Chapter - 33
Embryonic Development in Human

Embryonic development from cell division and cellular differentiation in zygote is known as human **Embryogenesis.** In human, this process of gradual development starts from a single celled zygote and continue up to development of newborn baby.

Cleavage and Morulation

The process of fertilization in human completes in fallopian tube of oviduct where diploid zygote is formed by the fusion of sperm and ovum. Initial mitotic divisions in zygote are called cleavage. When zygote is proceed toward uterus from oviduct then cleavage starts.

First of all zygote divide mitotically into two equal cells which is called two celled stage. Later on out of these two cells the large cell divides mitotically to form three celled stage. After this the sequence of divisions increases and the number of cells increases but the size of zygote remains same.

When the number of cells becomes 16 then this solid state phase is called **Morula**. Zona pellucida named covering is present up to completion of morula formation. The process of formation of morula is called **Morulation**. This process is completed in three days. Outer most covering (zona pellucida) of morula prevents embryo from getting implantation elsewhere than uterus.

Blastulation

The process of formation of blastocyst from morula is known as **Blastulation.**

On reaching of morula in uterous its outer most cuboidal cells form a layer of flat cells which is called **Trophoblast**. Embryo is attached by these cells with uterine epithelium.

Due to secretion of uterine fluid in morula trophoblast separates from inner cell mass. By this, a cavity is formed which is called **Blastocoel**. A fluid is filled in it. As the amount of fluid increases, the size of cavity enlarges and internal mass of cells gets located at one place of embryo. The cells of trophoblast also become extremely flat. This stage is called blastocyst.

Blastocyst is attached with uterine endometrium by trophoblastic cells. The process of attachment of blastocyst with uterine wall is called **Implantation**. This type of implantation in human is called inter stitial because uterine endometrium slowly-slowly encircles the blastocyst. Resulting blastocyst getsinserting in uterine endometrium. It is called **Imposition**.

After imposition, the internal cell mass gets differentiated into ectoderm (external layer) and endoderm (internal layer). Mesoderm is formed in between ectoderm and endoderm,. The formation of three germinal layers from blastocyst is called gastrulation. In this process the cells reach their future location by amoeboid movement.

Fate of Germinal Layers

Out of these three germinal layers, each layer forms definite tissues, organs and systems of body. The fate of these layers in embryo and adult is described in the following given table 33.1

Table 33.1 Fate of germinal layers

Ectoderm	Mesoderm	Endoderm
Epidermis and skin derivatives	Dermis	
Cutaneous glands	Muscular tissue	Gastric and intestinal glands
Nervous system (Brain and spinal cord)	Connective tissue	Tongue
Motor and optic nerves	Endoskeleton	Lungs, Trachea & Bronchi
Eye (Retina, Lens and cornea)	Vascular system (Heart and Blood vessels)	Urinary bladder
Connective, Ciliary and Iris muscles	Kidney	Primordial cells
Olfactory epithelium	Reproductive system (gonads)	Gills
Internal ear (Membranous labyrinth)	Urinary and reproductive ducts	Liver
	coelom and coelomic epithelium	Pancreas
Stomodaeum	Sclerotic and choroid covering of eye	Thyroid gland
Salivary gland	Adrenal cortex	Parathyroid gland
Enamel of teeth	Spleen	Thymus
Proctodium	Notochord	Middle ear
Pituitary body	Parietal and visceral peritoneum	Eustachian tube
Pineal gland	Dentine of teeth	Jejunum
Adrenal medula		Lining of vagina and urethra
Hypothalamus		Prostate gland

