

UNITE

University of Teramo



Degree Program in Biotechnology

COURSE OF CYTOLOGY AND HISTOLOGY
Prof. Mauro

The body of a complex multicellular adult organism is formed by one or more populations of cells, morphologically different from one another, which cooperate and integrate to perform functions..

HISTOLOGY

Discipline that studies Tissues at the morpho-functional level.

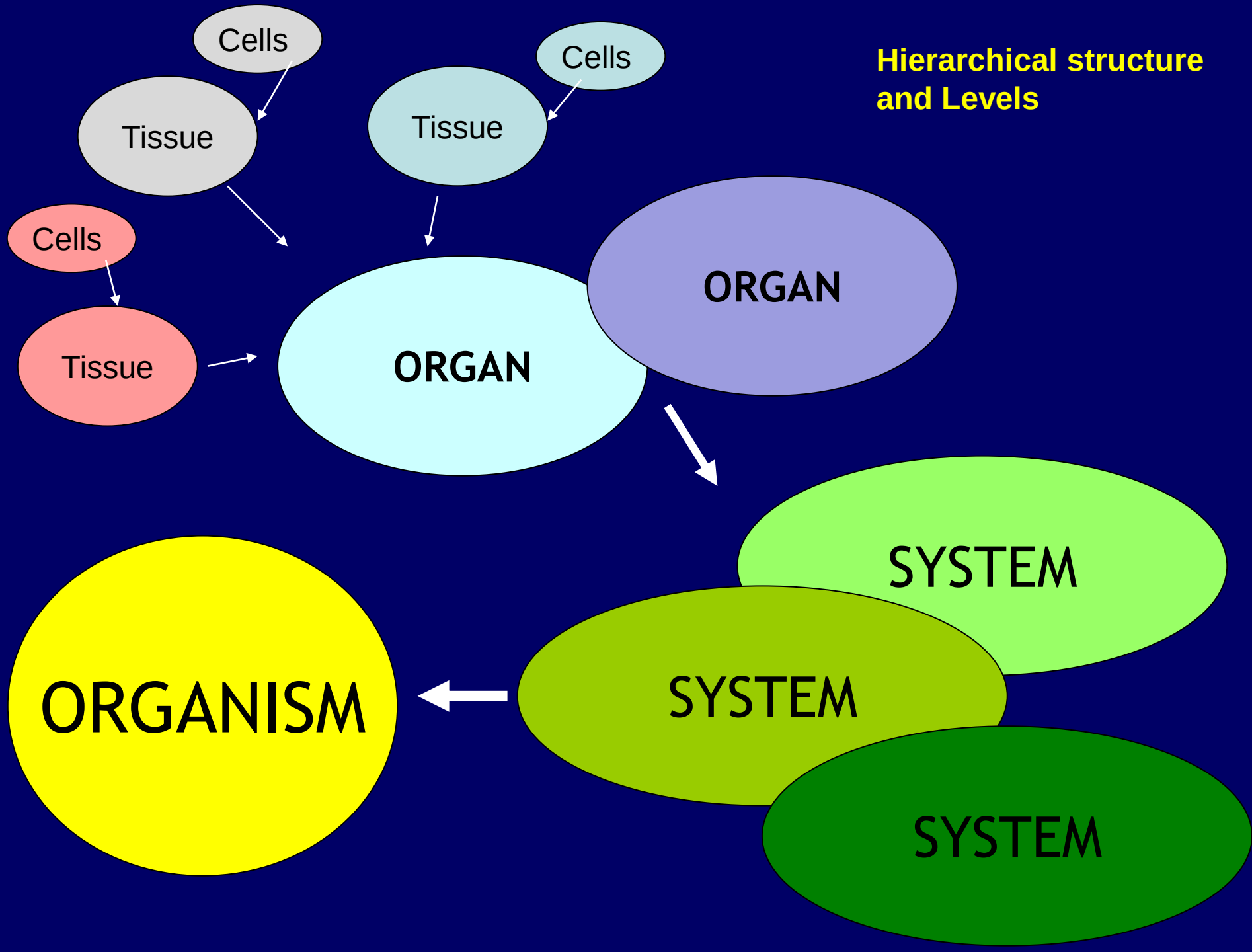
TISSUE

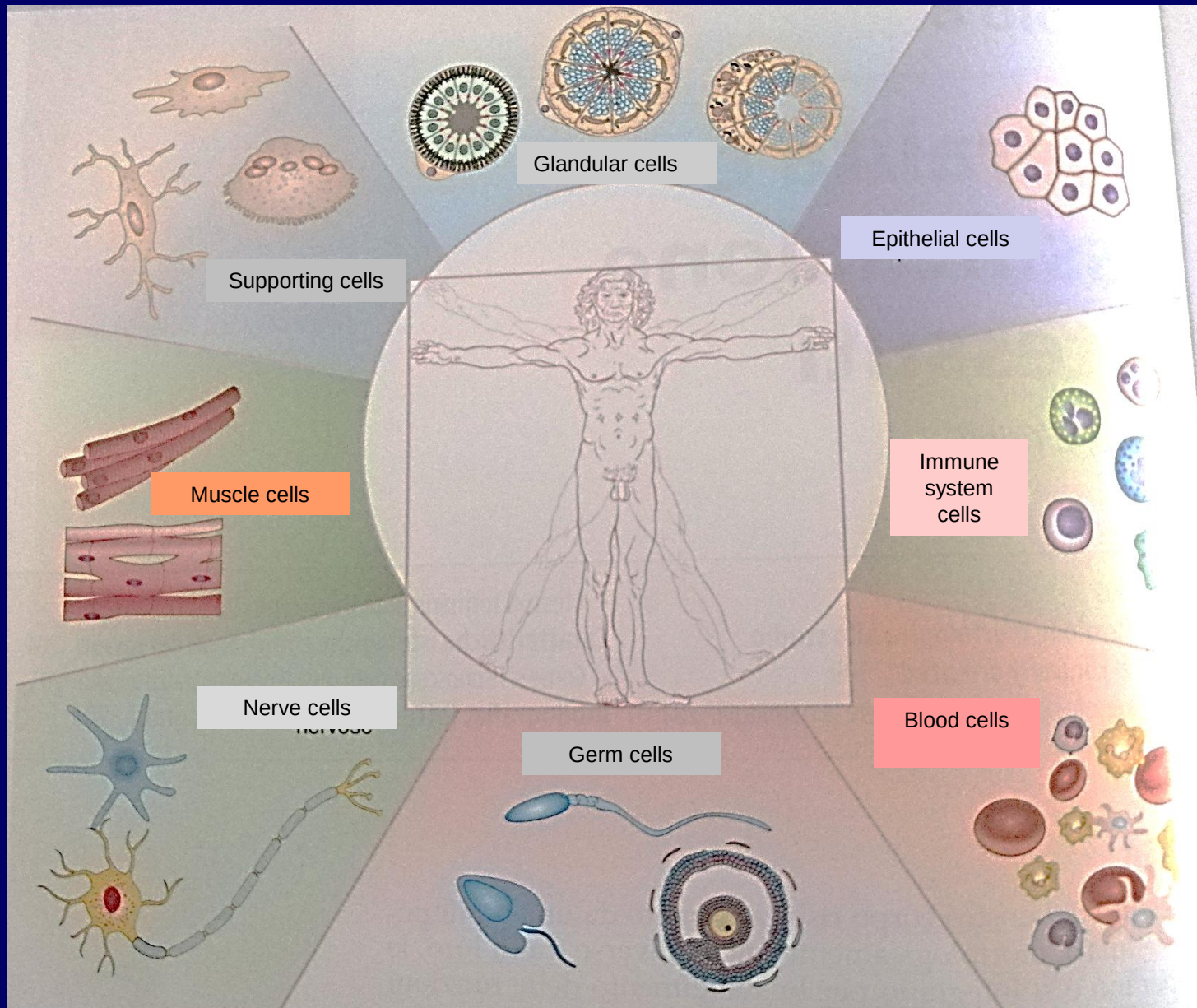
A group of cells with the same shape, function, and embryonic origin.

The cells that make up tissues are embedded in an extracellular matrix (ECM), forming a structured network of macromolecules synthesized by the cells themselves.

