

3rd WEEK OF DEVELOPMENT

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GASTRULATION

During 3rd week of development, gastrulation takes place. The process by which bilaminar disk is converted into trilaminar disk is called gastrulation. The embryo having three layers is called gastrula.

The process of gastrulation include:

1. Formation of primitive streak and primitive node
2. Formation of primitive groove and primitive pit
3. Movement of epiblast cells towards the primitive streak and node
4. Formation of endoderm and mesoderm from the epiblast cells
5. Formation of ectoderm

PRIMITIVE STREAK

The cells in central axis of epiblast start proliferating and develop a longitudinal streak called primitive streak which moves forward from caudal end to cephalic end (the end towards prechordal plate). The pre-chordal plate is the area where epiblast and hypoblast are very sticky with each other. The anterior wide part of the primitive streak is called **primitive node**.

PRIMITIVE GROOVE

Cells from the center of primitive streak and primitive node begin to disappear. The longitudinal line where cells are deficient within the primitive streak is called primitive groove. The area of deficient cells within the primitive node (as well as underlying epiblast) is called primitive pit.

FORMATION OF ENDODERM

The cells from the epiblast start migrating towards primitive streak bilaterally due to release of special chemical substance called **fibroblast Growth factor-8** by the primitive streak and primitive node cells.

The epiblast cells, are held very tightly by sticky molecules called E-cadherins. Fibroblast growth factors inhibit the production of E-cadherins so that cells can migrate more easily.

From the primitive groove, these cells migrate down the epiblast, become flask-shaped and move towards hypoblast. The hypoblast cells start degenerating and are replaced by these flask-shaped cells, forming a layer of cells called endoderm. Hence endoderm is derived from the epiblast.

FORMATION OF MESODERM

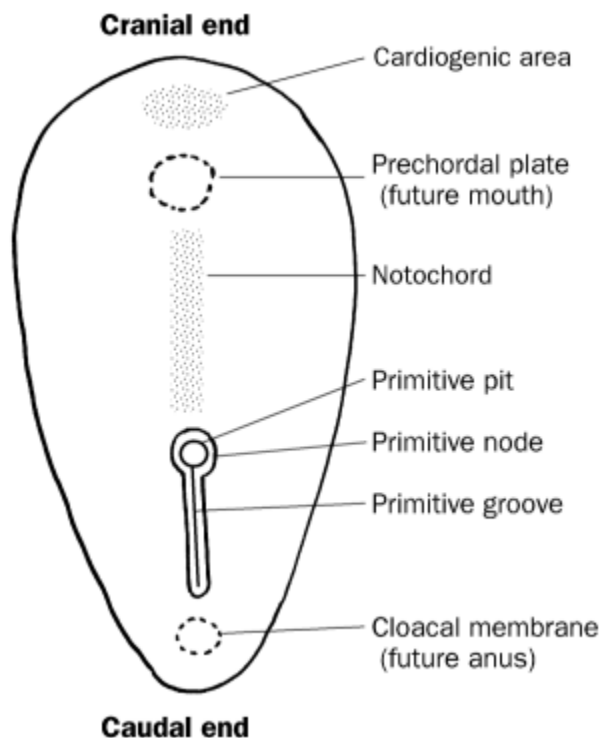
Then other generation of cells start migrating from the epiblast and spread above the endoderm. This layer of cells is called mesoderm. Hence both mesoderm and endoderm are derived from epiblast.

Mesoderm is present through the disk between ectoderm and endoderm except three places:

1. Pre-caudal plate (here ectoderm and endoderm stick close together)
2. Cloacal membrane present in caudal area
3. Buccopharyngeal membrane lying above cranial end of notochord.

From the buccopharyngeal or oral membrane, mouth of baby later develops while the caudal membrane will develop anus.

The primitive streak is present at caudal region of the disk so development of endoderm and mesoderm is more towards the caudal region. The cells keep migrating anteriorly from caudal part to cephalic part due to which shape of disc changes i-e it is narrower in caudal region and wider in cephalic region.



NOTOCHORD TUBE

Through the primitive pit, cells move down and then moves forward in a tubular fashion forming a tube until it reaches the prechordal plate. This tube is called notochord tube. Notochord is present between ectoderm and endoderm i-e mesoderm is missing in this area as well.

NEURO-ENTERIC CANAL

The notochord membrane close to endoderm fuses with the endoderm and both the posterior notochord membrane and endoderm disintegrates. When both the membranes disintegrate, the amniotic cavity temporarily gets connected with the digestive yolk sac and this connection is called neuro-enteric canal.

NOTOCHORD PLATE

The notochord tube then integrates with endoderm cells and form notochord plate due to which neuro-enteric canal will disappear.

DEFINITIVE NOTOCHORD

The notochord plate then detaches from the endoderm and proliferate into a solid mass of notochord cells. The endodermal cells also proliferate to fill the gap left by detachment of notochord. The solid rod formed on detachment is called definitive notochord. This notochord will induce the formation of neural tube and neural plate.

Eventually notochord disappears though some remnants remain inside the intervertebral discs in the form of nucleus pulposus.

END OF 3rd WEEK

The ends of trilaminar disc fuse together to form a tubular structure. By the end of 3rd week, gastrulation is complete. Once gastrulation process completes, primitive streak disappears.