Summary of Embryonic Stages in Human

1. **First week -** Fertilization within 24-30 hours of ovulation. Two celled stage in 48 hours, formation of morula on third day, Blastocyst enters in uterine cavity on fourth day, within 7-8th days implantation completes.
2. **Second week -** Blastocyst completely enters in uterine endometrium. Formation of embryonic disc and formation of external embryonic membranes are completed. On 14th day primitive streak is formed.
3. **Third to sixth week -** Endoderm and mesoderm named germinal layers are formed on third week. Nerurulation formation starts on 20th day. On 28th day heart beat (113 beat/min) starts, pharyngeal arch is formed and quantity of amniotic fluid increases around the embryo. Brain develops rapidly. Lungs and Kidneys are visible.
4. **Sixth to Eighth week -** External ears start appearing. Development of RBC in liver starts, formation of diaphram in sixth week, formation of breast, in seventh week elbow and fingers become visible, in 7th week the process of bone formation is also start. Up to the end of 8th week the embryo takes the shape of small human. Now it is called foetus, heart is completely developed and beats 167 times / min. In 80% foetus right arm becomes functional otherwise left arm in 8th week. This is the first evidence of behavior of right or left arm. In 8th week foetus takes turn and also

becomes some active. Eyelids get developed. 8th week is the end of embryonic period. By this time more than 90% structure found in an adult are developed.

