The Organisation of the Human Body

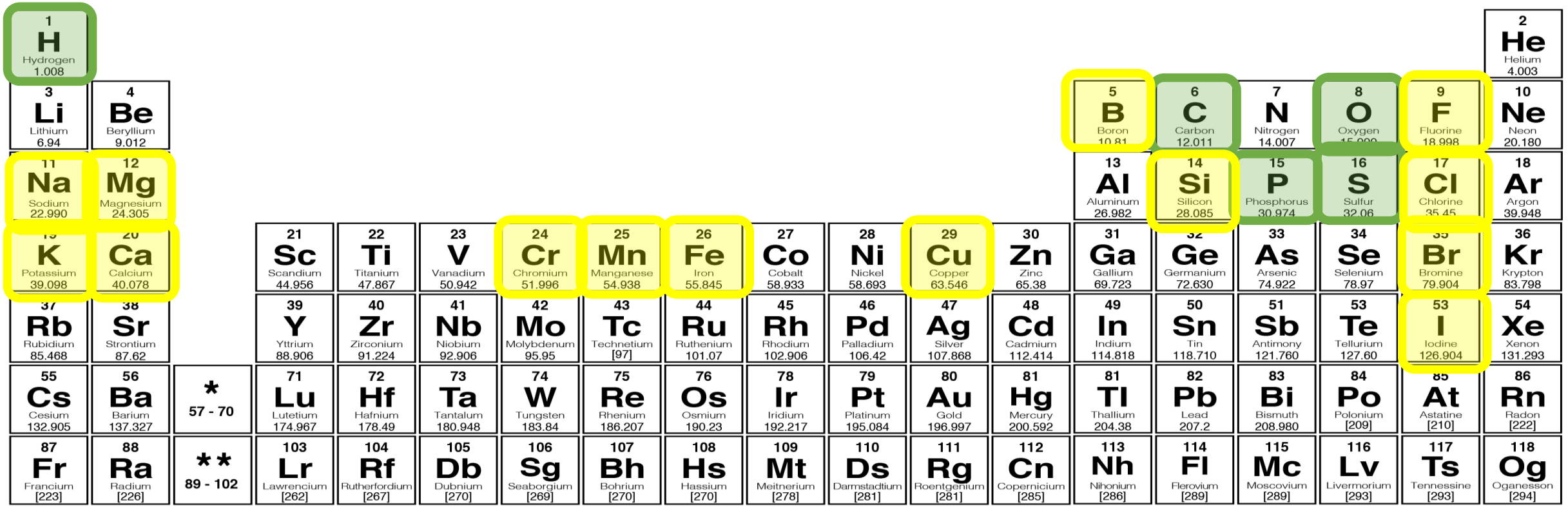
People and Health

science is a way

Organisation of Living Matter

Subatomic level	• Protons, neutrons and electrons
Atomic level	• Bioelements
Molecular level	• Inorganic and organic biomolecules. **Virus**
Cellular level	• Capacity to perform vital functions
Organism level	• Tissues, organs, apparatus and systems
Population level	• Organisms from the same species sharing a particular area
Community level	• Different species populations inhabiting the same environment
Ecosystem level	• Including the relations between biotic and abiotic factors
Biosphere level	• All the living beings and all the places where they live

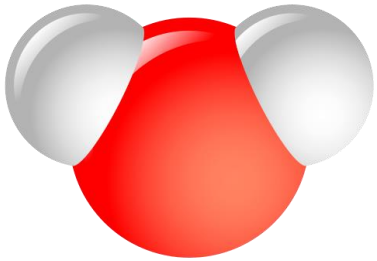
Atomic level

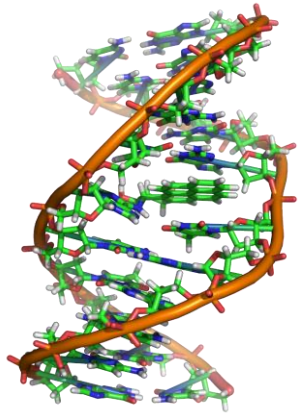


science is a way

Molecular level

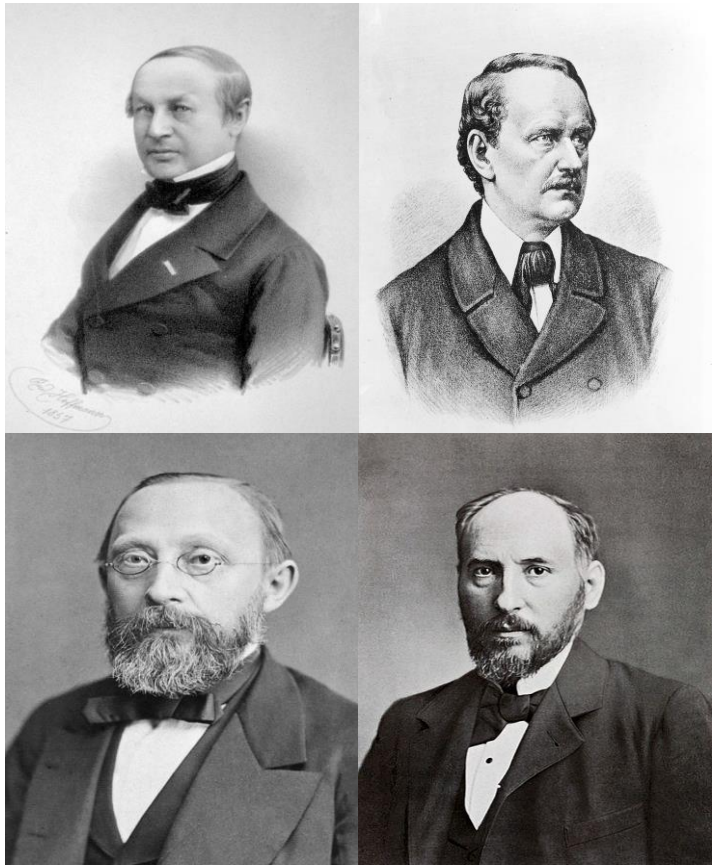
- The combination of bioelements made up biomolecules
  - **Inorganic biomolecules:**
    - Water
    - Minerals
  - **Organic biomolecules:**
    - Carbohydrates
    - Lipids
    - Proteins
    - Nucleic acids





Cellular Level

- **Cell theory**
  - All living organisms are composed of one or more cells
  - The cell is the most basic unit of life
  - All cells arise only from pre-existing cells



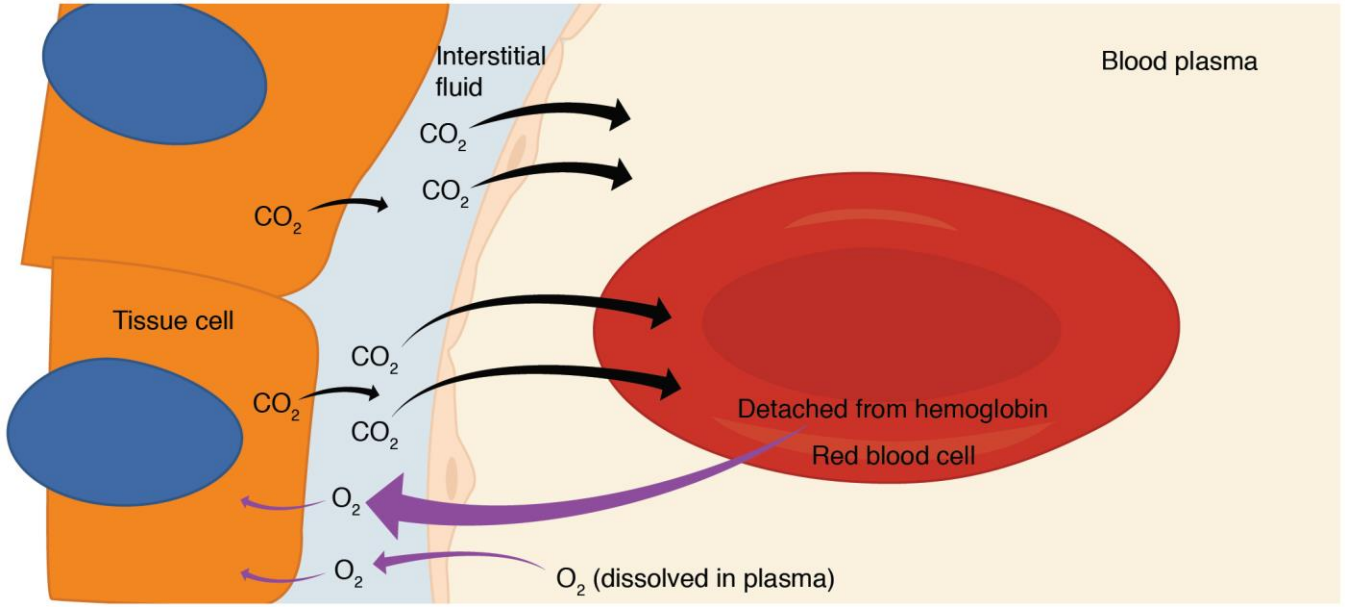
Cellular Level

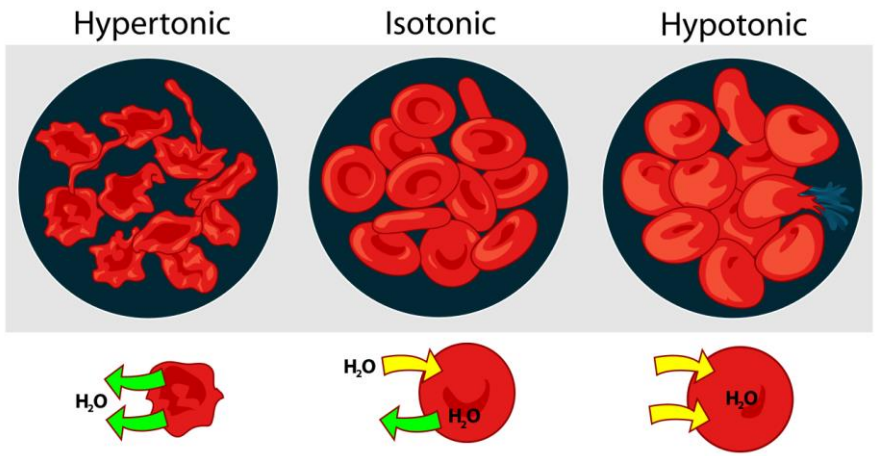
- **Eukaryotic cell basic structures**
  - Membrane:
    - Layer that isolates cell from the environment and controls the entrance and release of substances
  - Cytoplasm:
    - A fluid where the most of the chemical reactions take place
  - Nucleus:
    - The place where the genetic information is kept

