Lecture 7

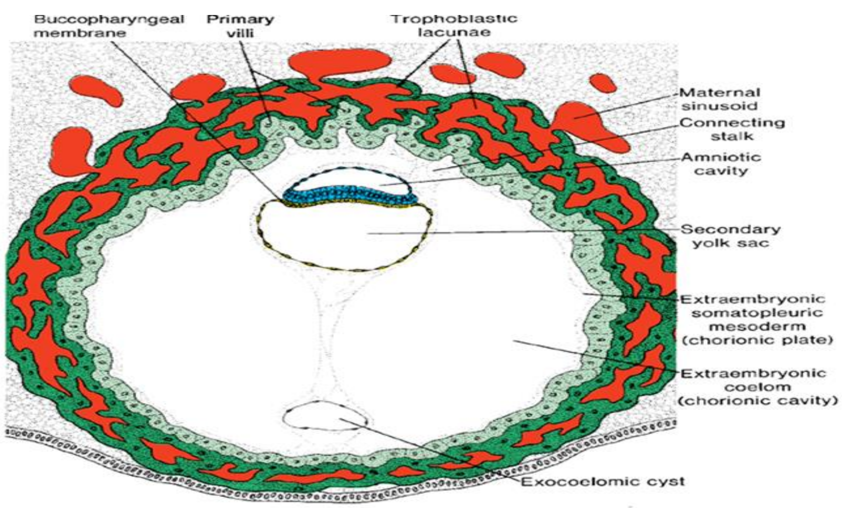
Third to eight week of development

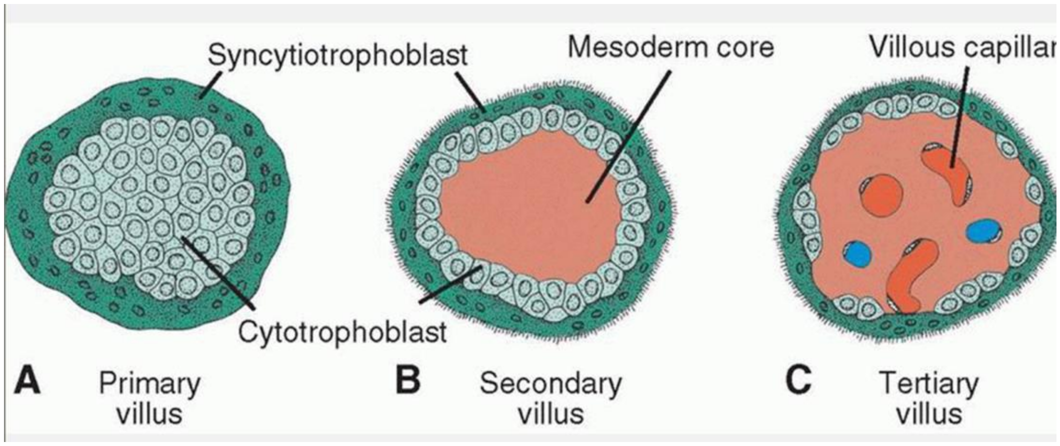
Objectives:

1. Define the neurulation.
2. Explain the congenital anomalies that occur during neural tube formation
3. Enumerates the derivatives of the ectoderm and mesoderm.

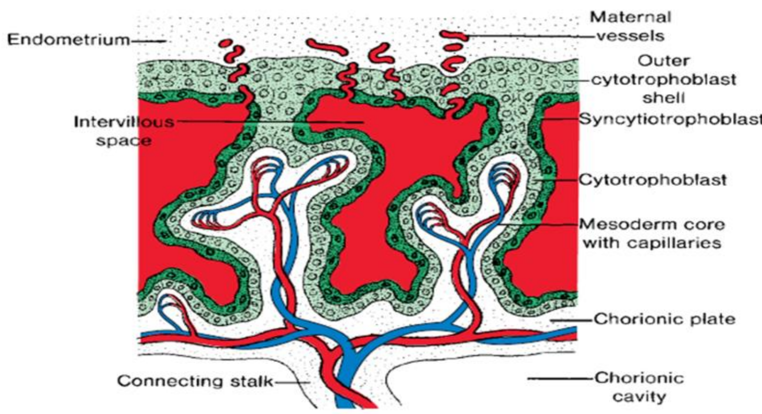
Further development of trophoblast

By the beginning of the 3rd week, the trophoblast is characterized by primary villi that consist of a cytotrophoblastic core covered by a syncytial layer. During further development, mesodermal cells penetrate the core of primary villi and grow toward the decidua. The newly formed structure is known as a secondary villus. By the end of the third week, mesodermal cells in the core of the villus begin to differentiate into blood cells and small blood vessels, forming the villous capillary system. The villus is now known as a tertiary villus or definitive placental villus.

