

## Introduction to Embryology

**Embryology** is defined as the branch of biology and medicine that studies embryos and how they develop. *The study of how embryos develop from fertilization to birth is an example of embryology.*

### Types of Egg according to amount of yolk

<u>Egg Type</u>	<u>Example</u>
a) Alecithal - Almost without yolk.	Placental mammals
b) Microlecithal (oligo)- Small amount of yolk.	amphioxus
c) Mesolecithal - Moderate amount of yolk.	Lung-fishes, frogs, and toads.
d) Macrolecithal - Very large amounts of yolk.	Sharks, bony fishes, reptiles, birds, insects.

### Types of Egg According to Distribution of Yolk

- 1. Homolecithal** or Isolecithal: it is uniformly distributed e.g. amphioxus.
- 2. Telolecithal:** the yolk is concentrated in one half of the egg to form the vegetal pole and the yolk free portion is known as the animal pole. e.g., amphibians, reptiles, birds.
- 3. Centrolecithal:** Here the yolk occupies exactly the central portion of the egg while the cytoplasm is peripheral. Such eggs are found in insects.

### Types of cleavage

- 1) total or holoblastic cleavage:** In this type the cleavage furrow bisects the entire egg. Such a cleavage may be either equal or unequal.
  - a. Equal holoblastic cleavage** - In microlecithal and isolecithal eggs, cleavage leads to the formation of blastomeres of equal size. (Amphioxus and placental mammals)
  - b. Unequal holoblastic cleavage** - In mesolecithal and telolocithal eggs, cleavage leads to the formation of blastomeres of unequal size. Among the blastomeres there are many small sized micromeres and a few large sized macromeres(amphibians).
- 2) Meroblastic cleavage** - In this type the cleavage furrows are restricted to the active cytoplasm found either in the animal pole (macrolecithal egg) or superficially surrounding the egg (centrolecithal egg). Meroblastic cleavage may be of two types.
  - a. Discoidal cleavage** - Since the macrolecithal eggs contain plenty of yolk, the cytoplasm is restricted to the narrow region in the animal pole. Hence cleavage furrows can be formed only in the disc-like animal pole region. Eg: birds and reptiles.
  - b. Superficial cleavage** - In centrolecithal eggs, the cleavage is restricted to the peripheral cytoplasm of the egg. Eg: insects.

### Cleavage planes:

- 1. Meridional plane:** The plane of cleavage lies on the animal vegetal axis. It bisects both the poles of the egg. Thus, the egg is divided into two equal halves.
- 2. Vertical plane:** The cleavage furrows may lie on either side of the meridional plane. The furrows pass from animal to vegetal pole. The cleaved cells may be unequal in size.
- 3. Equatorial plane:** This cleavage plane bisects the egg at right angles to the main axis. It lies on the equatorial plane. It divides the egg into two halves.
- 4. Latitudinal plane:** It is similar to the equatorial plane, but it lies on either side of the equator. It is also called as **transverse** or **horizontal**

## Embryonic development of Amphioxus

- **Fertilization: External.**
- **Types of Egg:** Microlecithal, Isolecithal
- **Type of cleavage holoblastic**

### Steps of embryonic development

- Fertilization of egg by sperm forms zygote.
- Cleavage
- Blastula
- Gastrula
- Organogenesis:
  - Neural tube
  - Notochord
  - Myotomes

### Cleavage

**First:** meridional equal 2

**Second:** meridional equal 4

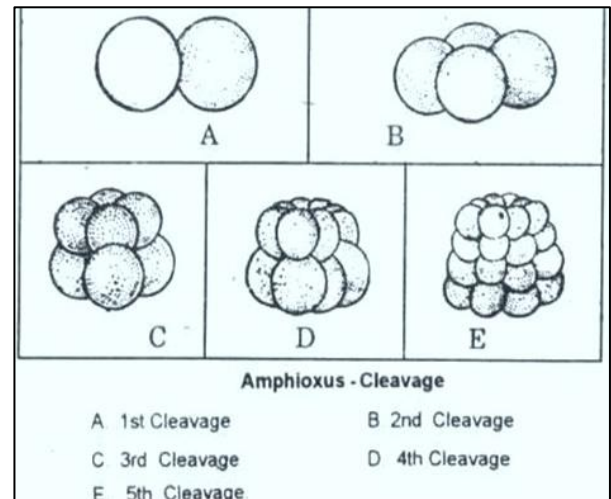
**Third:** latitudinal unequal (south) 8

**Fourth:** meridional equal 16

**Fifth:** latitudinal unequal 32

**Sixth:** nearly meridional 64

**Seventh:** 128

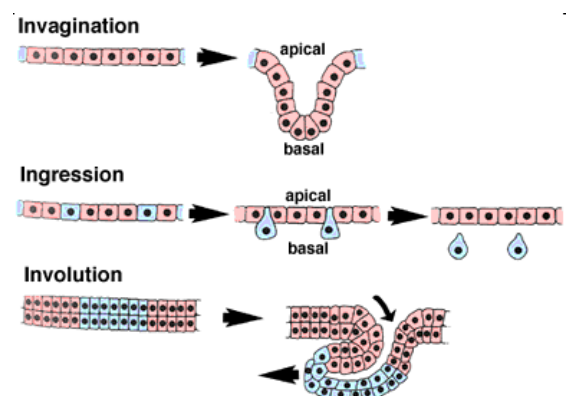


### Blastulation:

Blastula stage is a ball of cells that exceeds more than 256 blastomeres. The blastoderm formed of one cell layer thick. The blastocoel enclosed almost the central cavity.

### Gastrulation:

This occurred as a result of different cell movements simply by epiboly, invagination & involution.



### Organogenesis:

Synchronized with gastrulation are the process of formation of neural tube (neuralization), formation of notochord (notogenesis), and formation of mesoderm (mesogenesis) and coelom. And it includes:

- a) **neural tube formation:** The ectoderm cells of gastrula become thick and large to form a neural plate. The center of the plate is depressed to form a neural groove. the cells of sides rise up to form neural folds. The two folds meet each other and fuse over the groove forming a closed longitudinal hollow neural tube.

**b) Formation of notochord.** The cells located mid dorsally in the roof of archenteron form the **notochordal plate**. It bulges up, towards the neural plate and finally pinched off from the archenteron to become the notochord. It elongates with the embryo, forming a solid mid-dorsal skeletal rod.

**c) Formation of mesoderm**

**Myotomes and coelom.** At the time of notogenesis, the presumptive mesodermal cells in the dorso-lateral roof of archenteron also become deeply folded forming a longitudinal fold or groove on either side. Transverse partitions appear to divide each mesodermal groove into a linear series of mesodermal or coelomic pouches which are in continuation with the archenteron. After separation of notochord and coelomic sacs, the archenteron is reduced to enteron. The other mesodermal sacs on either side become each segmented into a small dorsal somite and a large lateral plate mesoderm.