TRANSPORTATION THROUGH THE MEMBRANE

- The cell membrane is semipermeable, only allowing the passage of some substances
  - **Diffusion**:
    - Small molecules passage (e.g. oxygen, carbon dioxide)
    - From the higher to the lower concentration place
  - **Osmosis**:
    - Water passage
    - Based on tonicity differences

Diffusion & Osmosis

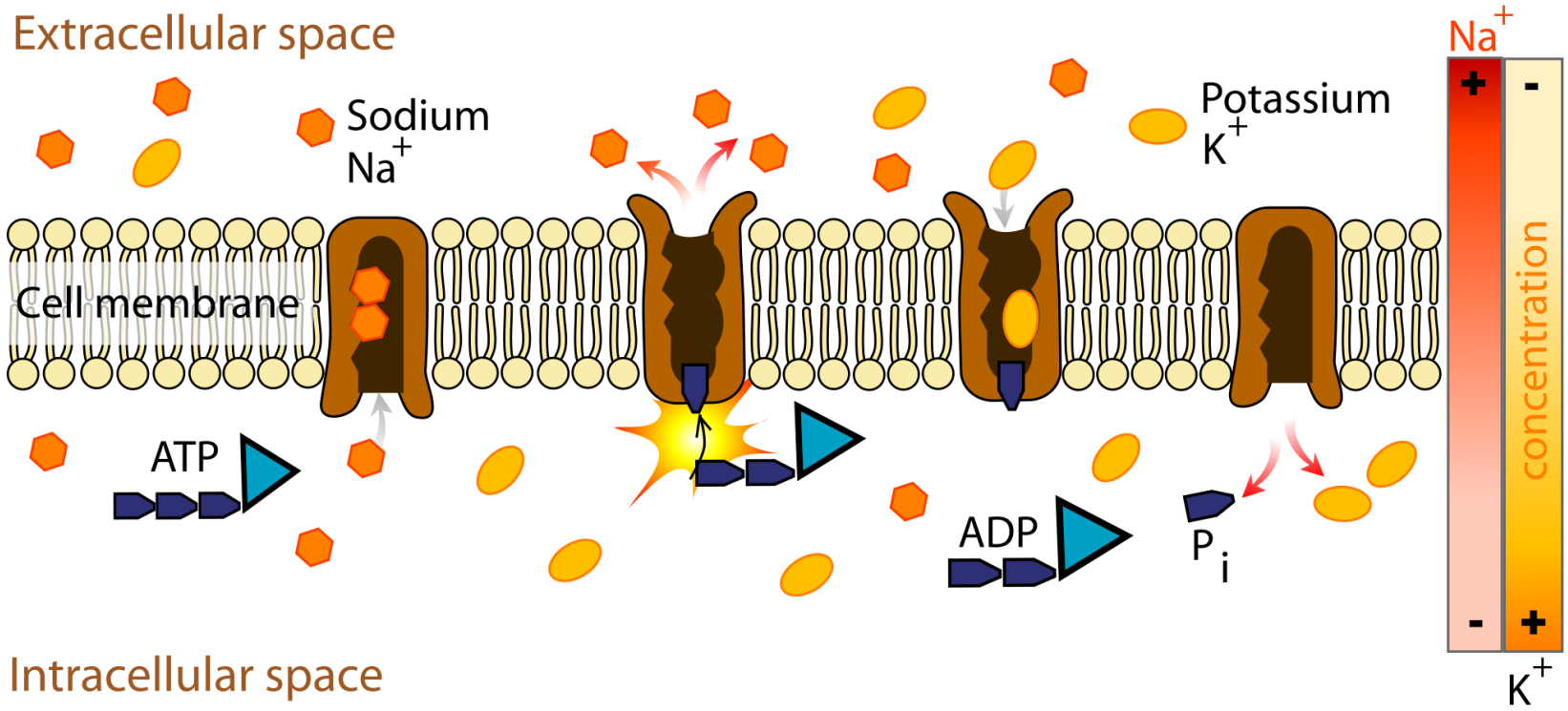




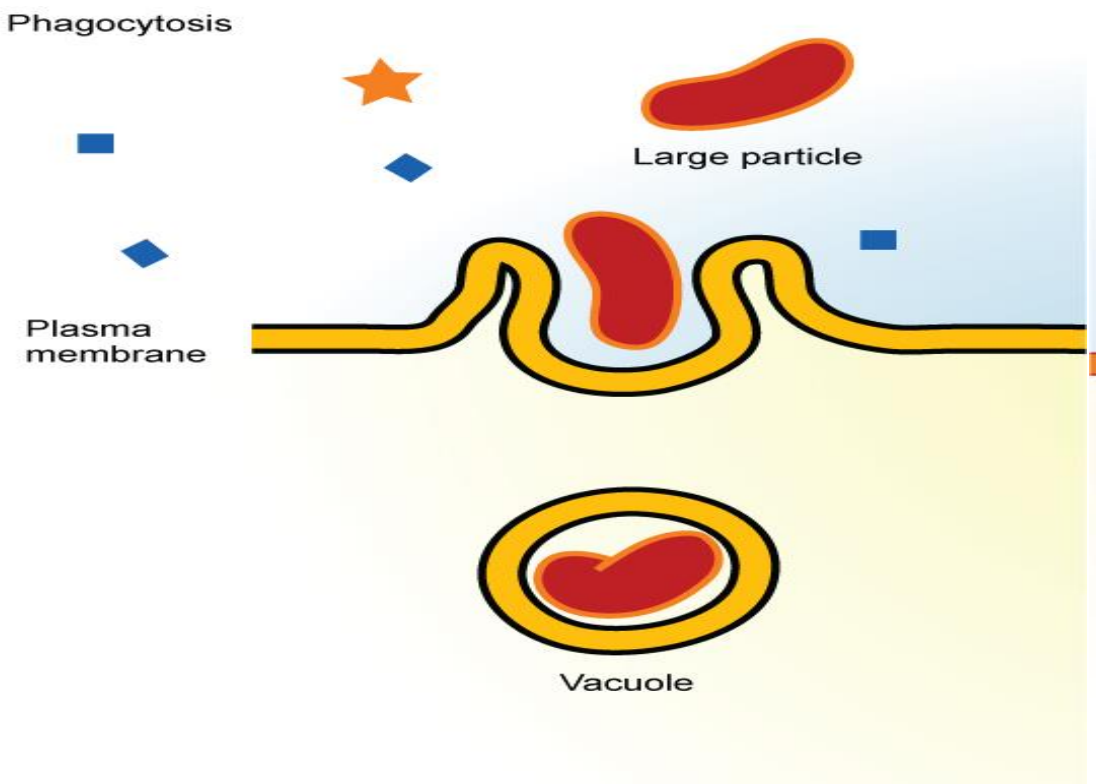
TRANSPORTATION THROUGH THE MEMBRANE

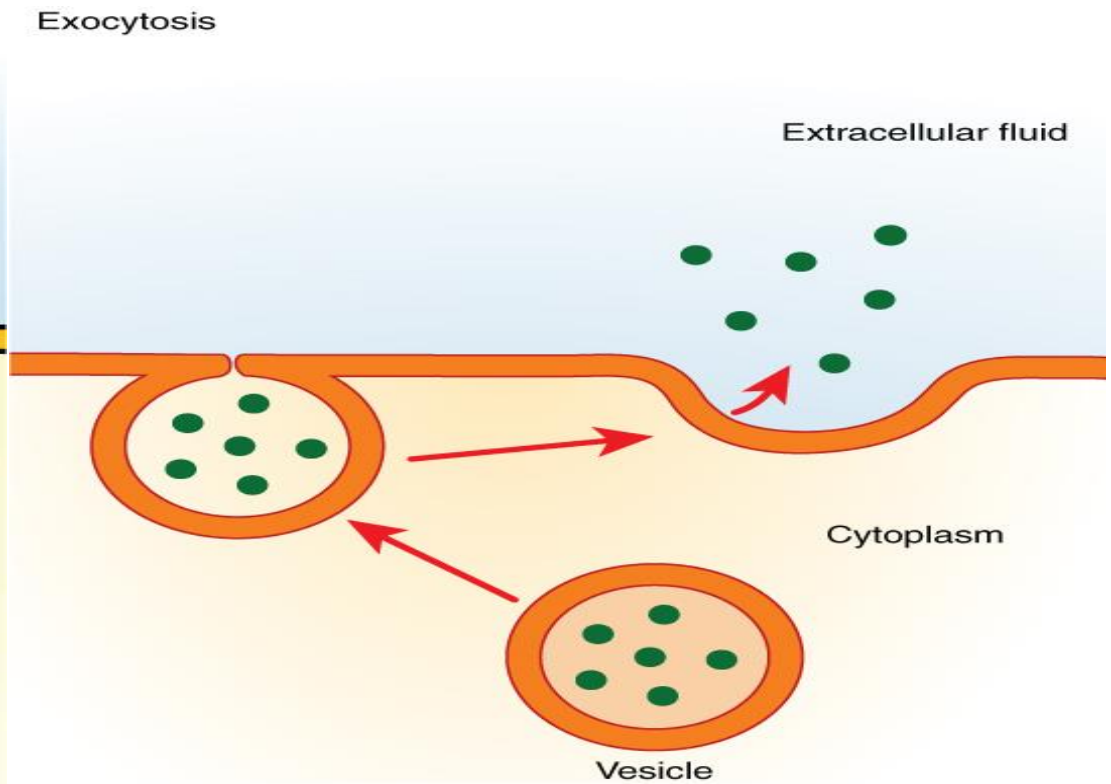
- **Active transport:**
  - Substances transportation using energy (ATP)
  - From the lower to the higher concentration place
- **Endocytosis / Exocytosis:**
  - Large particles incorporation or expulsion using vesicles