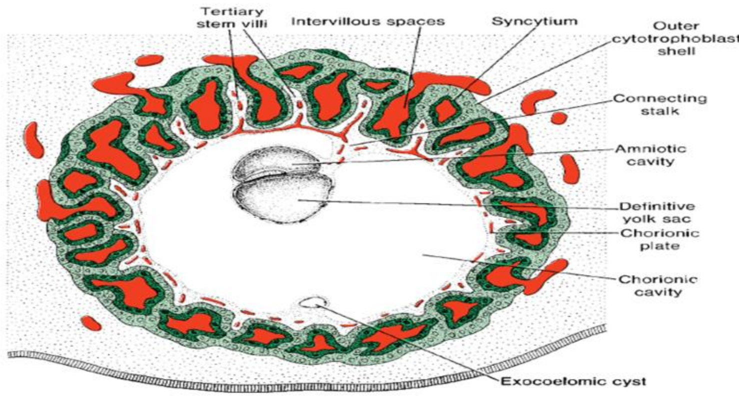




Capillaries in tertiary villi make contact with capillaries of the chorionic plate. These vessels, in turn, establish contact with the intraembryonic circulatory system, connecting the placenta and the embryo.



The chorionic cavity, meanwhile, becomes larger, and by the 19th or 20th day, the embryo is attached to its trophoblastic shell by a narrow connecting stalk. The connecting stalk later develops into the umbilical cord, which forms the connection between the placenta and embryo.

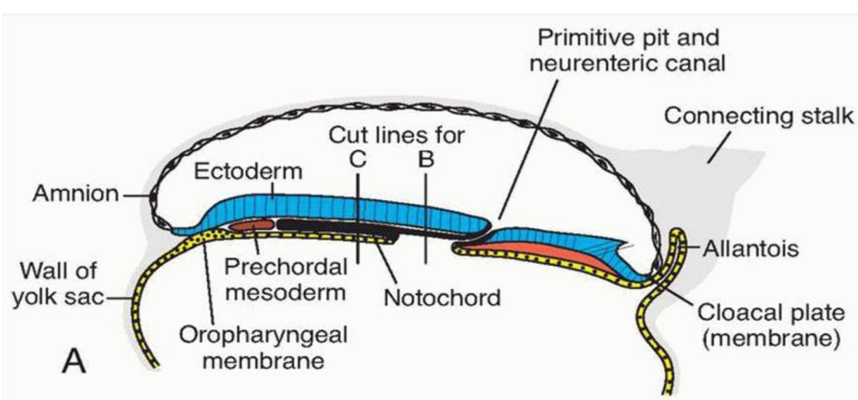


The embryonic period

Period of organogenesis, occurs from **the third to the eighth weeks of development** and is the time when each of the three germ layers, ectoderm, mesoderm, and endoderm, gives rise to a number of specific tissues and organs.

