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Cleavage

cleavage is the rapid mitotic cell division of the zygote. It gives rise to a mass of cell c/d morula. which ultimately by cellular rearrangement forms the blastula. In each division, the cell becomes smaller.

Planes of cleavage

1. Meridional plane



2. Vertical or longitudinal plane



3. Equatorial cleavage



4. Latitudinal Plane



① Meridional :- cleavage furrow passes through the centre of animal vegetal axis.

② Vertical - passing through Animal to Vegetal but not at centre.

⑤ Equatorial : Bisects at right angle through median axis.

⑥ Latitudinal or transverse or horizontal : Either side of equatorial plane.

Patterns of Cleavage Planes :-

① Radial cleavage : when the successive cleavage planes cuts straight through the egg at right angle to one another. The blastomeres so formed are symmetrically arranged around the polar axis. The blastomeres are arranged in radial symmetry. meaning eg Echinoderms

② Polyradial cleavage : when the three planes of cleavage are not at right angle to each other. eg Ctenophora.

③ Spiral cleavage :- The planes are neither parallel nor perpendicular to animal vegetal axis. The cleavage is at oblique angles forming spiral arrangement of the blastomeres. eg Annelida, mollusca

④ Bilateral cleavage : The first cleavage plane establishes the only plane of symmetry. Each successive division orient itself to this plane of symmetry. eg Tunicates

⑤ Rotational cleavage: In mammals, the first cleavage plane runs through animal-vegetal axis to yield a two-celled embryo. During 2nd cleavage one of the blastomeres divide meridionally while the other divides equatorially. Thus, cleavage plane in one blastomere is rotated 90° with respect to the cleavage plane of other blastomere.

Moreover, the divisions are asynchronous. Thus the mammalian embryo may often contain the odd no. of cells. After 3rd division, the cells form a highly packed configuration called as



Cleavage type based on the potency of blastomeres :-

① Determinate: In this, the fate of each (or) blastomere is pre-determined i.e. if the region specified for endoderm is experimentally removed the embryo will lack endoderm. It is also known as mosaic cleavage. e.g. Nematodes, Annelids, Molluscs.

② Indeterminate: In this, the fate of the blastomeres is not pre-determined and has the potential to develop into any organ. It is known as regulative cleavage as the fate of the blastomere is regulated by its neighbours e.g. vertebrates.

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Influence of yolk on cleavage

Cleavage occurs rapidly in active cytoplasm than yolk-laden cytoplasm. The yolk exerts a preventing influence on cleavage. Types of cleavage based on amount and distribution of yolk:-

① Holoblastic : The cleavage furrow extends completely through the egg. Holoblastic could be either equal holoblastic or unequal holoblastic.



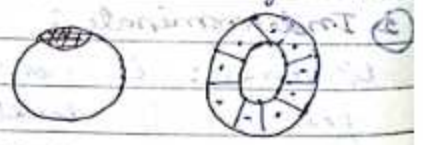
1a) Equal holoblastic : occurs in microlecithal [little yolk] or iso-lecithal [same or equal yolk] (yolk distributed evenly).

Blastomeres are of equal size. e.g. Amphioxus.

1b) Unequal holoblastic : In meso-lecithal eggs ① [meso means average], unequal sized blastomeres are formed. small blastomeres - micromeres e.g. Amphibians. large " - megameres

② Meroblastic : meso means partial (occurs in eggs with large amt of yolk)

2a) The telolecithal eggs have cytoplasm confined to a narrow disc mass lying



on top of the yolk called as blastodisc. (The cleavage furrow cannot cut through the yolk and stops at the border b/w the yolk and cytoplasm.) This is c/d discoidal meroblastic

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cleavage. e.g. Elasmobranchs, bony fishes, reptiles and birds.

2.b) Superficial cleavage. In centrolecithal eggs the cleavage is limited to the surface layer of yolk - free cytoplasm while the yolk remains uncleaved. e.g. insects, arthropods.