

Gastrulation in amphioxus

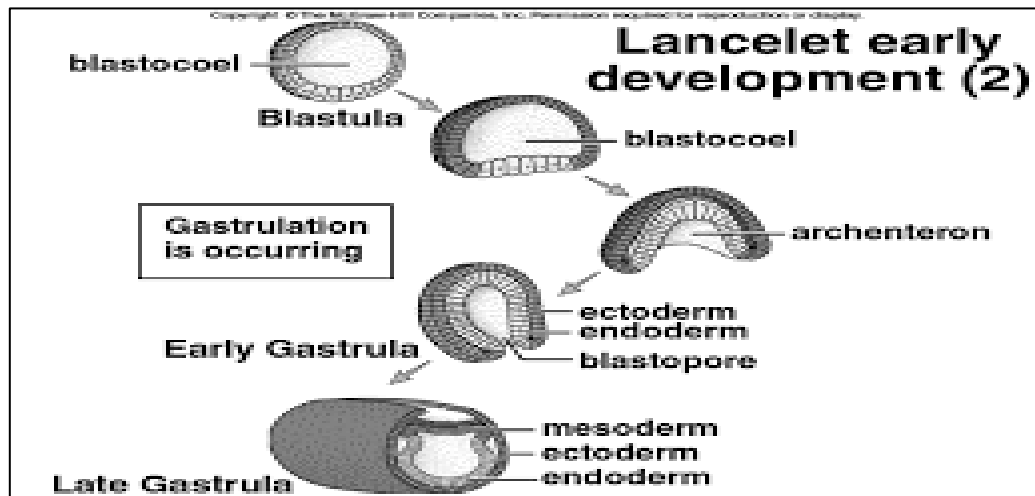
During gastrulation, cell movements result in a massive reorganization of the embryo from a simple spherical ball of cells, the blastula, into a multi-layered organism. During gastrulation, many of the cells at or near the surface of the embryo move to a new, more interior location. The primary germ layers (endoderm, mesoderm, and ectoderm) are formed and organized in their proper locations during gastrulation. Endoderm, the most internal germ layer, forms the lining of the gut and other internal organs. Ectoderm, the most exterior germ layer, forms skin, brain, the nervous system, and other external tissues. Mesoderm, the middle germ layer, forms muscle, the skeletal system, and the circulatory system.

• Early Gastrula

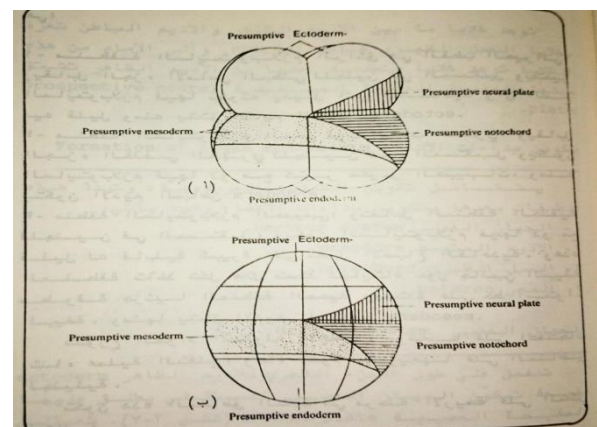
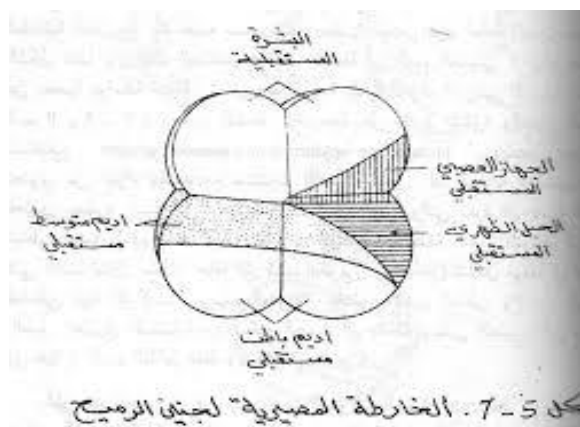
The blastomeres at the vegetal pole are big, therefore they begin to invaginate inside the blastocoel toward the animal pole. A new cavity appears called the gastrocoel (archenteron)

• Late Gastrula

The invagination of the cells at the vegetal pole has complete, the blastocoel disappears and the formation of the gastrocoel has complete. The external opening of the gastrocoel is called the blastopore. The embryo in this stage consists of two layers, the external layer is called the ectoderm, and the internal layer called the endoderm.



مراحل تكوين المعيدة في الرميح



الخارطة المصيرية للرميح

Early Embryo

The embryo becomes long and flat at the dorsal side and concave at the ventral side. The anterior side of the embryo is recognized from the anterior neuropore.

The anterior neuropore leads to a narrow canal called the neurocoel (neural canal) along the dorsal side of the body.