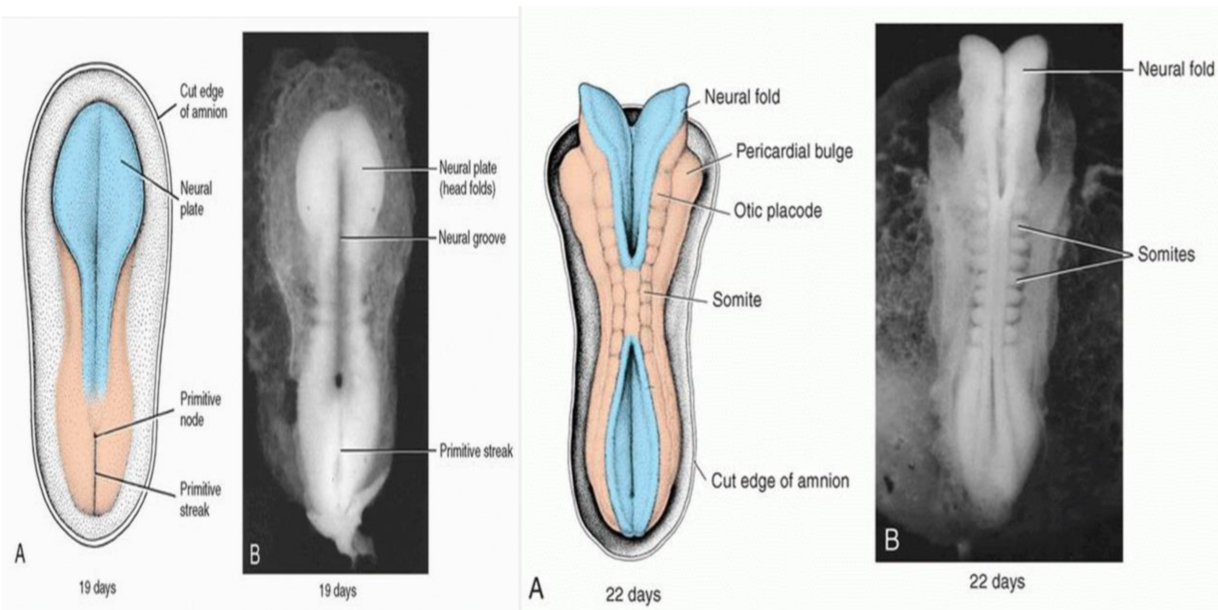
DERIVATIVES OF THE ECTODERMAL GERM LAYER

At the beginning of the third week of development, the ectodermal germ layer has the shape of a disc that is broader in the cephalic than in the caudal region. Appearance of the notochord and prechordal mesoderm induces the overlying ectoderm to thicken and form the neural plate. Cells of the plate make up the neuroectoderm, and their induction represents the initial event in the process of neurulation.

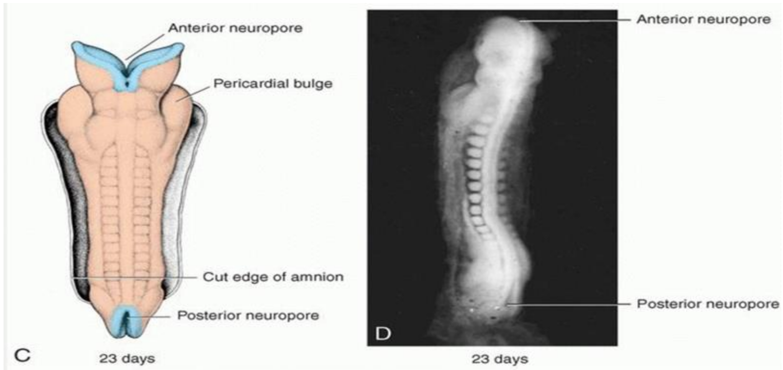


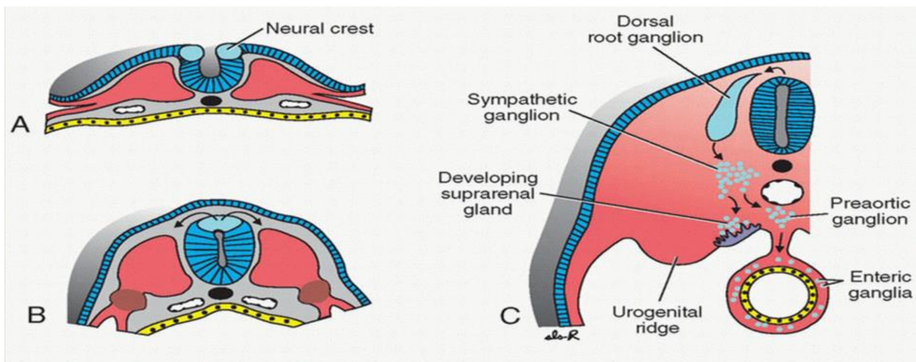
Neurulation

Is the process whereby the neural plate forms the neural tube. By the end of 3rd week → the lateral edges of the neural plate become elevated to form neural folds, and the depressed mid region forms the neural groove. Gradually, the neural folds approach each other in the midline, where they fuse. Fusion begins in the cervical region and proceeds cranially and caudally. As a result, the neural tube is formed.



Until fusion is complete, the cephalic and caudal ends of the neural tube communicate with the amniotic cavity by way of the anterior (cranial) and posterior (caudal) neuropores, respectively. Neurulation is then complete, and the CNS is represented by a closed tubular structure with a narrow caudal portion, the spinal cord and much broader cephalic portion characterized by a number of dilations, the brain vesicles.





