TOPIC: GASTRULATION IN FROG

LECTURE NO:10
BSC(HONS.) PART 1-PAPER II-GROUP B
DATE: 30TH MARCH 2020
AUTHOR:NIRMAL KUMARI

GASTRULATION IN FROG

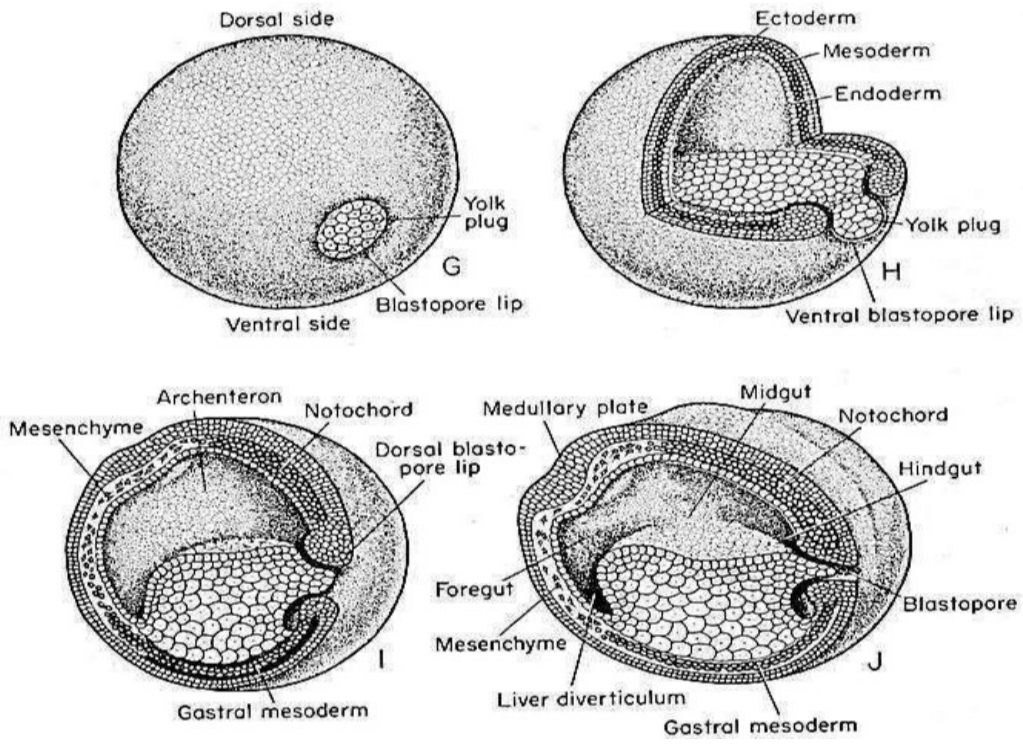

Fig. Gastrulation in frog

Gastrulation is the process of highly integrated cell and tissue migrations of prospective endodermal and mesodermal areas to their definite positions into the

interior of the embryo. These movements are self-determined and interdependent and are termed morphogenetic movements, creating new relationships and ultimately a triploblastic embryo. The cellular preparations for these movements take place during cleavage. The amphibian embryo undergoes a midblastula transition during which the cell cycle slows down (as a result of acquisition G_1 and G_2 phases of the cell cycle), cell division becomes a synchronus, the cells gain the ability to move from their original positions, and the transcription of new mRNA is seen from the nucleus for the first time in the animal's life. In Xenopus, this transition occurs immediately after the twelfth cleavage (Newport and Kirschner, 1982). There occur three types of morphogenetic movements in amphibian gastrulation.