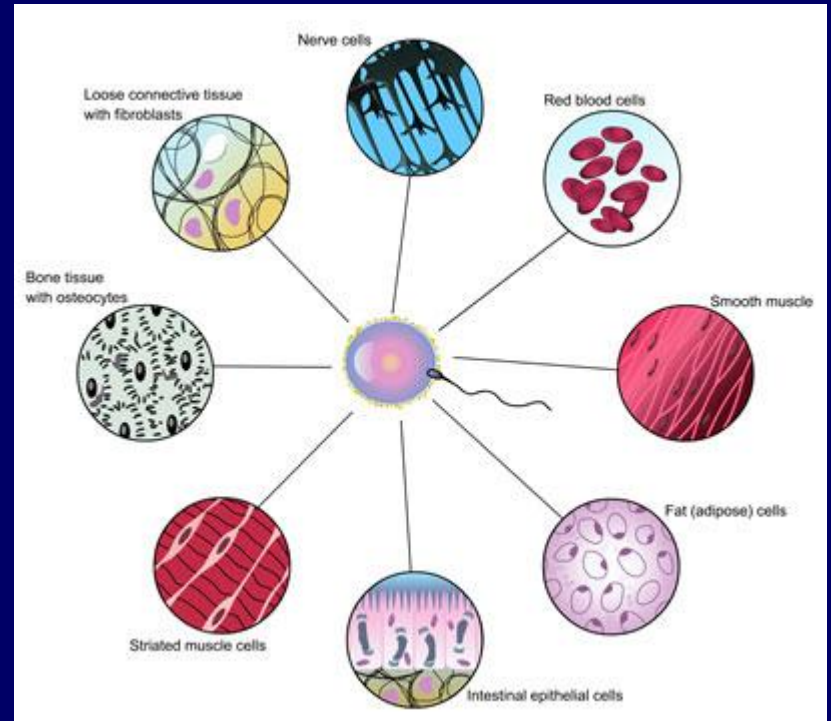
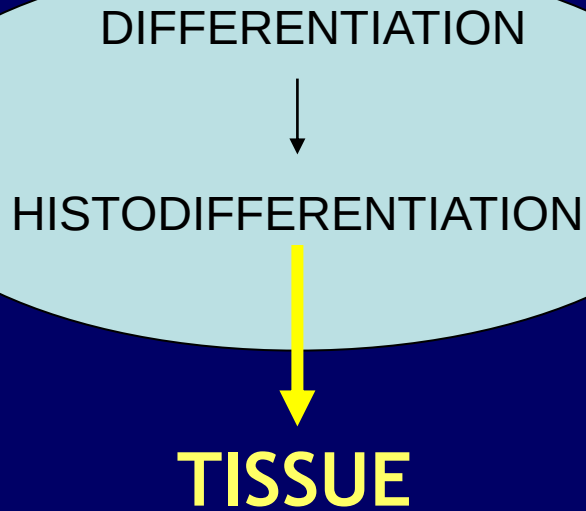
Histological knowledge is essential to acquire and understand all the mechanisms underlying human pathologies.