Active Transport



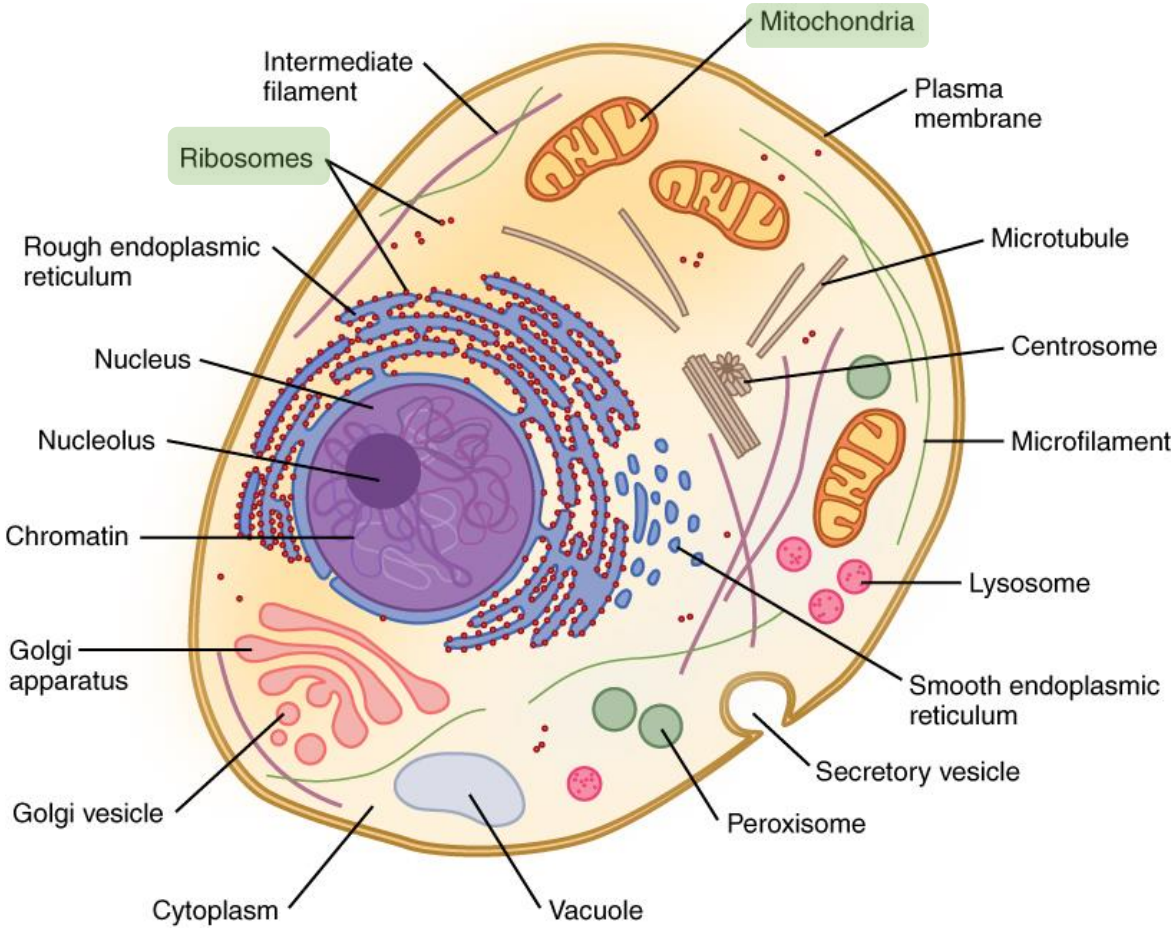
Endocytosis & Exocytosis





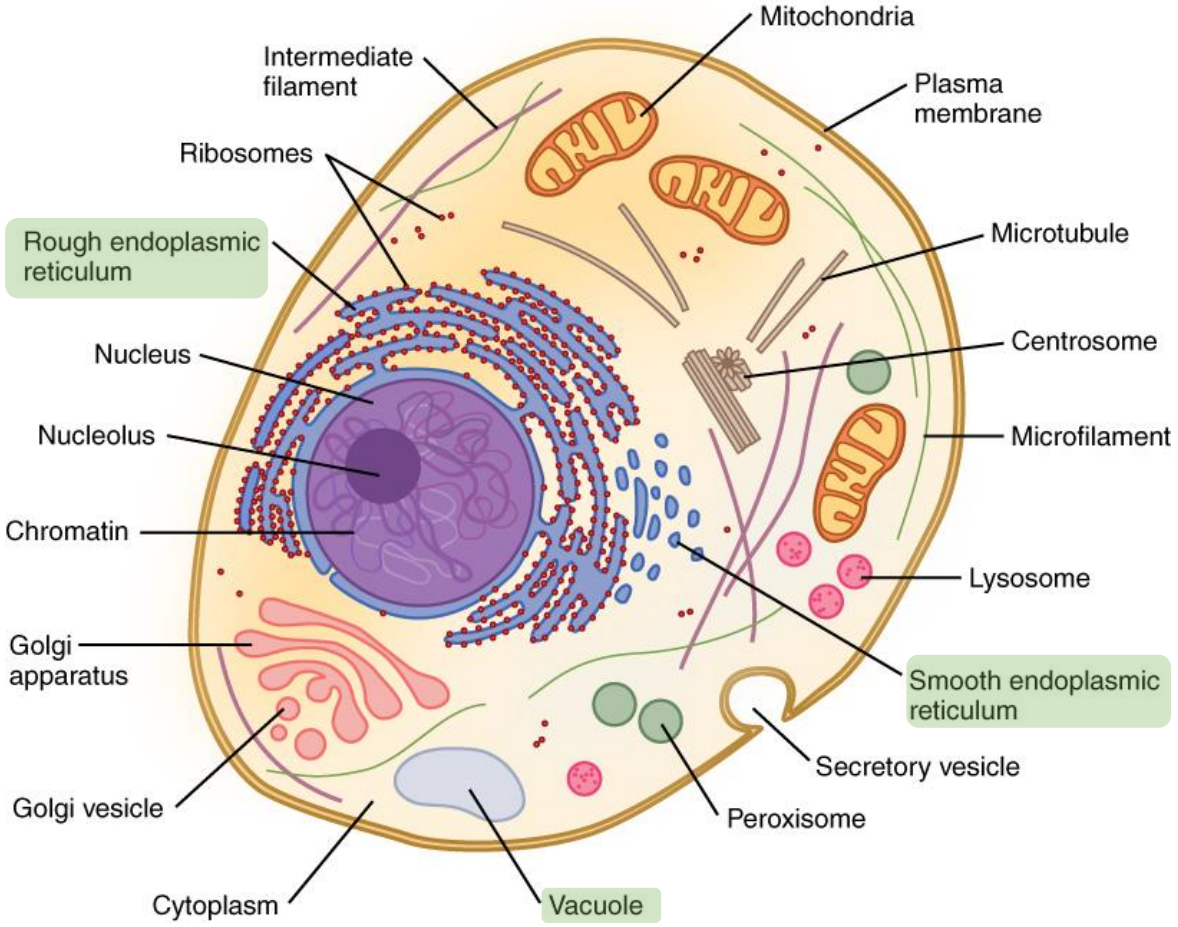
Cytoplasmic Organelles

- **Mitochondrion:**
  - Double membraned
  - It obtains energy via cell respiration.
- **Ribosome:**
  - Made of RNA and proteins
  - Free in the cytoplasm or attach to the Endoplasmic Reticulum
  - It synthesises proteins



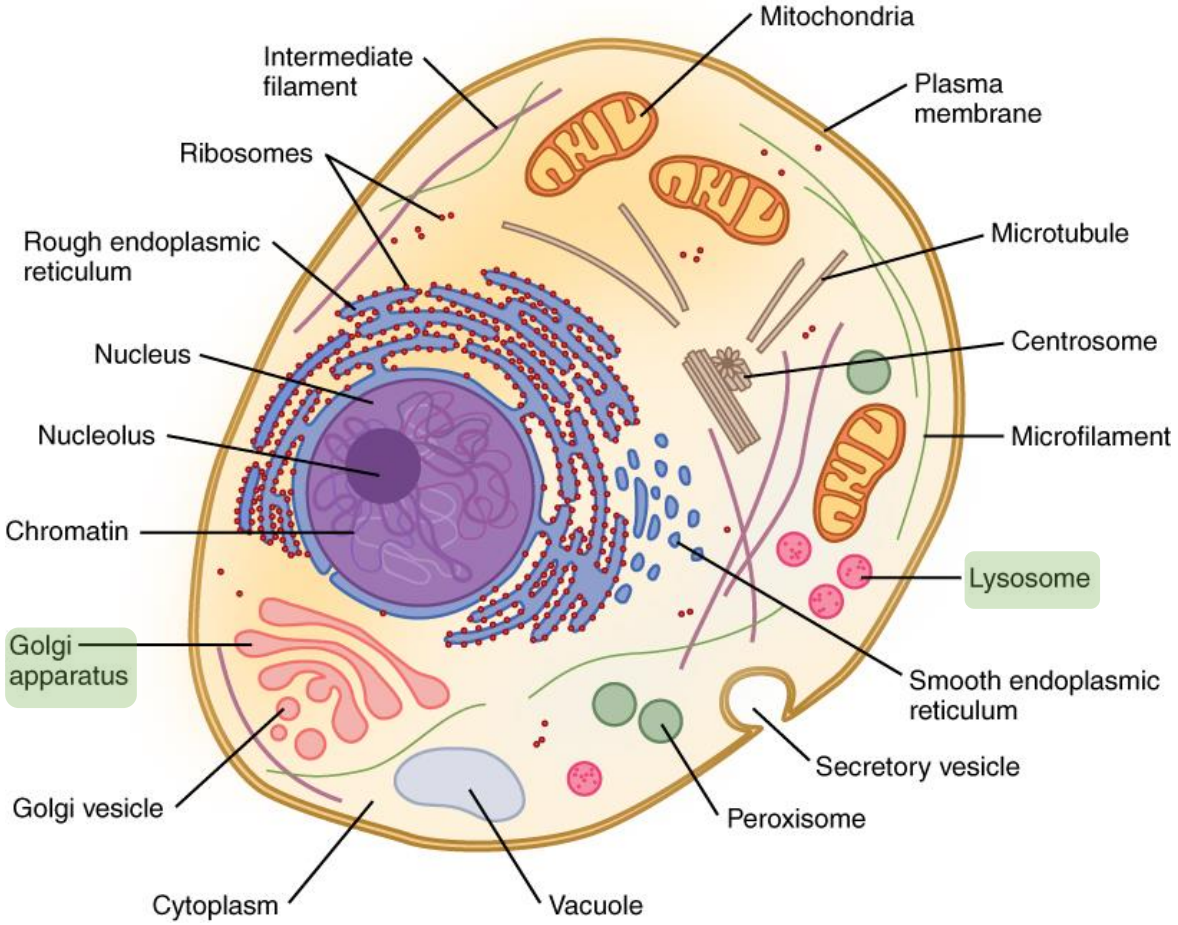
Cytoplasmic Organelles

- **Vacuole:**
  - Vesicle that stores different types of substances
- **Endoplasmic reticulum:**
  - Smooth ER manufactures lipids and detoxifies the cell.
  - Rough ER manufactures and stores proteins.



