and consists of several layers.

Table 7: *SUSHRUTASAMHITA*- 7 LAYERS OF *TWACHA* (SKIN) (*Vrihi*-ricegrain)²

Sr.No.	Type Of <i>Twacha</i>	Thickness (in portion of <i>vrihi</i>)	Concerning <i>Vyadhi</i> (disease)	Description
1	<i>Avabhasini</i>	18 th	<i>Sidhma, Padmakantaka</i>	Imparts with its 5 varieties, colour and brightness to the complexion.
2	<i>Lohita</i>	16 th	<i>Tilakalaka, Vyanga, Nyachha,</i>	-
3	<i>Shweta</i>	12 th	<i>Charmadala, Mashaka, Ajagalli,</i>	-
4	<i>Tamra</i>	8 th	<i>Kilasa, Kushtha</i>	-
5	<i>Vedini</i>	5 th	<i>Kushtha, Visarpa</i>	-
6	<i>Rohini</i>	1 <i>vrihi</i>	<i>Granthi, Apachi, Arbuda, Slipada, Galaganda</i>	-
7	<i>Mansadhara</i>	2 <i>vrihi</i>	<i>Bagandara, Vidradhi, Arsha</i>	-

Charak samhita: 6 layers of *Twacha* (skin)¹

- *Udakadhara*
- *Asrugdhara*
- *Sidhmakilassambhavadhishthana*
- *Dadrukushthasambhavadhishthana,*

- *Alajividradsambhavadhishthana*

- The skin layer when gets penetrated fainting takes place (*tamapravesh*), Also cyst formation (*arunshi*) and the interphalangeal joints become blackish red in colour, which is difficult to treat.

DEVELOPMENT OF SENSE ORGANS ACCORDING TO MODERN EMBRYOLOGY

Table 8: SKIN (*TWACHA*)^{7,8,9,10}

Sr.No.	Part of Skin	Derives From
1	Epidermis	Surface ectoderm
2	Melanoblasts	Neural crest
3	Dermis	Condensation and differentiation of mesenchyme underlying
4	Nails	Surface ectoderm
5	Hair	Surface ectoderm
6	Sebaceous	As a bud arising from ectodermal cells forming the wall of a
7	Sweat gland	As a down growth from the epidermis

TIMETABLE

Surface ectoderm (single layered): 2nd month
It multiplies to several layers between: 2nd & 4th months
Cells from neural crest migrate into the skin between: 1st & 3rd months
Dermal papillae: 3rd to 4th month
Mammary line: 7th week

TONGUE (*JIVHA*)^{7,8,9,10}

Develops in the floor of developing mouth in relation to pharyngeal arches.

Each pharyngeal arch arises as mesenchymal thickening in the lateral wall of the foregut and it grows ventrally to become continuous with the corresponding arch of the opposite side.

The medial most parts of the pharyngeal arches proliferate to form-2 lingual swellings-separated from a median swelling –tuberculum impar. Appear at fourth week.

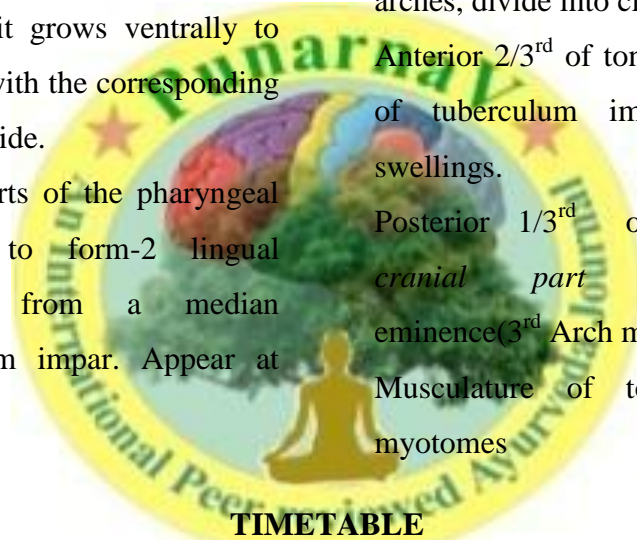
The down growth behind the tuberculum impar, marked by a depression-foramen caecum.

Midline swelling called as hypobronchial eminence seen in relation of 2nd, 3rd, 4th arches, divide into cranial and caudal parts.

Anterior 2/3rd of tongue-formed by fusion of tuberculum impar and 2 lingual swellings.

Posterior 1/3rd of tongue-formed by *cranial part of hypobronchial eminence*(3rd Arch mesoderm)

Musculature of tongue-from occipital myotomes



TIMETABLE

Development of tongue Starts : 4th week of intrauterine life
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NOSE (*GHRANA*)^{7,8,9,10}

Derived from the frontonasal process

Nasal cavity is formed as follows-

An ectodermal thickening, nasal placode appears over the frontonasal process. The

placode gets depressed below the surface to form the nasal pit. The nasal pits enlarge to form the nasal cavity.

