Al-Mamoun university collage

Physiology

Medical lab Tech

Second stage

Ass.lec Dhuha Ali Abass

2023/2024

Lecture 3

Cell structue and function

Cell: is the basic living unit of the body. About 100 trillion cells in human being (25% of them are red blood cells [RBCs].

There are two types of cells that make up all living things on earth:

Prokaryotic cell: more primitive, small and without nucleus or organelles; like bacteria and blue-green algae.

Eukaryotic cell: advanced, larger, and contain nucleus plus organelles; like animals, plants, fungi, and protozoa.

What do Prokaryotes and Eukaryotes have in Common
:

- Plasma Membrane, an outer covering that allows selective entry and exit of substances in and out of the cell, is found in both cell types. Their fundamental composition in forming a lipid bilayer with embedded proteins is also the same.

- Both contain cytoplasm, a jelly-like fluid that fills the cell's interior, where all other cellular components are found.

- DNA is the genetic material in both cell types.

- In both, ribosomes help in protein synthesis

Basis	Prokaryotic Cell	Eukaryotic Cell
1. Examples	Cells of bacteria, archaea or, cyanobacteria or blue-green algae	Cells of plants, animals, fungi and protozoa .
2. Type	Unicellular	Unicellular or multicellular
3. Type of Organization	Simple	Complex
4. Cell Wall	Usually present. Made of peptidoglycan or mucopeptide.	If present (in plants and fungi) made of cellulose.
5. Nucleus	Absent.	Present.
6. DNA	Circular, double-stranded Found freely in the cytoplasm.	Linear double-stranded. Found within the nucleus.
7. Plasmid	Present.	Absent.
8. Mitochondria	Absent	Present
9. Endoplasmic Reticulum	Absent	Present
10. Golgi Apparatus	Absent	Present
11. Lysosomes	Absent	Present
12. Peroxisomes	Absent	Present
13. Centrosome	Absent	Present except for flowering plants
14. Cytoskeleton	Absent	Present
15. Flagella	Microscopic in size. Simple in structure, made of protein.	Submicroscopic in size. Complex in structure.
16. Cilia	Absent	Present
17. Reproduction	Asexual	Mostly sexual

Our bodies are not made of prokaryotic cells, but there is ~1.3 kg of bacteria living within our guts. Because these cells are small in size they actually outnumber our body cells (eukaryotic cells). Intestinal bacteria are believed to be beneficial; produce vitamins & stimulate the immune system.

Differentiation: when cells specialize. As a result of differentiation, cells vary in size and shape due to their unique function.

Cytoplasm, Nucleuss and Organelles :

Cytoplasm is the gelatinous liquid that fills the inside of a cell. It is composed of water, salts, and various organic molecules. Some intracellular organelles, such the nucleus and mitochondria, are enclosed by membranes that separate them from the cytoplasm.

Nucleus in biology, a specialized structure occurring in most cells (except bacteria and blue-green algae) and separated from the rest of the cell by a double layer, the nuclear membrane. This membrane seems to be continuous with the endoplasmic reticulum (a membranous network) of the cell and has pores, which probably permit the entrance of large molecules. The nucleus controls and regulates the activities of the cell (e.g., growth and metabolism) and carries the genes.