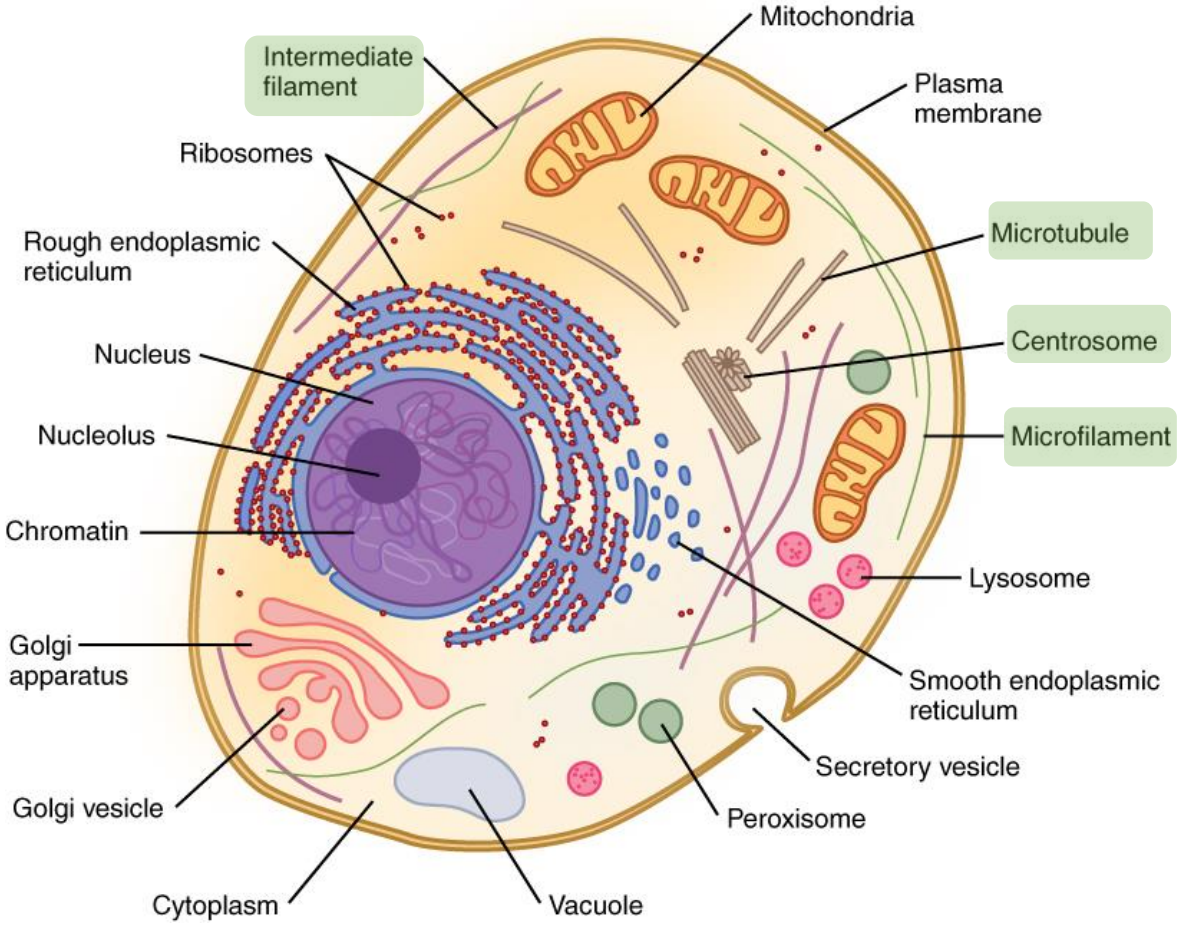
Cytoplasmic Organelles

- **Lysosome:**
  - It performs the digestion of large molecules.
- **Golgi apparatus:**
  - It processes proteins and creates membranes.



Cytoplasmic Organelles

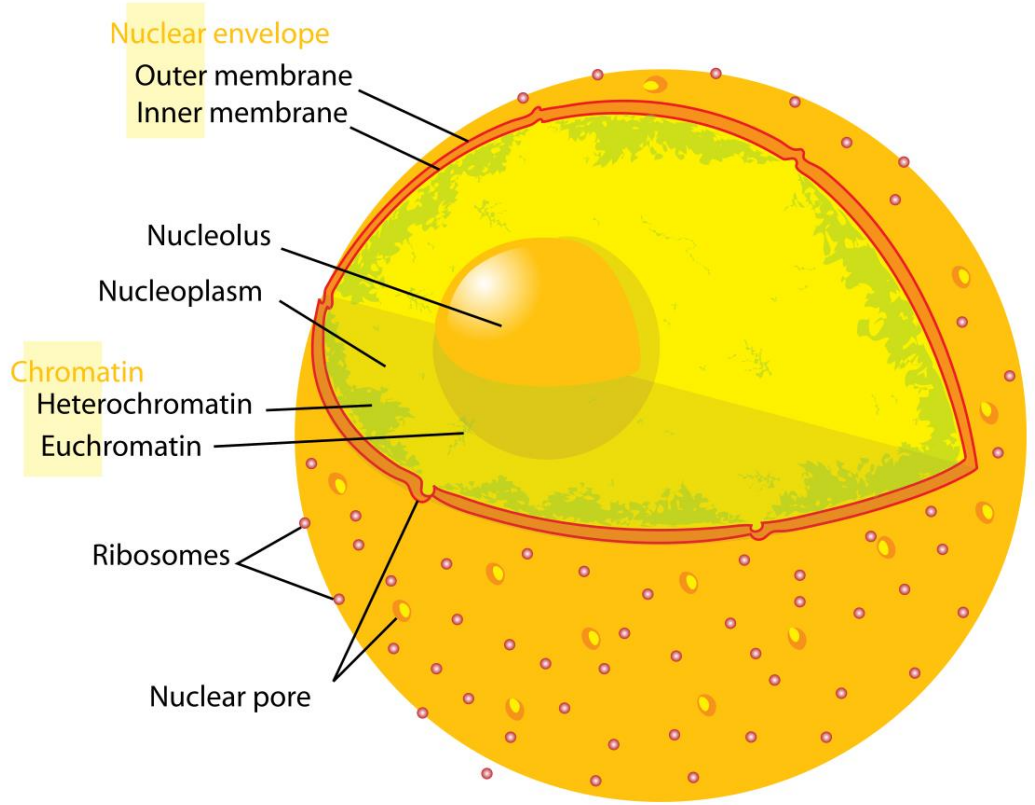
- **Centrosome:**
  - It controls the movement and the sharing of chromosomes.
- **Cytoskeleton:**
  - It keeps the cell shape



The Cell Nucleus

- **Nuclear envelope**
  - Double membrane connected by pores.
  - It controls the substances passage to or from the nucleoplasm.
- **Chromatin**
  - Made of DNA and proteins.
  - During cell division it forms the chromosomes.
- **Nucleolus**
  - It produces the ribosomes

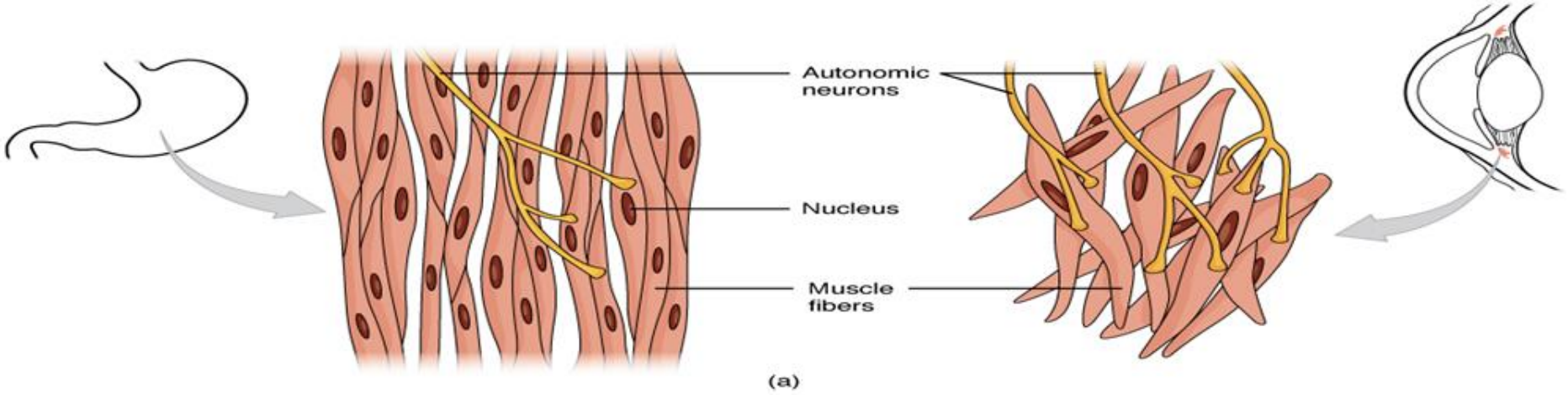
The Cell Nucleus



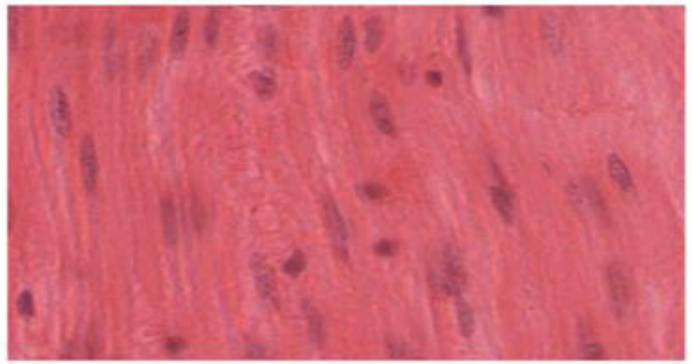
Tissues

- **Definition:** Cluster of cells with the same morphology and function.
- **Cell differentiation:**
  - Cell specialises performing different tasks
  - Because of this specialisation, different cells are created.
  - Differentiation levels:
    - Shape
    - Function
    - Activity of the cytoplasmic organelles