The paranasal sinuses appear as the outgrowths from the nasal cavity.

TIMETABLE

The various processes like the fronto-nasal process develop : at the end of the 4th week.
Nasal pits develop : early in the 5th week
Maxillary processes fuse with the medial nasal process : during the 7th week

EYE (CHAKSHU) ^{7,8,9,10}

The lens placode is seen on the ventro-lateral aspect of the developing forebrain, lateral and cranial to the nasal placode. The lens placode sinks below the surface and is cut off from the surface ectoderm. The developing eyeball produces a bulging. The bulging of eyes is

directed laterally at first and lie in the angles between the maxillary and the lateral nasal processes. With the narrowing of the frontonasal process, they come to face forwards. The eyelids are derived from folds of ectoderm that are formed above and below the eyes and by mesoderm enclosed within the folds.

Table 9: EYE (CHAKSHU) ^{7,8,9,10}

Sr.No.	Structure	Derived From
1	Retina	Optic vesicle ,converted into optic cap
2	Lens	Lens placode
3	Coats of eyeball	Mesoderm surrounding the optic vesicle
4	Cornea	Surface ectoderm
5	Eyelids	Surface ectoderm
6	Lacrimal sac	Ectoderm in the naso-optic furrow

TIMETABLE

<p>Optic sulcus: 22nd day</p> <p>Optic vesicle in contact with Surface ectoderm and lens placode : 4th week</p> <p>Choroidal fissure formed and lens Vesicle is seen at : 6 week</p> <p>Solid lens at : 7 week</p> <p>Eyelids : 7th week</p> <p>Eyes moved to the front and the Face looks human: 8th week</p>
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EAR (KARNA) ^{7,8,9,10}

The external ear is formed around the dorsal part of first ectodermal cleft.

A series of mesodermal thickenings (called as tubercles) appear on the mandibular and hyoid arches, where they adjoin this cleft.

The pinna (auricle) is formed by fusion of these thickenings.

Membranous labyrinth-(internal ear) derived from thickening of surface

ectoderm- otic placode- otic vesicle- different parts of the labyrinth.

Bony labyrinth-mesenchyme surrounding the membranous labyrinth

Middle ear, auditory tube-tubotympanic recess (1st and 2nd pharyngeal pouches)

Malleus and incus-Meckel's cartilage

Stapes- cartilage of 2nd pharyngeal arch

External acoustic meatus-1st ectodermal cleft

Auricle-swelling that appear around the cleft

TIMETABLE

Tubercles forming pinna: 6th week
Otic placodes form otic vesicle : 22nd day
Cochlea and semicircular canals Start forming during: 6th week Completed during 8th week
Scala vestibuli and scala tympanin: 10th week
Canalization of external acoustic meatus in: 7th month
Auricle starts forming in : 5th week

Table 10: TIMETABLE OF EVENTS IN DEVELOPMENT OF SENSE ORGANS^{7,8,9,10}

Sense	Onset (Approximately)(In Intrauterine Life)
Ear	4 th week onwards
Eye	4 th week onwards
Tongue	4 th week onwards
Nose	End of 4 th week onwards
Skin	In 2 nd -4 th month onwards

DISCUSSION

The information about the development of the *indriyas* (sense organs) and the related aspects like shape, function, *marmasambandh* have been described thoroughly in *Ayurveda*. In *Charaksamhita*, it is stated that sense organ development starts in first month, means fourth week of the intrauterine life and completed in 3rd month. The words like *sad* and *asad avayava* have been used to describe the microscopic and macroscopic development of the organs.¹

According to *Sushrutsamhita*, *sukshma angaavayavas* develop in third month².

Ashtangasangrah describes that *sarva angaavayavas*(organs) and *indriyas*(sense

organs) develop in third month³. *Garbhpanishada* states that *indriya* (sense organ) formation gets completed in sixth month.⁵

In modern anatomy, it is revealed that the sense organ development starts approximately fourth week onwards.^{7,8,9,10}

Though some of these organs have started developing from the second month of the intrauterine life like skin and tongue.

CONCLUSION

Studying the *ayurvedic shareer* and modern anatomy, we can say that the sense organ development in *Ayurveda* is discussed right from the fourth week onwards, where the references describe the *sukshma* (microscopic) development of the sense organs and then the *Shula* (macroscopic) development onwards (*pravyakta*). Similarly modern embryology also describes the sense organ development starting around fourth week

(second month) of the intrauterine life onwards.

SCOPE OF STUDY

From the above references, there is a wide scope of study concerning the comparative study of the development of the *indriyas* or sense organs in the intrauterine life in *Ayurved* and Modern Anatomy. This study might help to treat the sense organ diseases in a different way altogether.

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