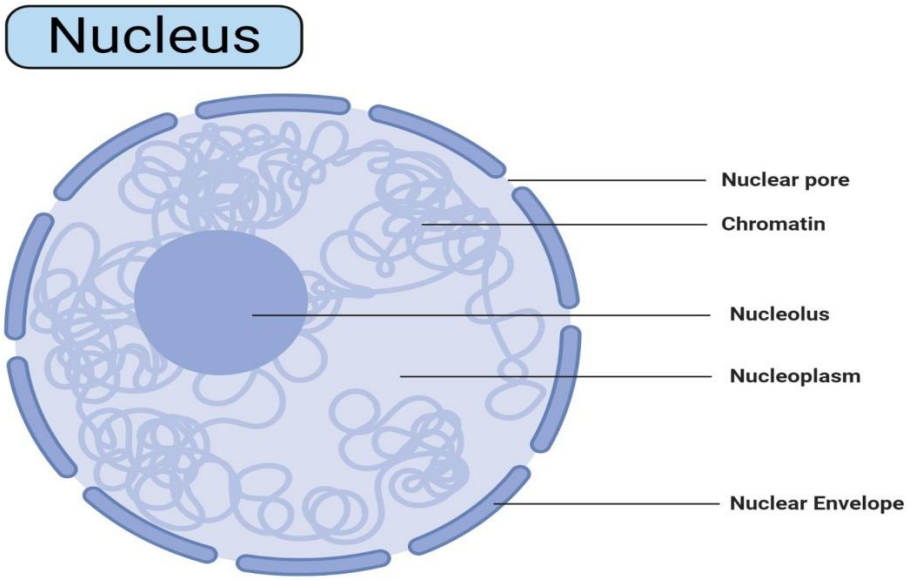
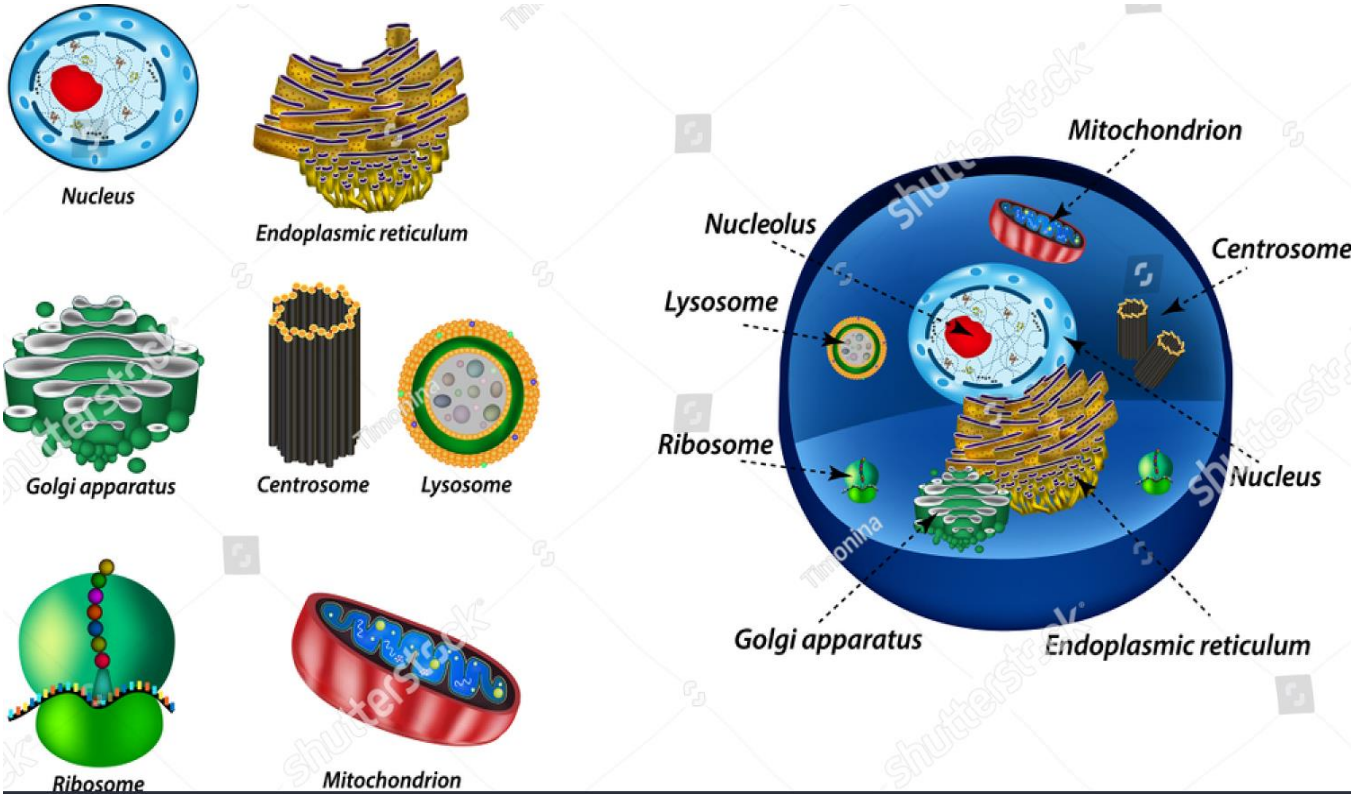


Figure: Nucleus, Image Copyright © Sagar Aryal, www.microbenotes.com

Organelles



Golgi apparatus: Is a cell organelle that helps process and package proteins and lipid molecules, especially proteins destined to be exported from the cell. Camillo Golgi discovered it . .