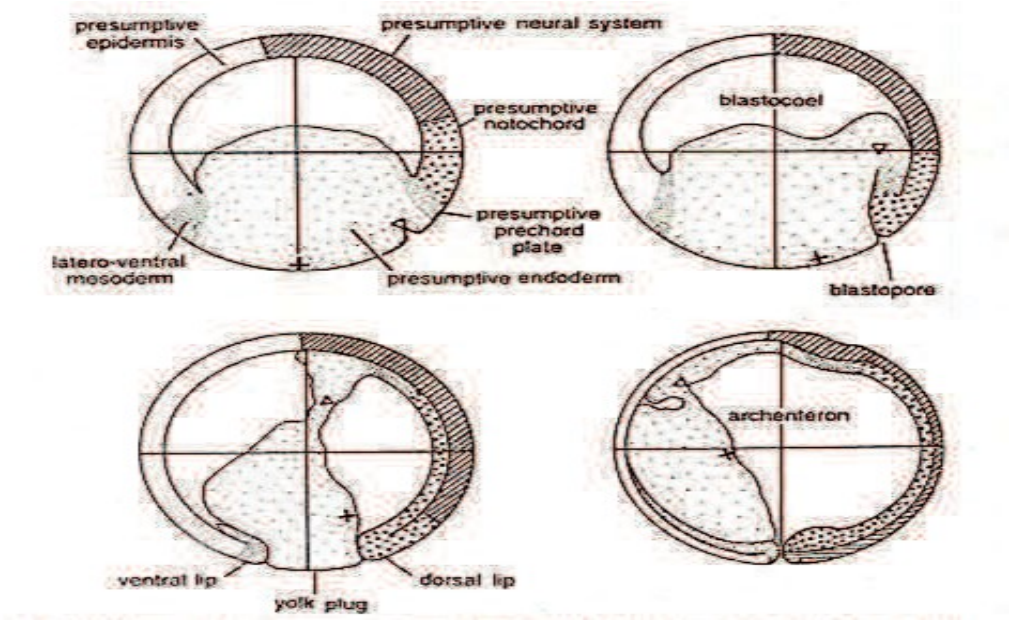

Fig. Migration of the presumptive organ forming areas of the blastula during the gastrulation in the Frog. The triangle marks the endodermal cells which start invagination and form the foregut. The cross marks the position of endodermal cells which were at the vegetal pole when gastrulation began and which are covered by epibolic growth of ectoderm.

Invagination: In frog embryos, gastrulation is initiated at the future dorsal side of the embryo, just below the equator in the region of the grey crescent. (Fig.4.4). Here the marginal endodermal cell sinks into the embryo thus forming a slit like blastopore. These cells now change their shape and become flask shaped.These are called as bottle cells. The bottle cells maintain the contact with the outer surface with the help of cytoplasmic strands whereas their main body is displaced towards the inside of the embryo. Therefore in frog, gastrulation begins in the marginal zone near the equator of the blastula. Here the endodermal cells are not so large or so yolky as the most vegetal blastomere.

Thus although the bottle cells may be responsible for creating the initial groove, the motivating force, this appears to come from the deep layers of marginal cells. Furthermore, this deep layer of cells appears to be responsible for the continued migration of cells into the embryo.

Involution: The next phase of gastrulation involves the involution of the marginal zone cells, while the animal cells undergo epiboly and converge at the blastopore. On reaching the tip of the blastopore, the marginal cells turn inward and travel along the inner surface of the outer cells sheets (Fig. 4.5). Thus, the cells constituting the lip of blastopore are constantly changing. The first cells to form the dorsal lip are endodermal cells that invaginated to form the leading edge of the archenteron.