Tissues

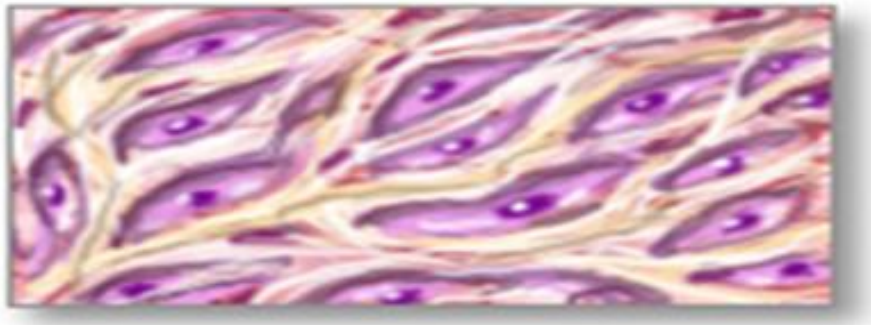


(a)

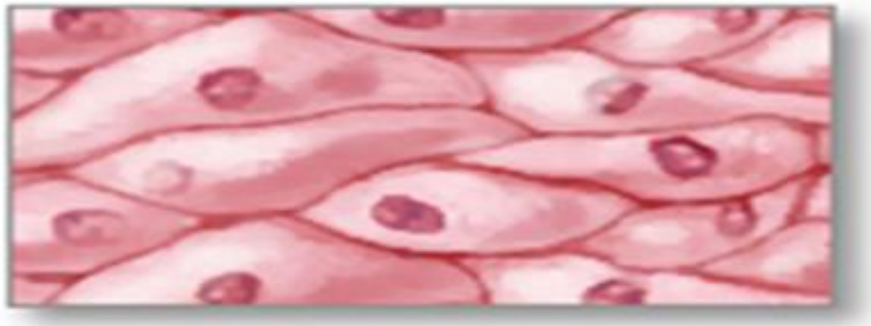


(b)

