Quadrant II – Transcript and Related Materials

Programme: Bachelor of Science (First Year)

Subject: Zoology

Paper Code: ZOC 108

Paper Title: Developmental Biology

Unit: Introduction

Module Name: Planes and Patterns of Cleavage

Name of the Presenter: Ms. Swizzle Furtado

NOTES:

Cleavage is the repeated mitotic division of the zygote causing an increase in the number of cells. The daughter cells generated by these divisions are termed blastomeres. Cleavage is also known as segmentation or cellulation.

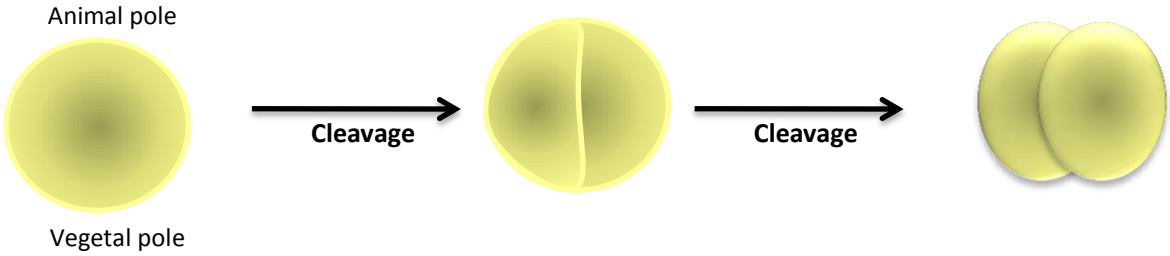
Characteristics of Cleavage

- All Divisions of cleavage are mitotic.
- Early cleavage divisions occur synchronously.
- One consequence of cleavage is that the ratio of cytoplasmic to nuclear volume gets increasingly smaller as cleavage progresses.
- The blastomeres do not move during cleavage, so the shape does not change but there is formation of a cavity called the blastocoel.
- Cleavage converts the zygote into a compact mass of blastomeres called **Morula**, which transforms into **Blastula**. Having a single layered thick blastoderm surrounding the blastocoel.
- The plane of cleavage is determined by the position of the spindle of the dividing blastomere.

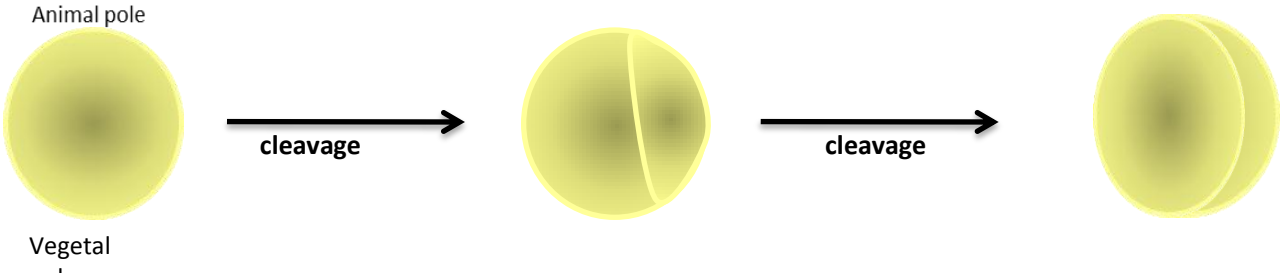
Planes of cleavage

During early cleavage, divergent geometrical relationships exist between the blastomeres depending upon cleavage furrows which divide the egg from different planes.

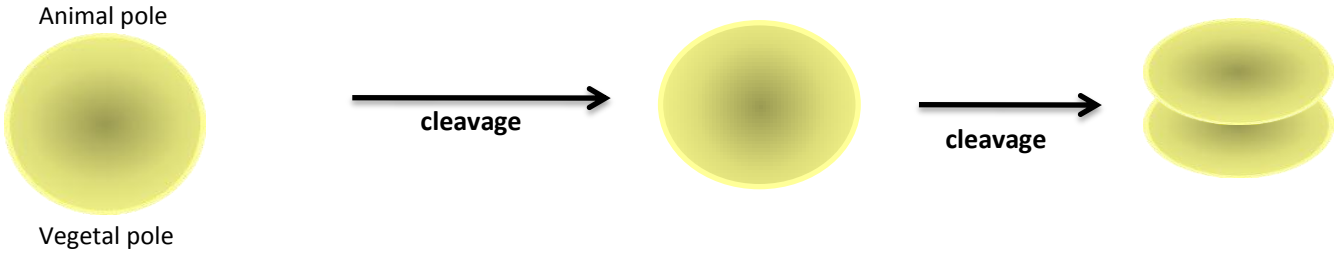
Meridional Plane: When a furrow cleaves both the poles i.e the animal and vegetal pole of the egg passing through the median axis it is called meridional plane of cleavage. Example: first cleavage of Chick