In general terms, the ectodermal germ layer gives rise to organs and structures that maintain contact with the outside world:

● The central nervous system;

● The peripheral nervous system;

● The sensory epithelium of the ear, nose, and eye; and

● The epidermis, including the hair and nails.

In addition, it gives rise to:

● Subcutaneous glands,

● The mammary glands,

● The pituitary gland,

● And enamel of the teeth

Clinical correlation of neuralation

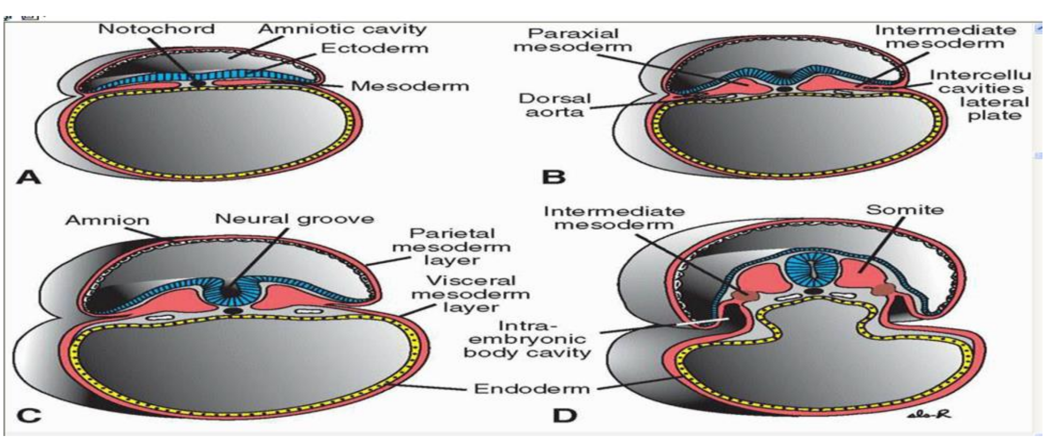
It results when neural tube closure fails to occur.

Cranial region → **anencephaly.**

Cervical region caudally → **spina bifida.**

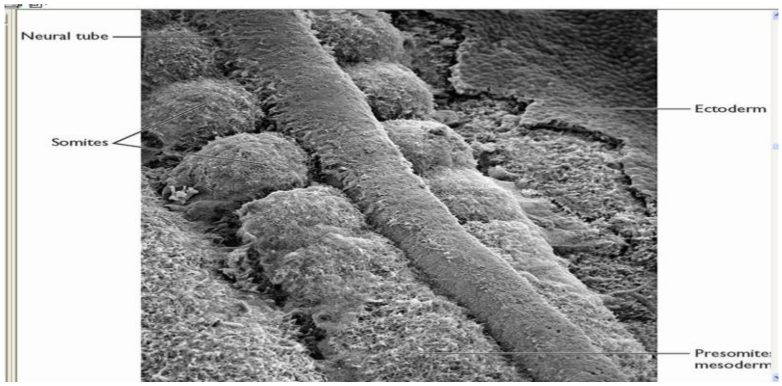
The most common site for spina bifida to occur is in the lumbosacral region, suggesting that the closure process in this area may be more susceptible to genetic and/or environmental factors.

DERIVATIVES OF THE MESODERMAL GERM LAYER



Paraxial mesoderm

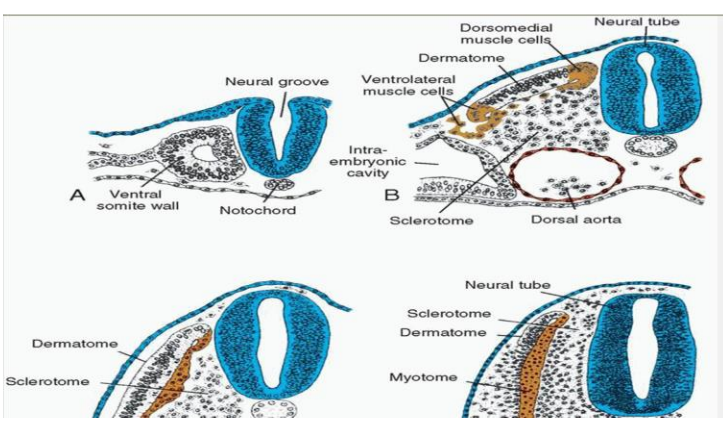
During the 3rd week, the PAM, develops into segmented tissue blocks on the sides of the neural tube, these are called the somitomeres, they develop in the head region and form the head mesenchyme. These blocks develop more to form the somites in the regions from the occiput to the caudal end of the trunk.



