

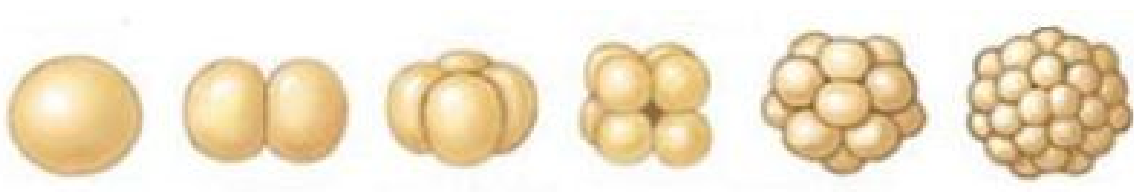
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## **CLEAVAGE PATTERNS AND CLEAVAGE IN AMPHIBIANS**

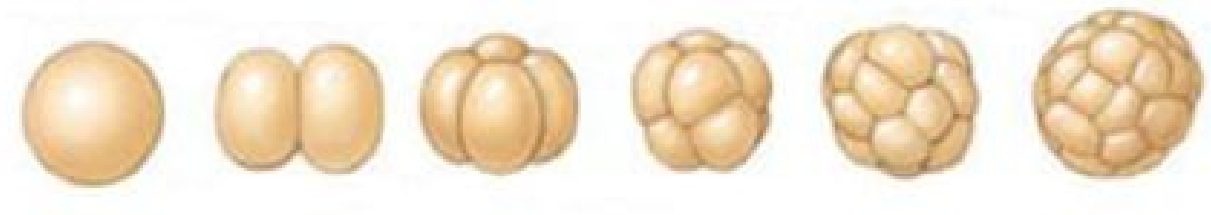
Early cleavage patterns vary widely between different groups of animals, based largely on the orientation of the division planes. The simplest pattern is radial cleavage, in which successive division planes are at 90 degree angles relative to each other. This results in the blastomeres aligned directly over or to the side of one another. In spiral cleavage, the division planes are not at 90 degree angles, resulting in blastomeres that are not aligned directly over or beside one another.

**Radial Cleavage:** occurs such that the resulting daughter cells are located exactly on top of one another. Radial cleavage is a characteristic of Deuterostomes, and results in indeterminate cells (Cells that can individually give rise to a complete embryo, and they don't have a determined embryological fate early on during the development of the embryo). In other words, you can take a single cell from a developing embryo, and given the right condition, that single cell can give rise to a whole embryo (If you've taken embryology classes you've definitely heard of experiments like this done with frog embryo).

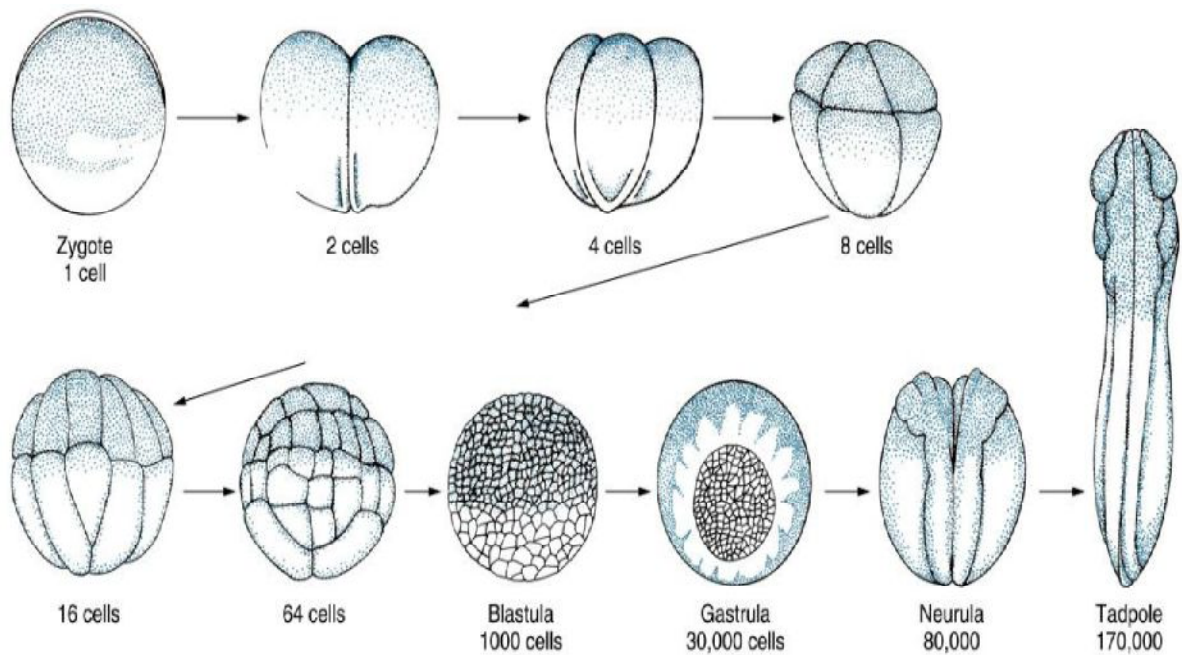
**Spiral Cleavage:** occurs such that the resulting daughter cells are not located exactly on top of one another; instead, they are located at a slight angle. Spiral cleavage is a characteristic of Protostomes, and results in determinant cells (Cell that have a determined embryological fate early on during the development of the embryo). In other words, determinant cells are programmed to become a specific type of cell, early on during the process.



## Radial cleavage



## Spiral cleavage



## CLEAVAGE IN AMPHIBIANS

### DETERMINATE AND INDETERMINATE CLEAVAGE

Cleavages may be classified into determinate and indeterminate types based on the potentiality of the blastomeres for the future development.

**Determinate:** the developmental fate of each embryonic cell is established very early. If a cell is isolated from the 4-cell stage the embryo will not fully develop. This is because the fate of each blastomere is predetermined in the early embryonic stage itself. Annelids, mollusks and ascidians which produce mosaic type of eggs exhibit determinate cleavage.

**Indeterminate:** early embryonic cells retain capacity to develop into a complete embryo if isolated from other cells. Cleavage produces blastomeres which are qualitatively equipotential or totipotent. When they are isolated, they develop into complete embryos. This is because the fates of blastomeres are not predetermined in the early embryonic period. Vertebrates and certain invertebrates such as echinoderms which produce regulative type of eggs exhibit indeterminate cleavage.