DSE-1BT: Developmental aspects of embryo

Cleavage:

❖ Cleavage

In embryology, cleavage is the division of cells in the early embryo. The process follows fertilization, with the transfer being triggered by the activation of a cyclin-dependent kinase complex. The zygotes of many species undergo rapid cell cycles with no significant overall growth, producing a cluster of cells the same size as the original zygote. The different cells derived from cleavage are called blastomeres and form a compact mass called the morula. Cleavage ends with the formation of the blastula.

Depending mostly on the amount of yolk in the egg, the cleavage can be **holoblastic** (total or entire cleavage) or **meroblastic** (partial cleavage).

❖ Different types of cleavage planes

An egg can be divided from different planes during cleavage. Depending on the position of the cleavage furrow the planes of cleavage are named.

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 cleavage.

❖ Role of yolk in cleavage

Yolk is needed for embryonic development. However the fertilized egg has to undergo all stages of development and result in a suitable 'young form' initiating next generation. Somehow with all the influences of yolk the developmental procedures are so adapted and modified that a well formed embryo will result. The initial influence of yolk is felt during the process of cleavage. The amount of the yolk and its distribution affect the process of cleavage.

Accordingly several cleavage patterns have been recognized.

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. Eg: 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.
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 3 the disc-like animal pole region. Such a cleavage is called discoidal meroblastic cleavage. Eg: birds and reptiles.

b) **Superficial cleavage** - In centrolecithal eggs, the cleavage is restricted to the peripheral cytoplasm of the egg. Eg: insects.