Organogenesis

After the completion of gastrulation, the embryo enters into organogenesis stage this is the process by which the ectoderm, mesoderm, and endoderm are converted into the internal organs of the body.

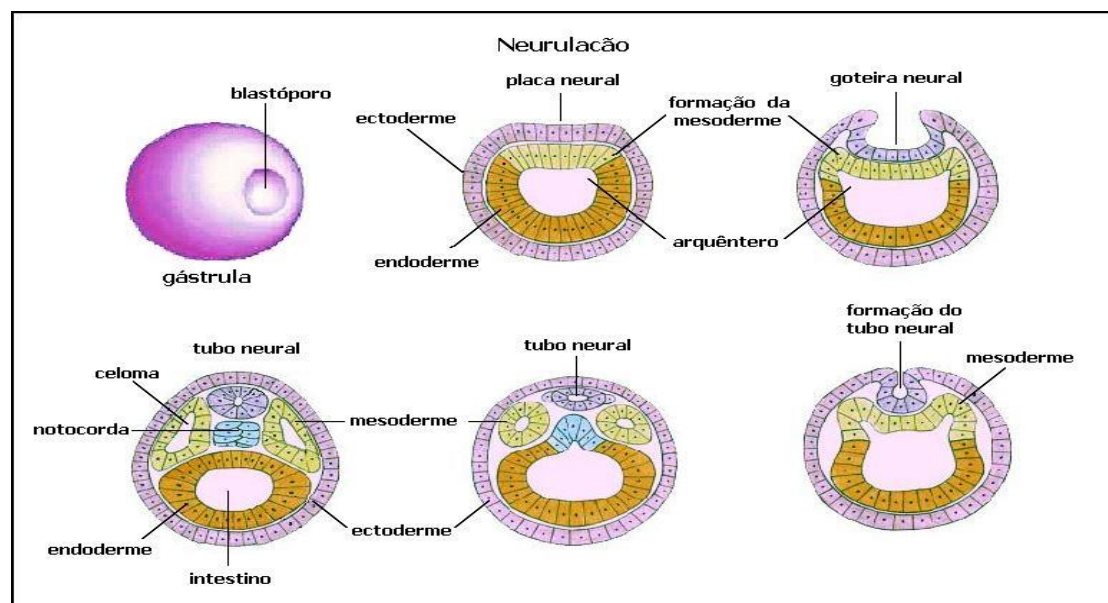
1- Formation of the Neural Tube (Neurulation)

The process of Neurulation consists of 3 stages:

a- **Neural plate stage:** The ectoderm is flattened and thickening along the dorsal region of gastrula and form a plate called the neural plate.

b- **Neural folds stage:** The neural plate sinks below the level of the remainder of the ectoderm, the lateral edges of ectoderm grow above the neural plate as folds the cavity between them is called **the neural groove**.

c- **Neural tube stage:** The neural folds are fusing over the neural groove and the neural plate rolls itself into a hollow tube called **the neural tube** and the cavity of the tube is called **the neurocoel (neural canal)** which forms in the future the central canal of the nervous system in the adult amphioxus.



2- Development of mesoderm and coelom

Mesodermal bands separated from the endoderm by dorsal evagination into the residual blastocoel. The lateral part of mesoderm form segments with cuboidal masses along the length of the animal of cells called **the mesodermal pouches** on both dorsal sides of the endoderm tube then developed to **mesodermal**

The mesodermal sacs grow down between the ectoderm & the endoderm and join under gut, the mesoderm become two layers and the space between is called the coelom

In the amphioxus the mesoderm develops into 2 regions, each region will give certain derivatives as below:

A. Dorsal Mesoderm

B. Lateral Mesoderm

A- Dorsal Mesoderm

The dorsal part of the mesoderm gives the somites. These somites will differentiate into **3** regions

1-Myotome; grow around notochord and give the muscles of the body

2- Dermatome ; grow under the epidermis posterior to myotome give the dermis of skin

3- Sclerotome; grow around neural tube differentiate into skeletal sheath of connective tissue

Lateral mesoderm

After the mesodermal somites grow ventrally they differentiate into two parts The part which remains near the epidermal ectoderm is called the **somatic (parietal) mesoderm.**

While the part which remains closely associated with endoderm is called **visceral (splanchnic) mesoderm,** the coelom is between them.

Development of Notochord

Side by side of neurulation the notochord begins formed is an embryonic structure common in all members of the phylum Chordata. The mesoderm and gut separated from each other, the notochord cells grow mid-dorsally in the roof of the archenteron these cells evaginate dorsally at the anterior end of the embryo and separated from endoderm this evagination continues slowly towards the caudal end and converts into solid, round cord below the neural tube and between the mesodermal somites.

Development of endoderm and alimentary canal

After the notochord and mesodermal segments dissociate themselves from the endoderm, the free edges of the endoderm fuse together along dorsal mid-line, the endoderm becomes a closed sac; the cavity of this sac converted into the cavity of the alimentary canal which opened with the exterior by mouth and anus at later stage of development.