**Hierarchical structure
and Levels**



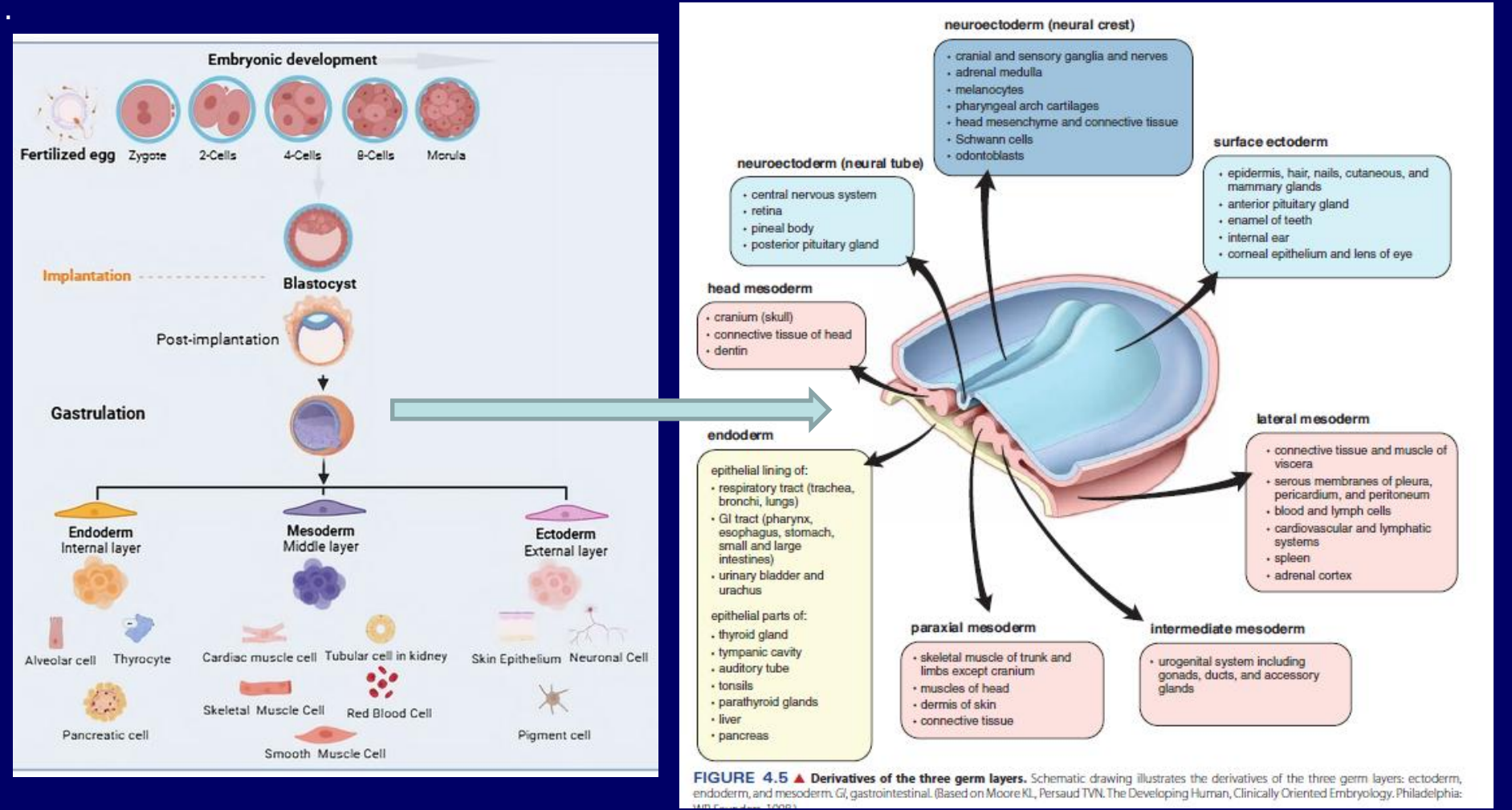


The formation of tissues (**Histogenesis**) is based on **Cell Differentiation** processes



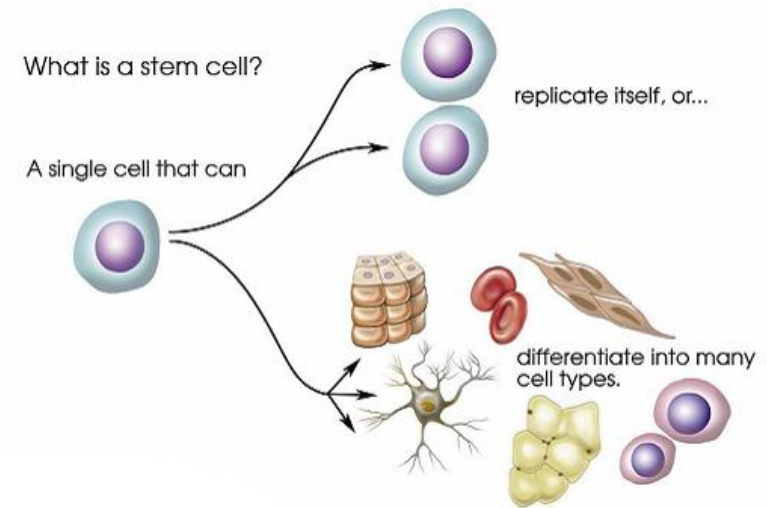
CELL DIFFERENTIATION: a process through which cells acquire specific phenotypic (morphological) and functional characteristics, resulting from the differential expression of portions of the genome and its epigenetic regulation. The selective expression of specific genes, in turn, leads to the synthesis of specific proteins responsible for the cell's shape and function.

Cell differentiation is a gradual process that begins with an initially undifferentiated cell (stem cell) which, during the early stages of embryonic development, undergoes a finely regulated differentiation pathway. This involves the activation of a specific gene expression program associated with progressive changes in cell shape and function, ultimately leading to the acquisition of the terminally differentiated or mature state within tissues.