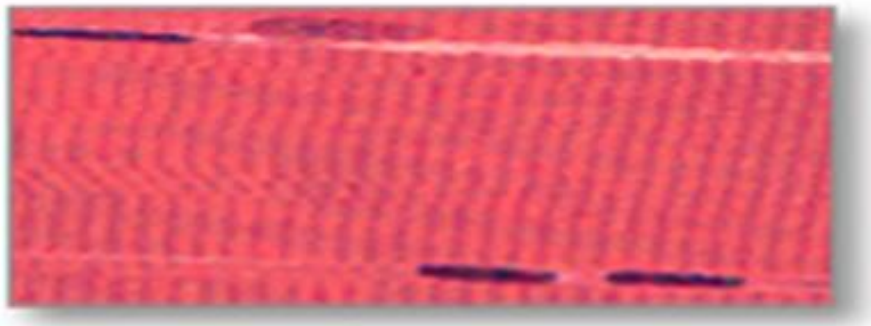
Types of tissues



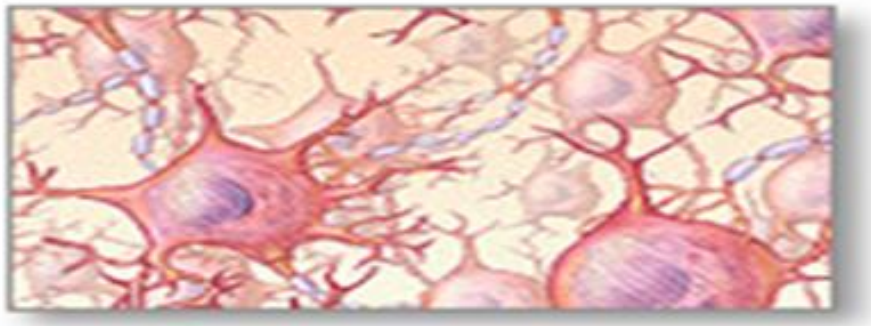
Connective tissue



Epithelial tissue



Muscle tissue



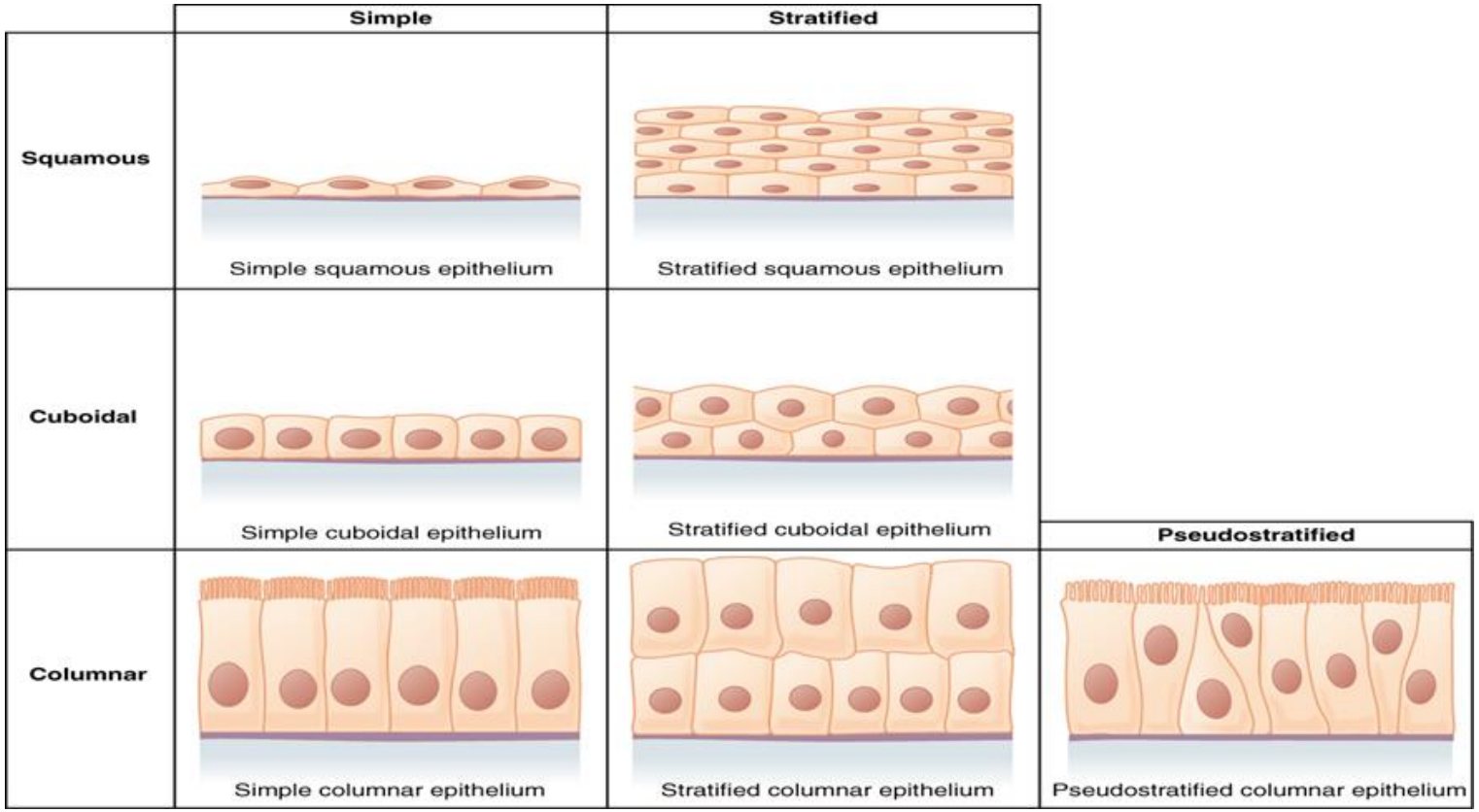
Nervous tissue

science is a way

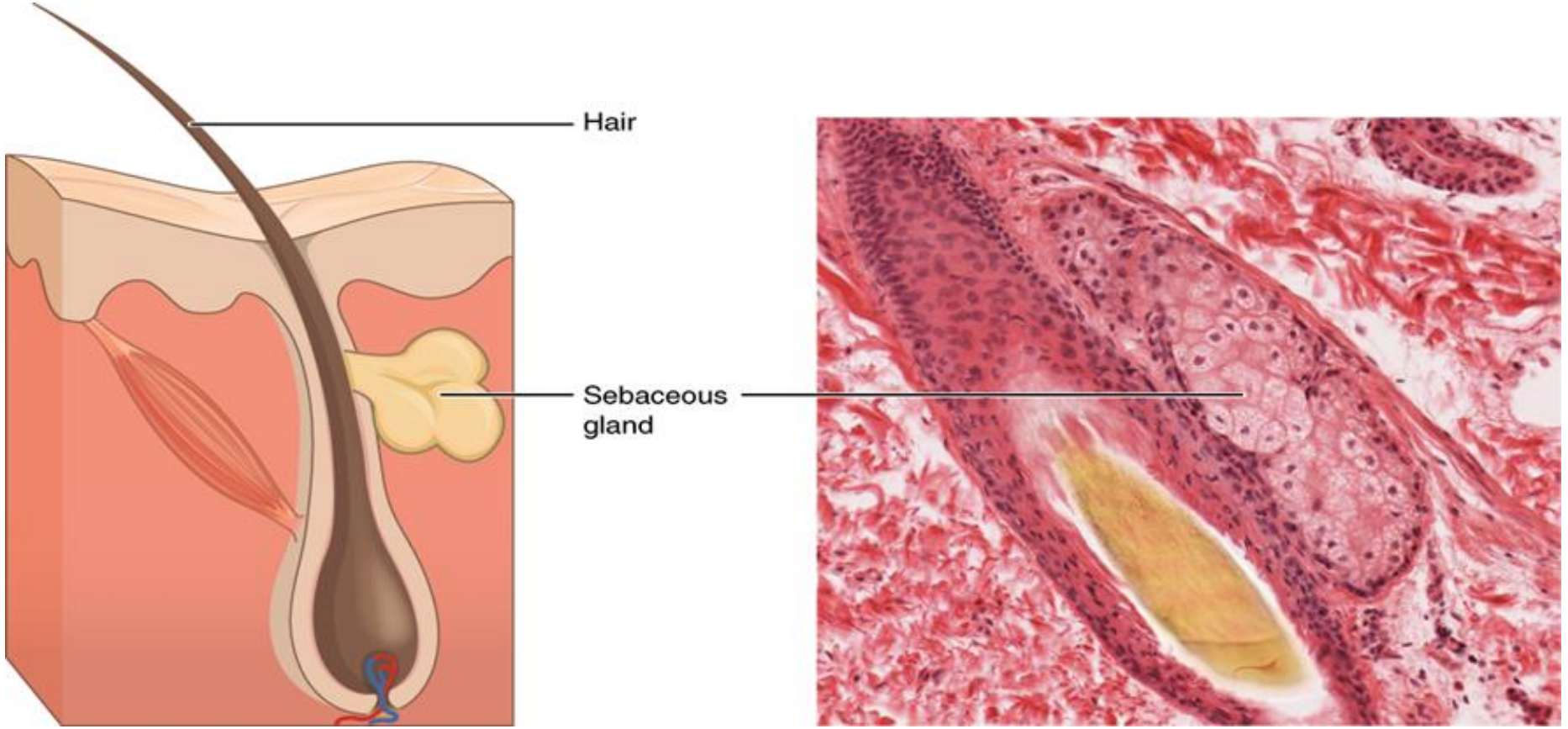
EPITHELIAL TISSUES

- Made of one or more layers where cells are arranged in tight junctions.
- **Epithelium tissue:**
  - It covers the surface of the body
  - Lining internal cavities
  - Enveloping organs
- **Glandular epithelium:**
  - They produce and release substances
  - Cells group forming glands

EPITHELIUM TISSUE



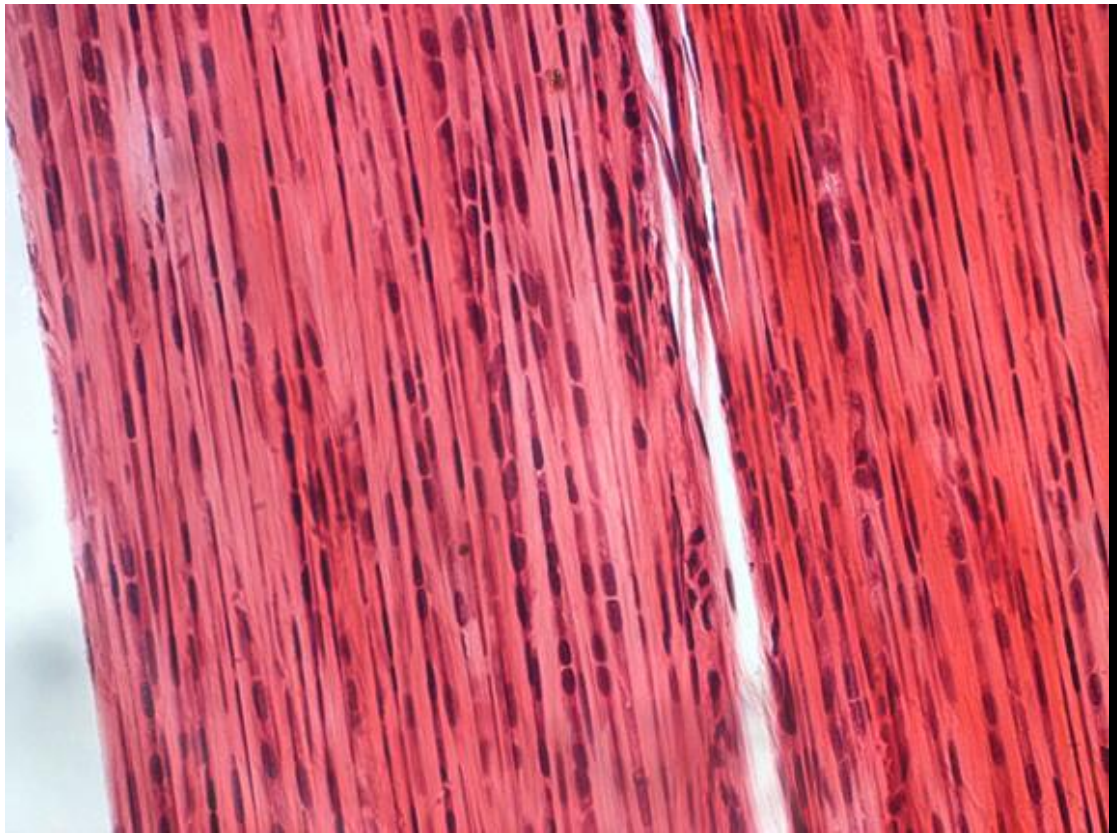
GLANDULAR EPITHELIUM

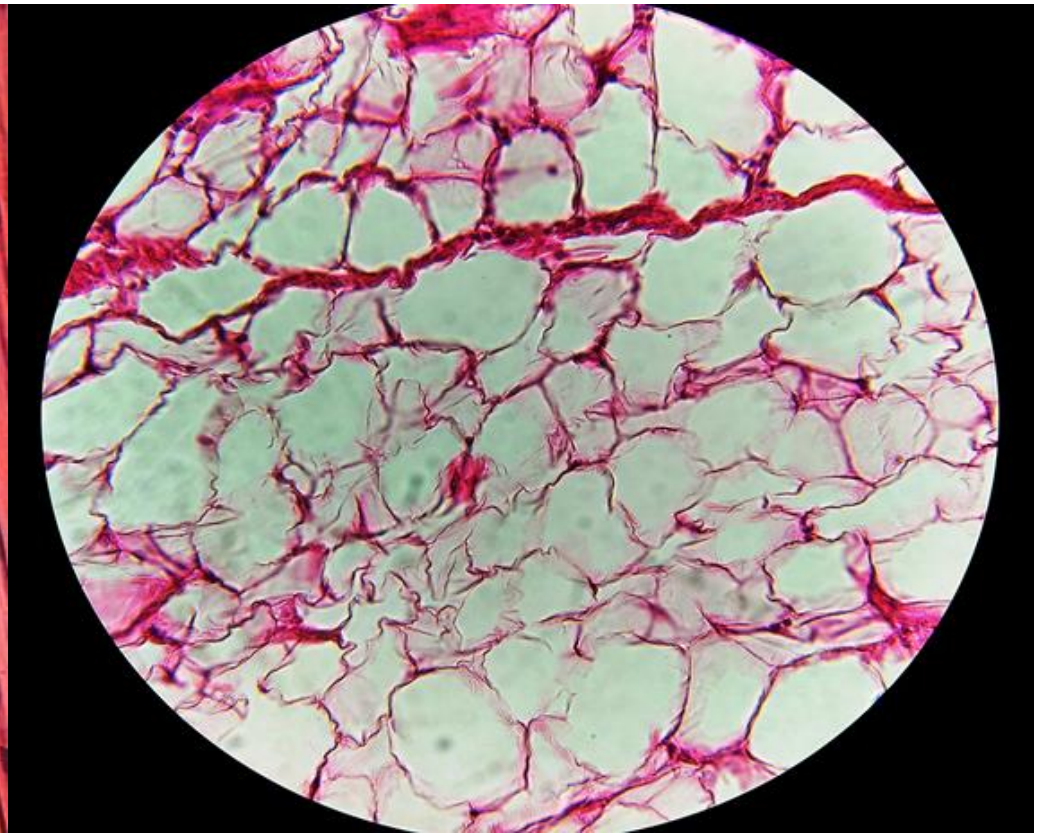


CONNECTIVE TISSUES

- The cells are separated by an extracellular matrix.
- Their function is to support, unify and connect systems in the organism.
- **Connective tissue:**
  - The extracellular matrix contains fibres (elastin, collagen).
  - It's found in the deep skin, tendons and ligaments.
- **Adipose tissue:**
  - The cells accumulate fat drops in the cytoplasm as an energy reserve and as cold insulation.