Endoplasmic reticulum: The ER is the largest organelle in the cell and is a major site of protein synthesis and transport, protein folding, lipid and steroid synthesis, carbohydrate metabolism and calcium storage.

Lysosomes: lysosome is a membrane-bound cell organelle that contains digestive enzymes. Lysosomes are involved with various cell processes. They break down excess or worn-out cell parts. They may be used to destroy invading viruses and bacteria.

Mitochondria: Have a double-membrane outer membrane & highly convoluted Inner membrane has folds or shelf-like structures called cristae that contain elementary particles; these particles contain enzymes important in ATP production.
Primary function is production of adenosine triphosphate (ATP)
Typical cells have about 1000 mitochondria, but active cells like muscles will have more..

Ribosomes: Ribosomes are made in nucleolus, then leave nucleus and enter cytoplasm Composed of rRNA (ribosomal RNA) & protein
Some are free, but others attach to the endoplasmic reticulum, producing the rough endoplasmic reticulum (RER) often linked together in chains called polyribosomes. Primary function is to produce proteins.

Peroxisomes: Membranous sacs of oxidase enzymes & replicate by pinching in half; functions Detoxify harmful substances, Break down free radicals (highly reactive chemicals).

Centrioles: Paired cylindrical structures located near the nucleus play an important role in cell division.

Flagella & cilia: hair-like projections from some human cells Cilia move materials across the cell surface. Cilia paralyzed by tobacco smoke and other pollutants cannot move mucus and it accumulates in the lungs and impairing respiration A flagellum is relatively long and there's typically just one (e.g., sperm) Flagellum propels the cell.

Homeostasis

It is the maintenance of a relatively constant internal environment in an organism. All body functions operate together to keep many variables (pH, temp., blood pressure, glucose level, electrolytes, blood elements, etc…) within normal limits.

Human body has control systems; that depend on info about the changes (for any variable) in the internal environment; these data come from **Receptor.**

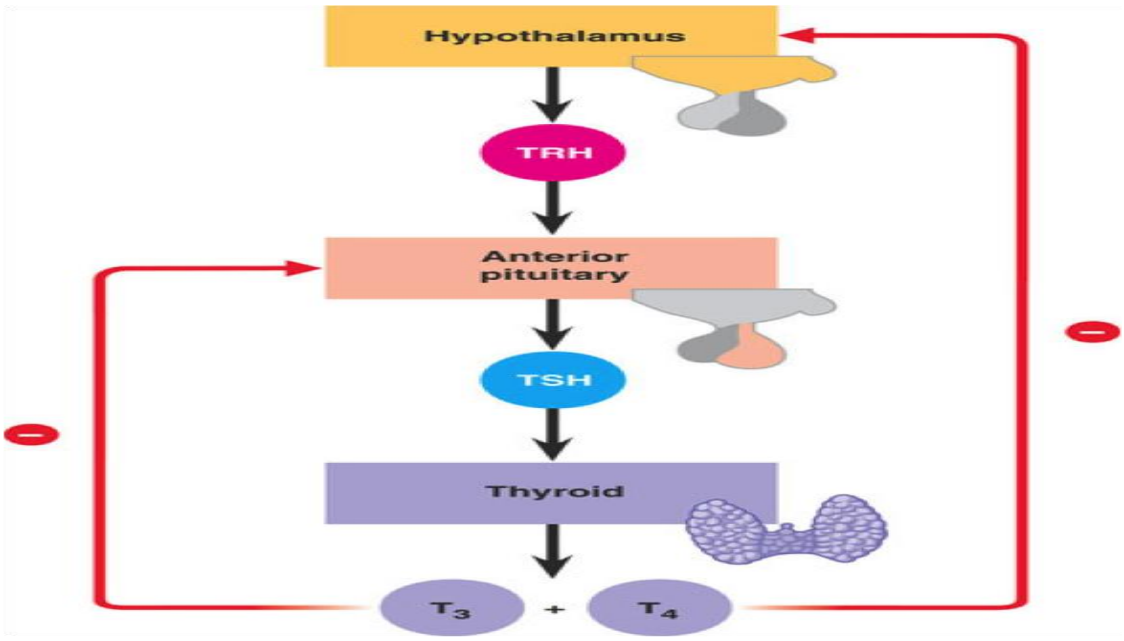
The mechanism by which receptors-organ systems-effectors control systemworks are:

1. **Nagative feedback :**

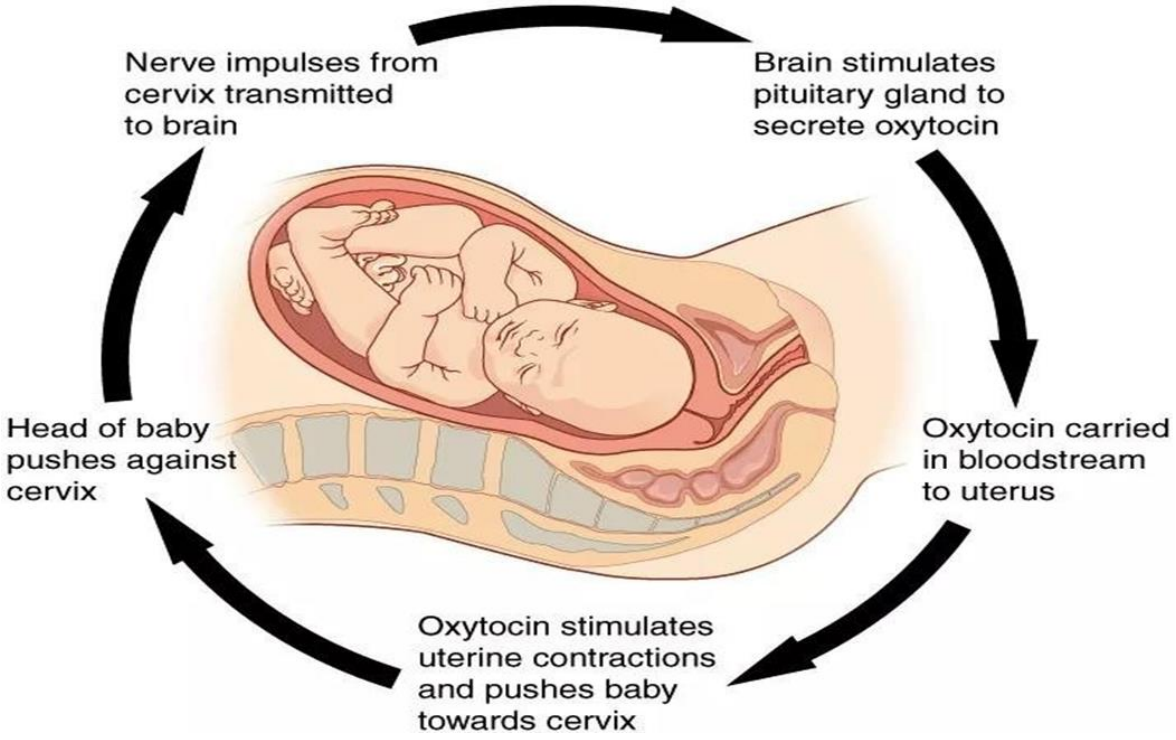
   Receptors sense a deviation from normal range for a variable and effectors work to return it to normal again. E.g. too hot, body sweats to lower body temp.

2. **Positive feedback :**

   Receptors sense that the body needs more power and the effectors respond by increasing or strengthening what is happening. Ex. Child birth, increases strength of uterine contractions , Hemostasis by platelets & clotting cascade



Nagative feedback



Positive feedbac