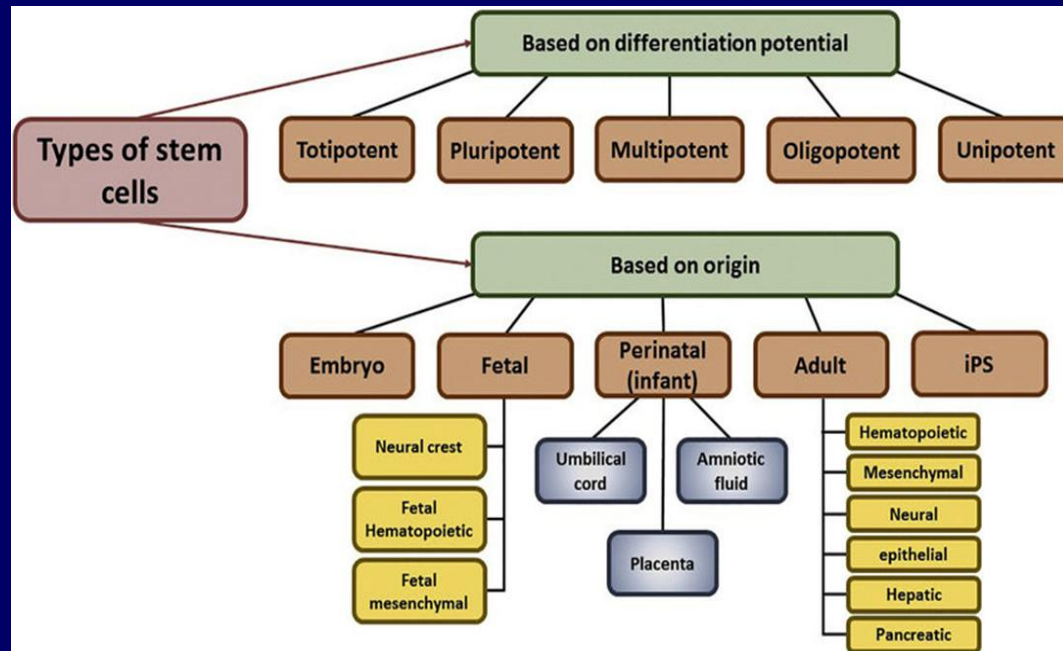
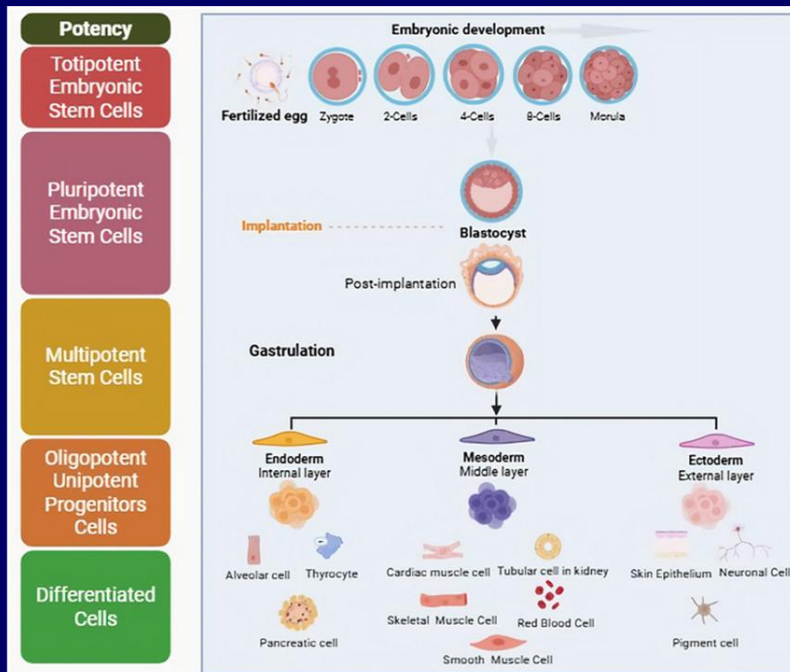


STEM CELL

- Self-renewal or clonogenicity
- Differentiation capacity



STEM CELL Type



TESSUES

are DYNAMIC structures

From a proliferative point of view, the cells that compose the various tissues are classified as follows:

Labile cells (constitutively renewable): these are cells with a high turnover rate, whose proliferation allows for continuous renewal of the tissue. Typical examples include the cells of the **epidermis** or the **intestinal mucosa**.

Stable cells (conditionally renewable): these are cells that normally do not proliferate but can do so if the tissue to which they belong is damaged — for example, **hepatocytes**.

Permanent cells (non-renewable): these are highly differentiated cells that have lost the ability to proliferate, such as the **hair cells of the inner ear**.