Connective & Adipose Tissues

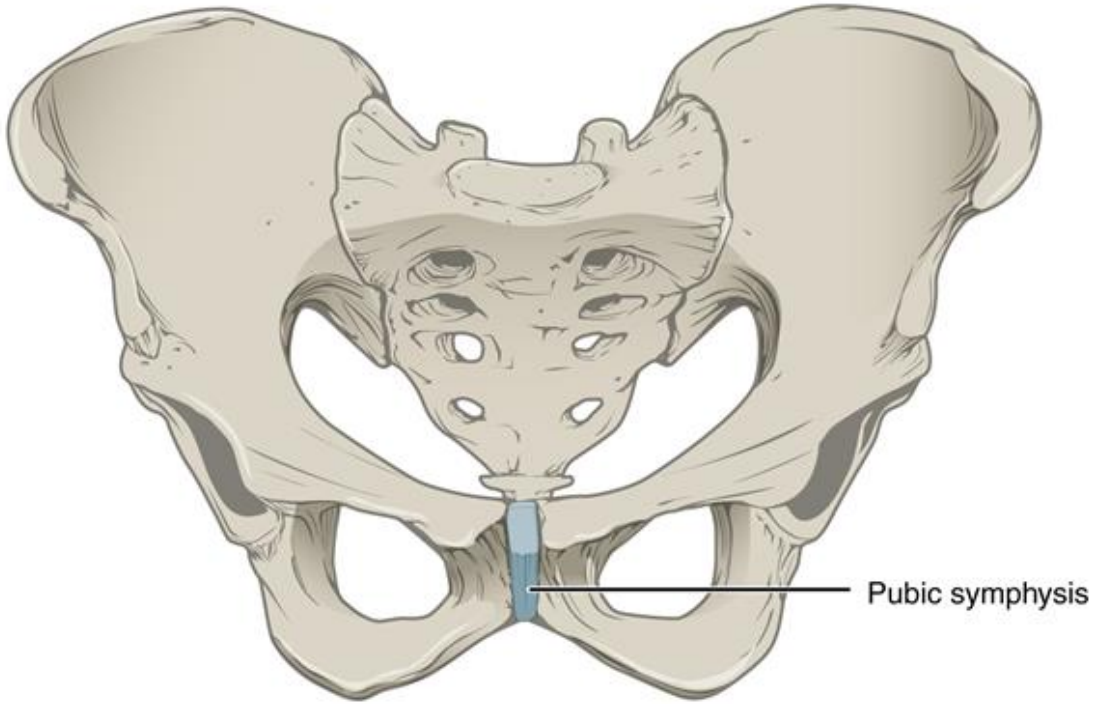


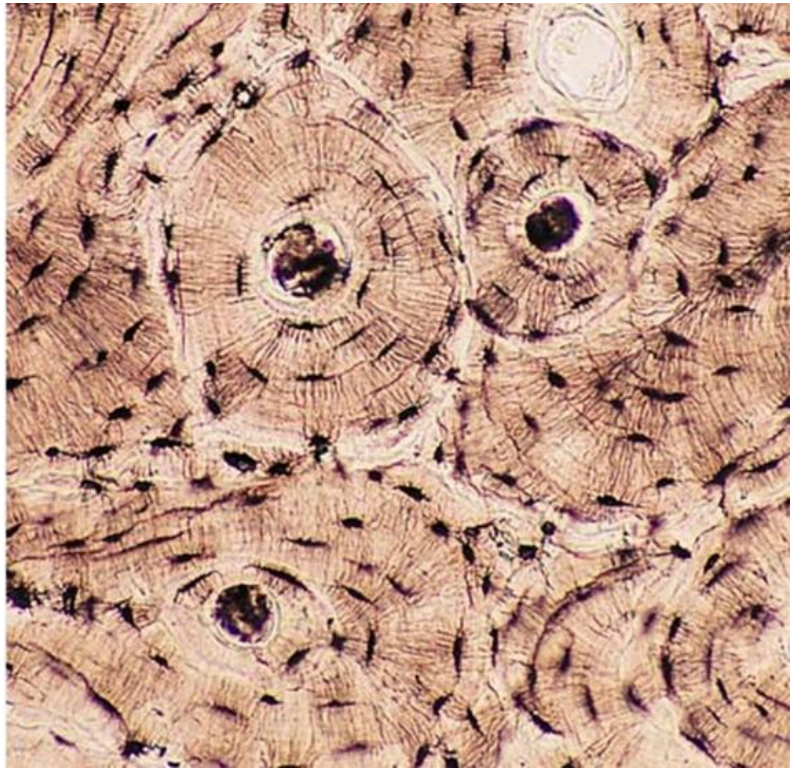


CONNECTIVE TISSUES

- **Cartilaginous tissue:**
  - Firm, elastic and strong tissue that protects the joints and forms structures such as the pinna, the trachea, the interverbal discs…
- **Bone tissue:**
  - Rigid tissue because of the minerals deposition.
  - It supports the organism and protects vital organs.

Cartilaginous & Bone tissues

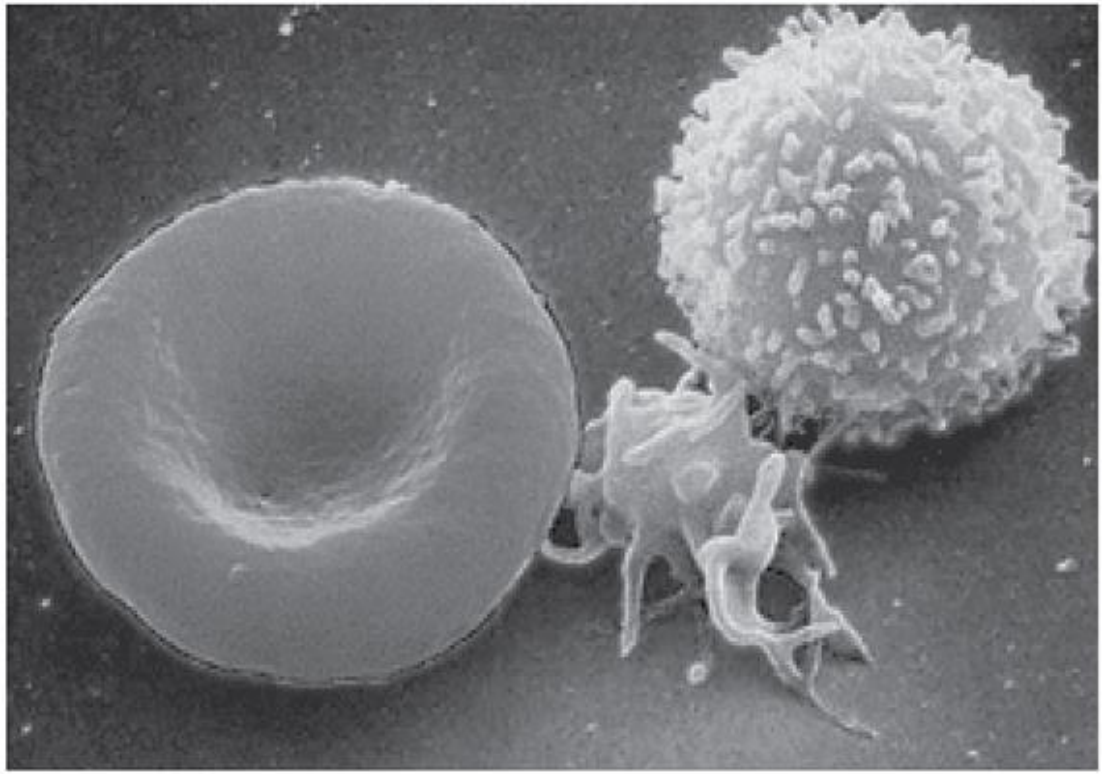


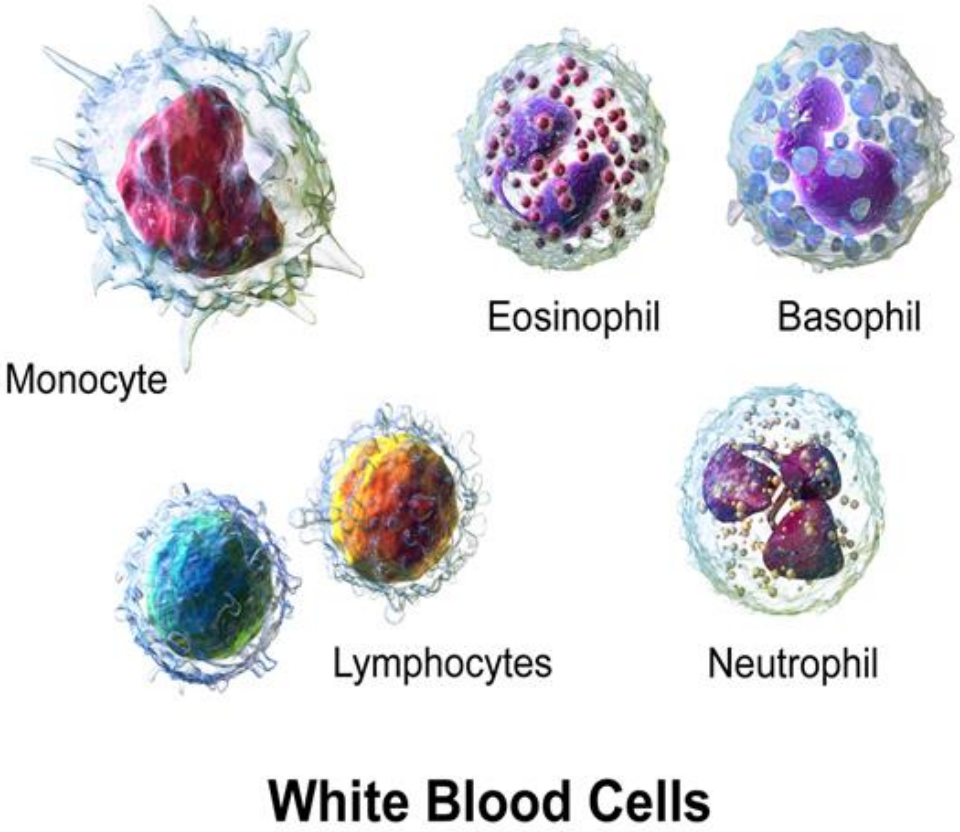


CONNECTIVE TISSUES

- **Blood tissue:**
  - The most special characteristic is the existence of a liquid extracellular matrix called plasma.
  - The cells suspended in there can carry out different functions, such as carrying gases (red blood cells), body defence (white blood cells) or haemostasis (a cell fragments called platelets).

Blood tissue



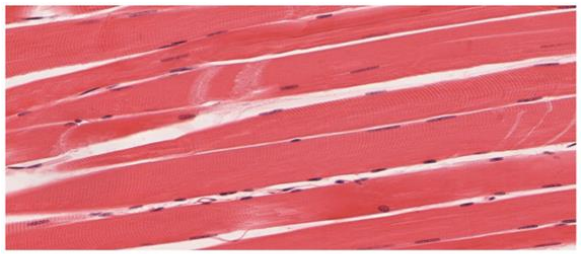


Muscle tissue

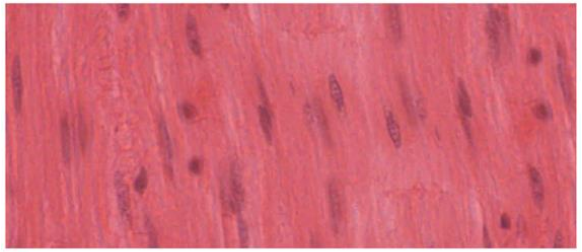
- It's made of elongated cells, called muscle fibres.
- These cells are able to contract in response to a stimulus.
- There are three different types of muscle tissues:
  - **Striated or skeletal muscle tissue:**
    - It moves the skeleton muscles.
  - **Smooth muscle tissue:**
    - It contracts involuntarily the muscles of the organs, such as the stomach, the uterus, the lungs…
  - **Cardiac muscle tissue or myocardium:**
    - It contracts involuntarily the heart.