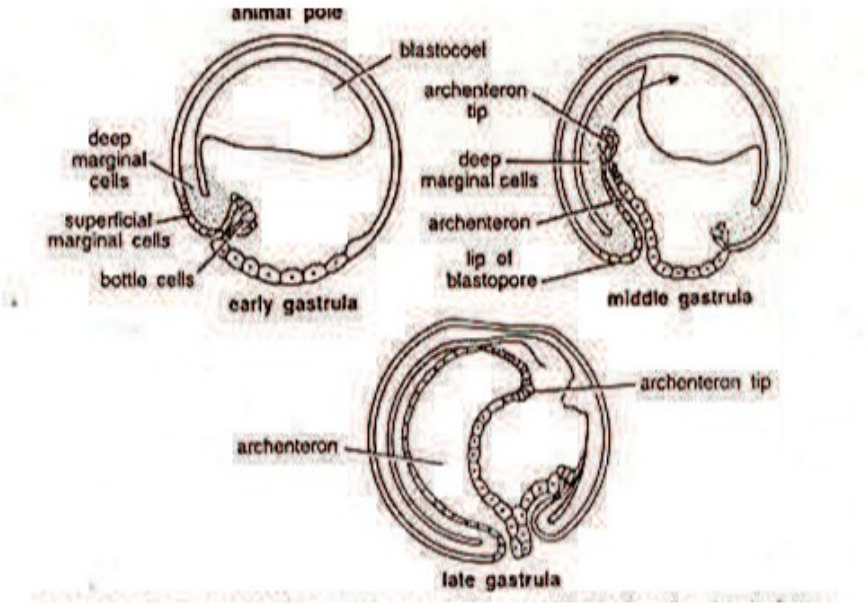

Fig.: Invagination of endodermal cells in an amphibian egg. The bottle cells originate from superficial marginal cells and become the archenteron tip. The involuting cells that form the mesoderm are derived from the deep marginal cells.

These cells later become the pharyngeal cells of foregut. As these first cells pass into the interior of the embryo, the blastopore lip becomes composed of involuting cells that are precursors of the head mesoderm. The next cells involuting over the dorsal lip of the blastopore are called the chorda mesoderm cells. These cells will form the Notochord, a transient mesodermal “back bone” that is essential for initiating the differentiation of nervous system.