Each somite forms its own:

- Sclerotome (the tendon cartilage and bone component).
- Myotome (providing the segmental muscle component).
- Dermatome (which forms the dermis of the back).

Each myotome and dermatome also has its own segmental nerve component.

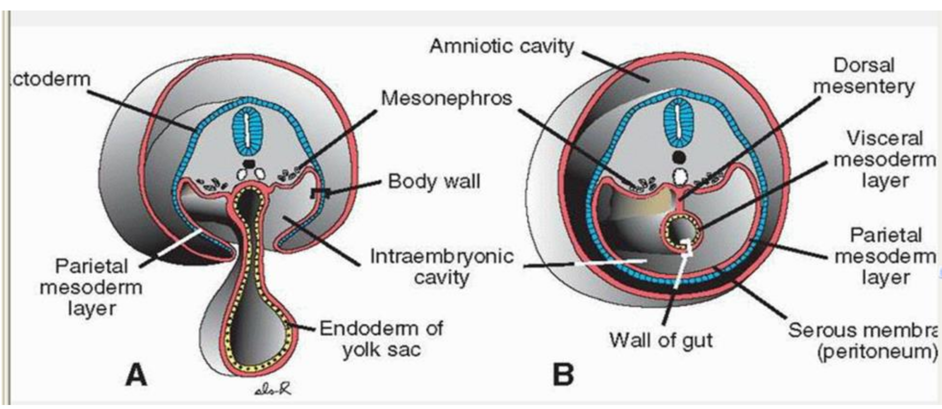


Intermediate mesoderm

- In cervical and upper thoracic regions: it forms segmental cell clusters (future nephrotomes).
- More caudally: it forms an unsegmented mass of tissue, the nephrogenic cord.
- Excretory units of the urinary system and the gonads develop from this partly segmented, partly unsegmented intermediate mesoderm.

Lateral plate mesoderm

It divided into parietal (somatic) and visceral (splanchnic) layers, which line the intraembryonic cavity and surround the organs, respectively. Mesoderm from the parietal layer, together with overlying ectoderm, forms the lateral body wall folds. These folds, together with the head (cephalic) and tail (caudal) folds, close the ventral body wall.

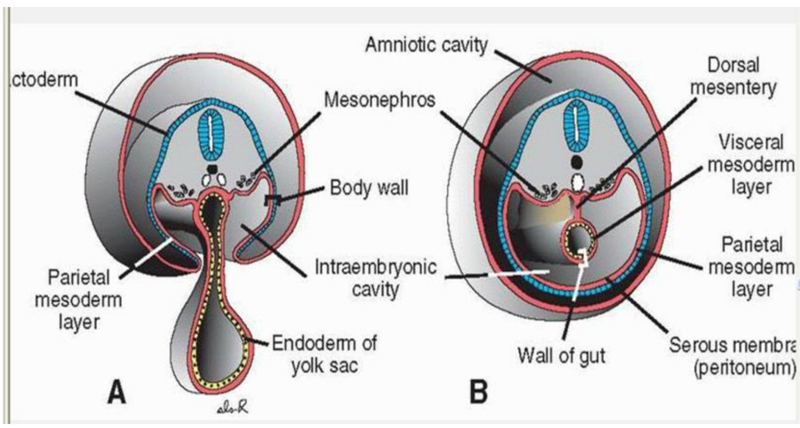


Derivatives of Parietal Layer

The parietal layer of lateral plate mesoderm forms the dermis of the skin in the body wall and limbs, the bones and connective tissue of the limbs, and the sternum. In addition, sclerotome and muscle precursor cells in parietal layer of lateral plate mesoderm form the costal cartilages, limb muscles, and most of the body wall muscles. Mesoderm cells of the parietal layer surrounding the intraembryonic cavity form thin membranes, the mesothelial membranes, or serous membranes, which will line the peritoneal, pleural, and pericardial cavities and secrete serous fluid.

Derivatives of Visceral Layer

The visceral layer of lateral plate mesoderm, together with embryonic endoderm, forms the wall of the gut tube. Mesoderm cells of the visceral layer form a thin serous membrane around each organ.



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