TYPES OF MUSCLE TISSUES

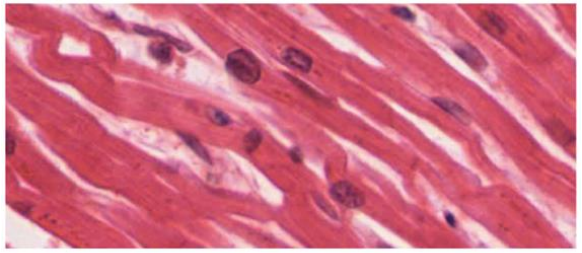
Skeletal muscle tissue



Smooth muscle tissue



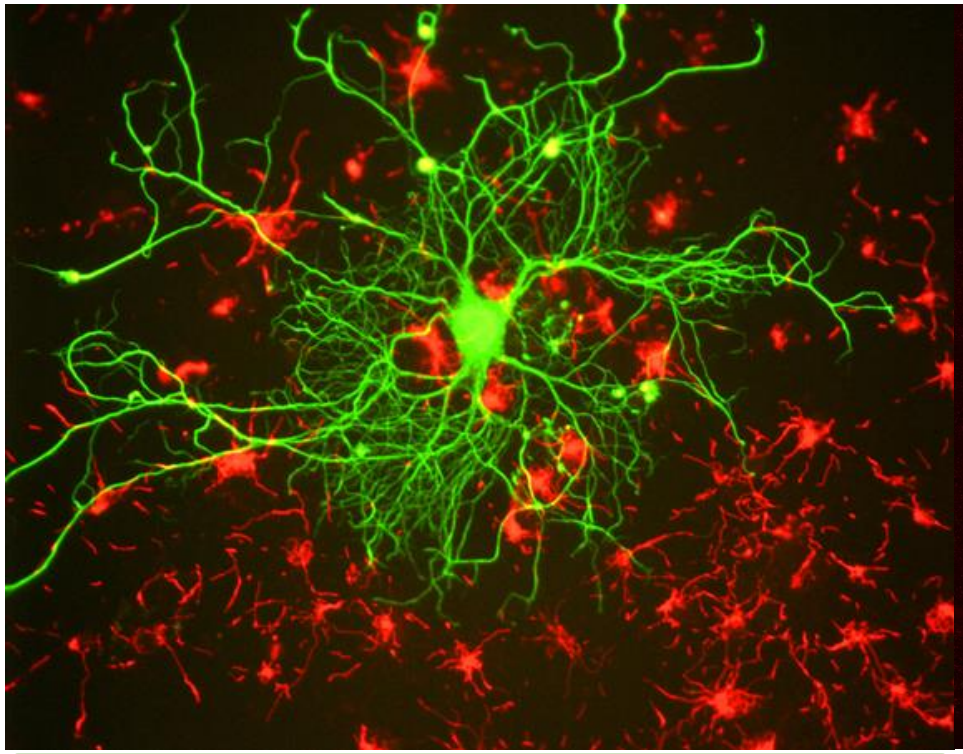
Cardiac muscle tissue



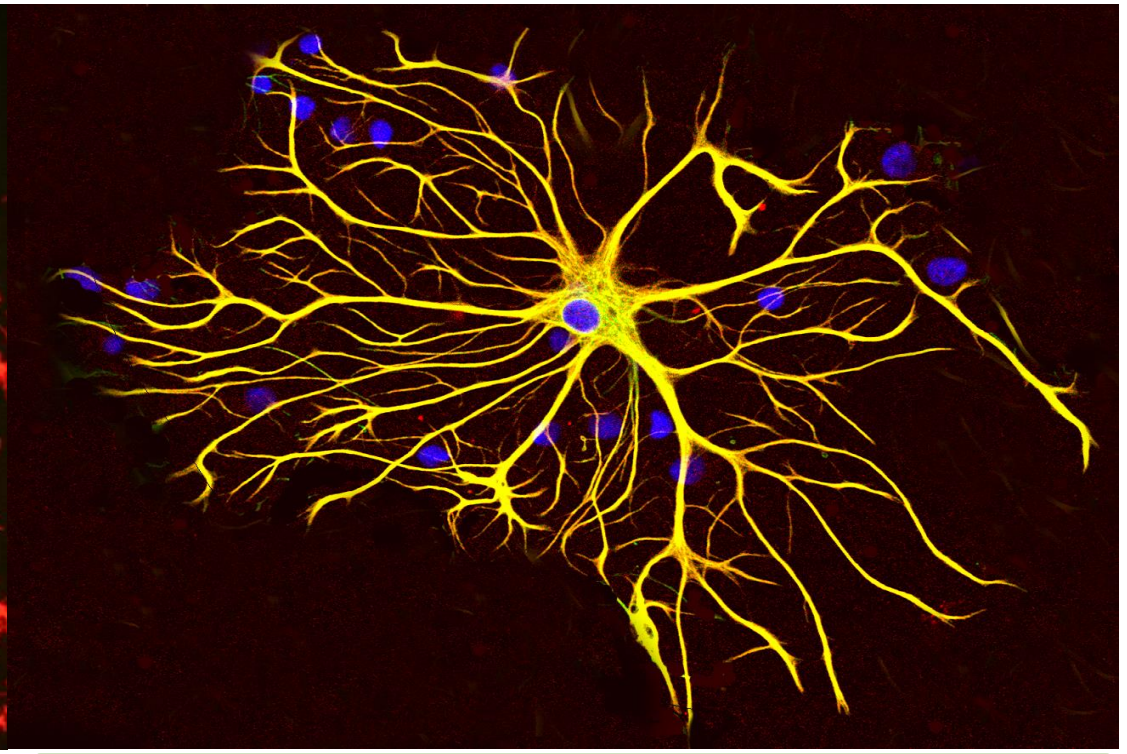
NERVOUS TISSUE

- It's made of two types of cells:
  - A very specialised cell called **neuron** that is able to create and transmit nerve impulses.
  - A cell found alongside the neurons called **glial cell**.
    - Its function is to protect and to supply the neuron with nutrients.
- The nervous tissue builds the nervous system up that coordinates the functioning of the organism.

Nervous tissue



Neuron

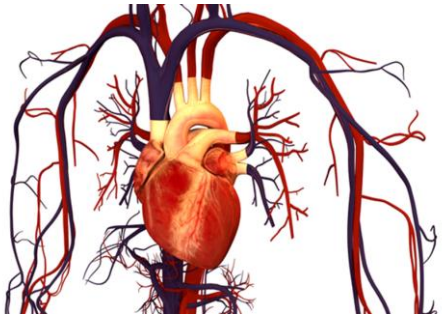


Glial cell (Astrocyte)

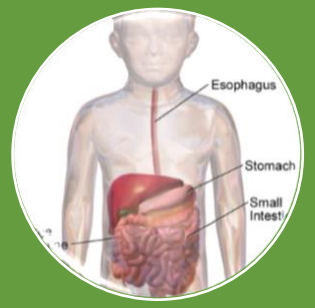
Organs & Systems

- **Organ:**
  - A group of different tissues that performs a more complex function.

- **System:**
  - A group of organs that perform a common function such as nutrition, interaction or reproduction.



Systems involved in the Nutrition function

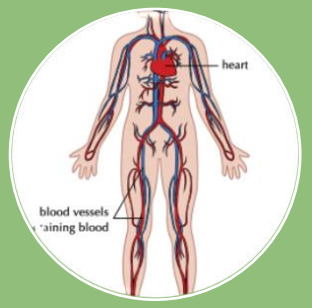


Digestive System

- It transforms food into nutrients
- It absorbs nutrients

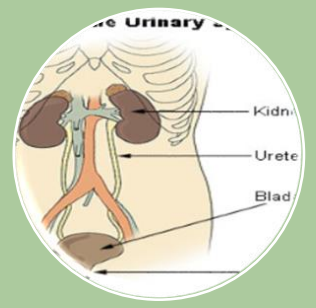
Respiratory System

- It exchanges carbon dioxide and oxygen



Circulatory System

- It provides oxygen and nutrients to the cells.
- It collects wastes and carbon dioxide.



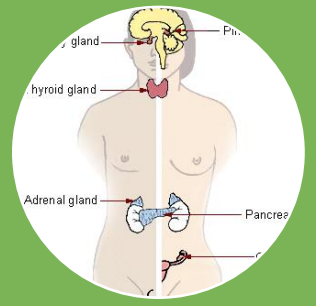
Excretory System

- It takes wastes to the exterior
- It regulates the internal environment

Systems involved in the Interaction function

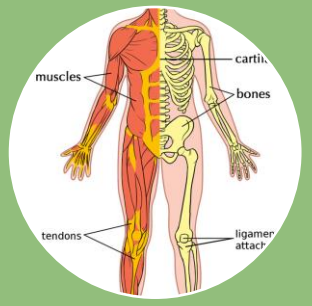
Nervous System

It receives information from the environment and makes the appropriate response.



Endocrine System

It secretes substances (hormones) that induce responses.



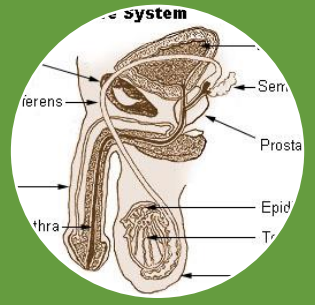
Muscular and Skeletal Systems

They are in charge of the movement

Sense Organs

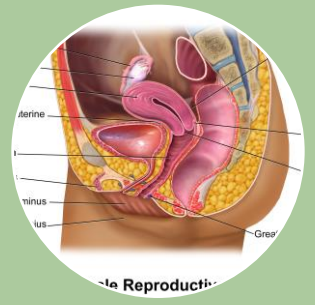
They capture relevant information to the nervous system

Systems involved in the Reproduction function



Male Reproductive System

It produces the male gametes (spermatozoids).



Female Reproductive System

It produces the female gametes (eggs) and protects the embryo during its development.