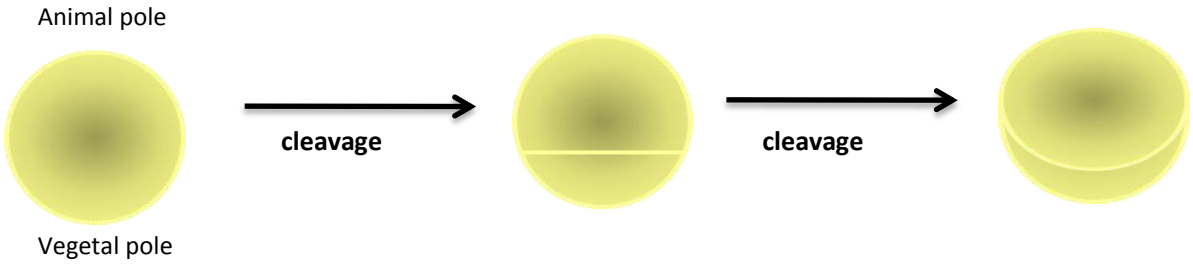
Vertical Plane: The cleavage furrow passes in a direction from the animal pole toward the vegetal pole but unlike meridional plane, it does not pass through the median axis of the eggs but courses through one side of the median axis. Example: third cleavage furrow of chick



Equatorial Plane: This type of cleavage plane divides the egg at right angle to the median axis and is halfway between the animal and vegetal poles. Example: first cleavage plane of higher mammals



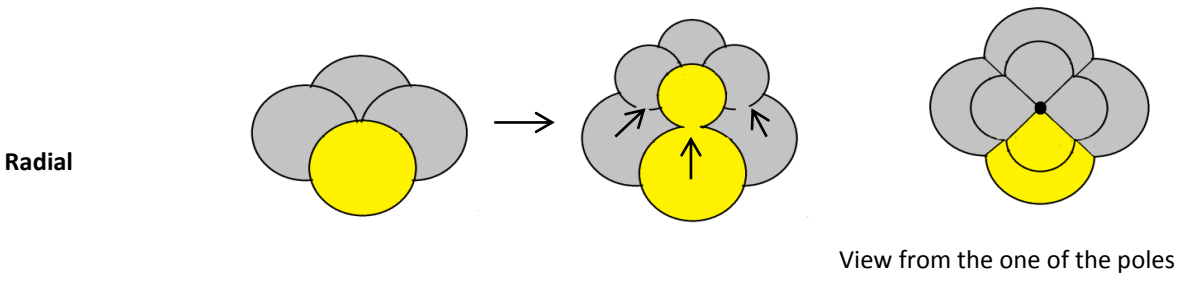
Latitudinal plane of cleavage: This is almost similar to the equatorial plane of cleavage, but the furrow runs through the cytoplasm on either side of the equatorial plane. It is also called as transverse or horizontal plane. Example: third cleavage plane of *Amphioxus*



Patterns of cleavage

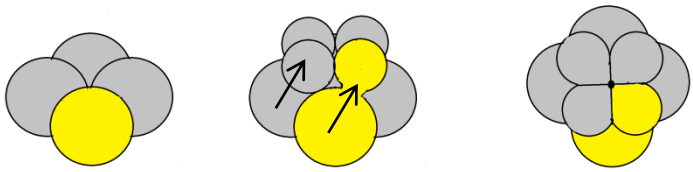
Repeated cleavage furrows produce a number of blastomeres which exhibit a specific pattern of arrangement.

Radial Cleavage: In radial cleavage, the successive cleavage furrow cuts straight through the egg , at right angles to one another so that the subsequent blastomeres appear to be arranged radially when viewed from either poles. Example: *Synapta*



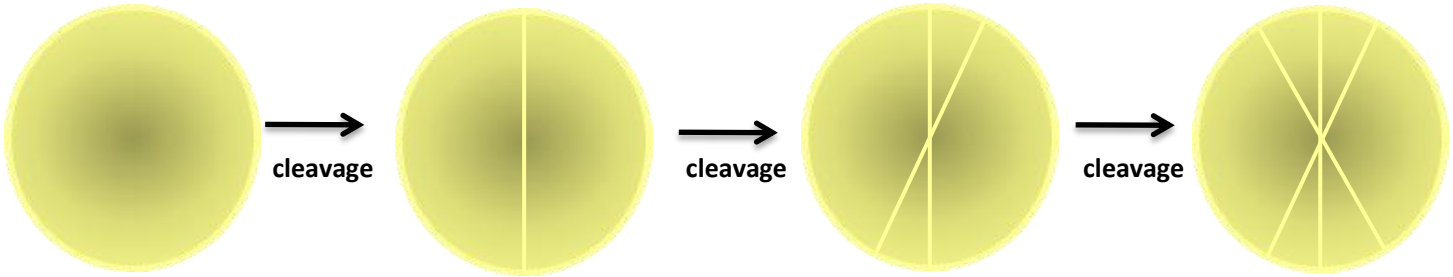
Spiral Cleavage: in Spiral cleavage there is rotational movement of cell parts which incline the mitotic spindles of blastomeres obliquely, and as a result a sort of spiral arrangement of four blastomeres is seen. The four blastomeres of upper tier do not lie over the corresponding blastomeres of lower tier but between them. Example: Nematoda

Spiral Cleavage



View from the one of the poles

Biradial Cleavage: This pattern arises when the three first division planes do not stand at right angles to each other. Example: Ctenophora



Bilateral cleavage: In bilateral cleavage the mitotic spindles and cleavage planes remain bilaterally arranged with reference to a plane of symmetry which coincides with the median plane of the embryo. Example: Tunicata