Stem cells exist in stem cell niche within tissues and are essential for maintaining tissue homeostasis (physiological renewal) and for the repair and regeneration processes that occur following cell damage.

TESSUES

The renewal of tissues implies the continuous death of some cells.

The loss of cells from a tissue may result from:

- Damage
- Physiological aging

Accidental or externally induced cell death

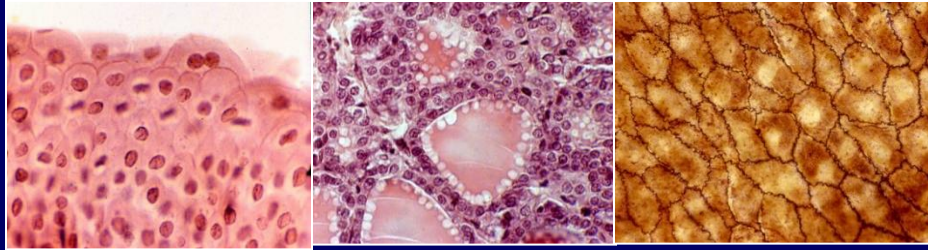
Necrosis: involves cell lysis and the release of cellular contents into the surrounding tissue, often causing toxic effects on neighboring cells and triggering an inflammatory response.

Programmed cell death in response to specific signals

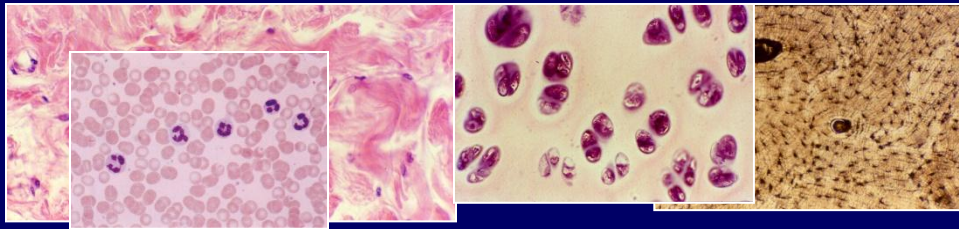
Apoptosis: a finely regulated process involving the transcriptional activation of specific effectors and the sequential occurrence of molecular events and specific morphological phases leading to the destruction of cellular components without cell lysis. At the same time, phagocytic cells (macrophages) are recruited locally to eliminate dead cells without releasing harmful substances into the surrounding tissue.

(Physiological cell turnover or in response to irreparable DNA damage)

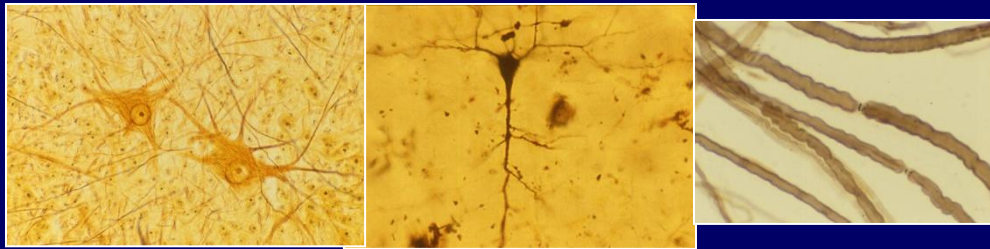
TESSUES



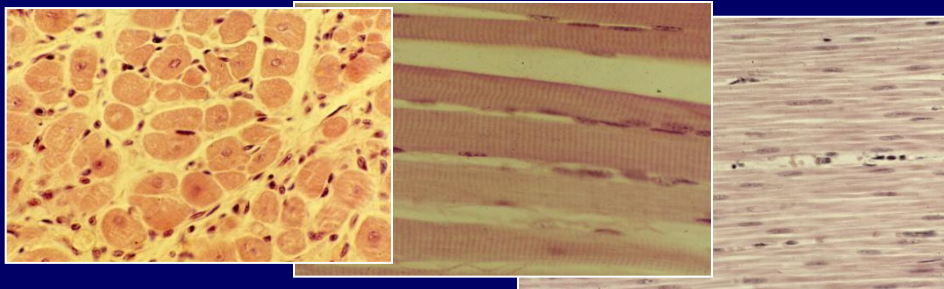
EPITHELIAL TISSUE



CONNECTIVE TISSUE



NERVOUS TISSUE



MUSCLE TISSUE