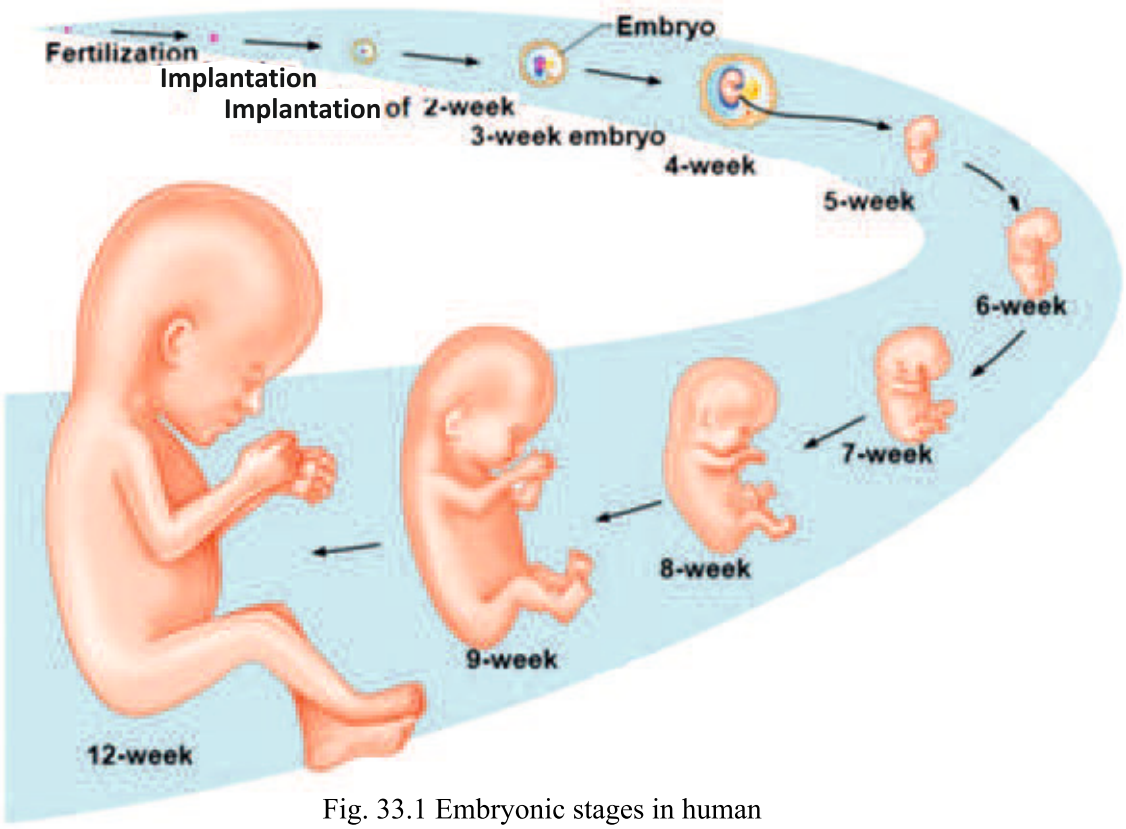

Fig. 33.1 Embryonic stages in human

5. **Ninth to twelfth week -** Sucking of thumb starts in 9th week, movements in hands and legs are possible. Eyelids become closed. Vocal cards in larynx get developed. During this time external sexual structures are developed. By this identification of boy or girl is possible. Weight increases up to 75% in 9th and 10th week. In 11th week foetus take yawing and maximum babies start sucking right thumb. In 10th 11th week sign of fingers and nails are completely developed. By the end of 11th week lips and nose are also developed.

6. **Third to Fourth month -** Development of taste buds in mouth, developing baby or foetus digest glucose taken by intestine and meconium the fecal matter excreted by child. Female foetus moves more than male foetus. Development of teeth takes place. The mother can clearly feel the movement of foetus called quickening.

7. **Fourth to sixth month -** Complete development of respiratory ducts, the foetus is covered with white liquid called vernix. Auditory organs and internal ears of foetus are completely developed and foetus reacts to high sound intensity. In 6th month hair starts appearing on head. Different glands start developing in skin. Breathing capacity in lungs develops.

8. **From six month till birth -** In 6th month foetus starts to open and close eyelids, at this time brain develops rapidly and its weight increases. In 7th month lacrimal glands are developed, ability of smelling power develops. The foetus starts changing face expressions, brown fats are formed below the skin, which helps in temperature regulation after birth. In 8th month alveoli develops in lungs. Labour pain starts in mother from oxytocin secreted by foetal placenta to which

birth takes place.

Important Points

1. Development of embryo from cell division and cell differentiation in zygote is called embryogenesis.
2. First of all zygote divides mitotically and after this the sequence of divisions increase. Then the number of mother cells increases but the size remains same. Cells formed by cleavage are called blastomeres.
3. After cleavage when the number of cells reaches 16 then solid state morula is formed.
4. The process of formation of blastocyst from morula is called blastulation.
5. The process of attachment of blastocyst with uterus wall is called implantation.
6. The process of formation of three germinal layers from blastocyst is called gastrulation. Out of these three germinal layers each layer forms definite tissues, organs and organ systems.
7. The period from fertilization to parturition is called gestation period. Gestation period is about 266 days in human.

Practice Questions

Multiple Choice Questions-

1. How many numbers of cells present in morula stage?
   (a) 4 (b) 8
   (c) 16 (d) 32
2. Which cavity is formed during blastulation?
   (a) Active pole (b) Inactive pole
   (c) Blastocoel (d) Amniotic cavity
3. Major parts of eyes are developed fro which germinal layer?
   (a) Ectoderm (b) Mesoderm
   (c) Endoderm (d) None of above
4. Kidney is formed from which germinal layer?
   (a) Ectoderm (b) Mesoderm
   (c) Endoderm (d) None of above
5. Which activity does not occur in human during first week of embryonic stage?
   (a) Implantation process
   (b) Formation of blastocoel
   (c) Formation of morula
   (d) Formation of primitive streak
6. In how may days, does the development of heart complete in human during embryonic development.
   (a) First week
   (b) Second week
   (c) Third to sixth week
   (d) seventh to eighth week

Very short Answer Questions-

1. What is embryogenesis?
2. Which type of cell division takes place during cleavage?
3. What are blastomeres?
4. How many blastomeres are found in human morula?
5. What is formed from blastopore in human?

Short Answer Questions-

1. How does blastocyst formed in human?
2. Mention difference between blastulation and gastrulation.

Essay Type Questions-

1. When and how does blastocyst form in human?
2. Describe gastrulation in human.
3. How does a child born in seven month survive? Explain.

Answer Key-

1 (c) 2 (c) 3 (a) 4 (b) 5 (d) 6 (d)