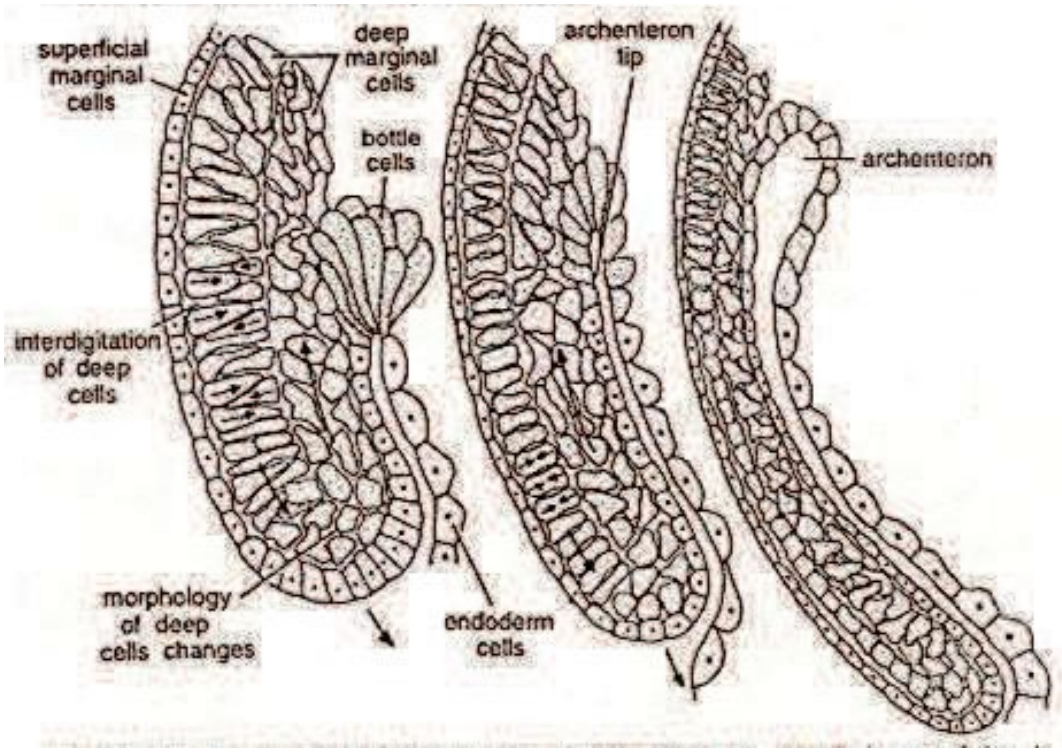

Fig. Integrative model of cell movements during gastrulation. (A) Early gastrulation is characterized by the interdigitation of the marginal deep layers and by involution (B, C) in later gastrulac, the deep marginal cells flatten and the formerly superficial cells from the wall of the archenteron. Bottle cells are darkly stippled.

(c) Epiboly:

As the new cells enter the embryo, the blastocoels are displaced to the side opposite the dorsal blastoporal lip. Meanwhile, the blastopore is displaced vegetal and widens as more animal hemisphere cells converge at the blastopore lip. The widening blastopore develops lateral lips and finally a ventral lip over which the additional mesodermal and endodermal precursor cells pass. With the formation of the ventral lip, the blastopore has formed a ring around the large endodermal cells that remain exposed on the surface (Fig. 4.7).

The remaining patch of the endoderm is called the yolk plug and it too, in eventually internalized. At this point, all the endodermal precursors have been brought into the interior of the embryo, the ectoderm has encircled the surface and the mesoderm has been brought between them.

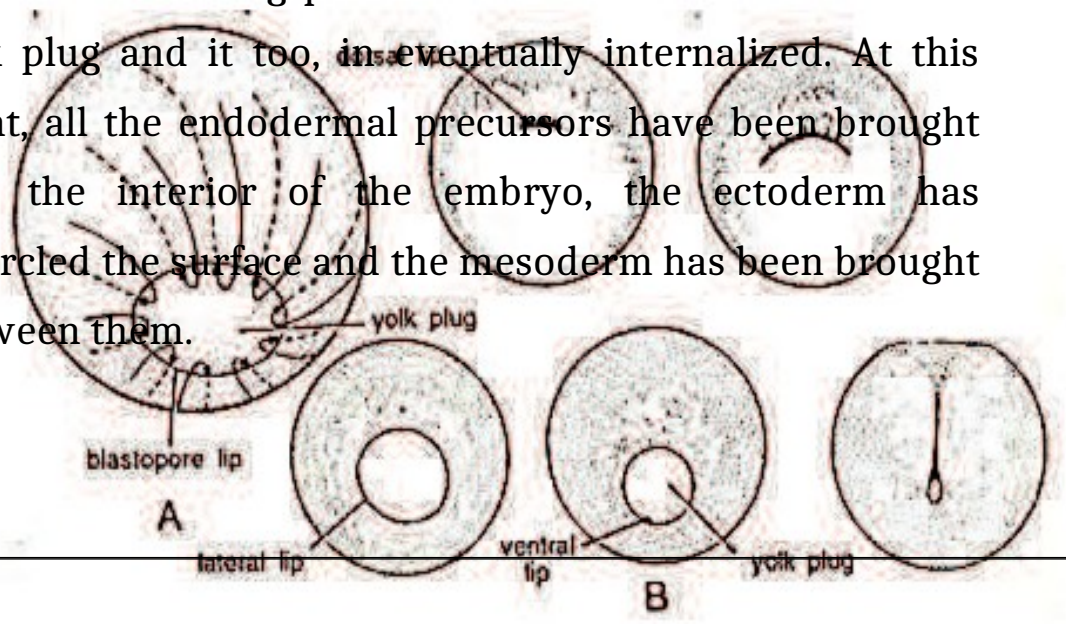

Fig. Epiboly of ectoderm (A) Morphogenetic movements of the cells migrating into the blastopore and then under surface (B) changes in the region around the bolastopore, as the dorsal, lateral and ventral lips are formed in succession when the ventral lip completes the circle, the endoderm becomes progressively internalized (After Gilbert, 1988).

****