HUMAN PHYSIOLOGY

Contents

Introduction and review of general physiology

Importance of physiology for the dentist

Cell physiology

Functions of cell organelles

Cell membranes

Transport across cell membranes

Body composition

Homeostasis and body fluids

Osmosis, osmolarity and osmotic pressure

Physiology

Definition:

is the science which refers to the functions of the living organism and its parts, and how these functions are performed.

Thus, physiology is not only a description of the function but also asks

Why and How?

Why should the dentist be familiar with physiology?

A knowledge of the fundamentals of human physiology is essential in the training of the dental student, **because** physiology constitutes, along with anatomy, the basic science upon which all medical and surgical knowledge is based; and dentistry is a highly specialized department of surgical practice.

To operate on the teeth without knowing something about the physiology of the body as a whole, **would reduce the dentist to the level of a craftsman** who, although perhaps very highly skilled in his technical work, was yet quite ignorant of the nature of the machine upon a part of which his work had to be done.

A knowledge of the laws of nutrition and dietetics form a most important part of every course in dentistry

The physiology of the digestive system, of the circulation of the blood and of the nervous system is not less important.

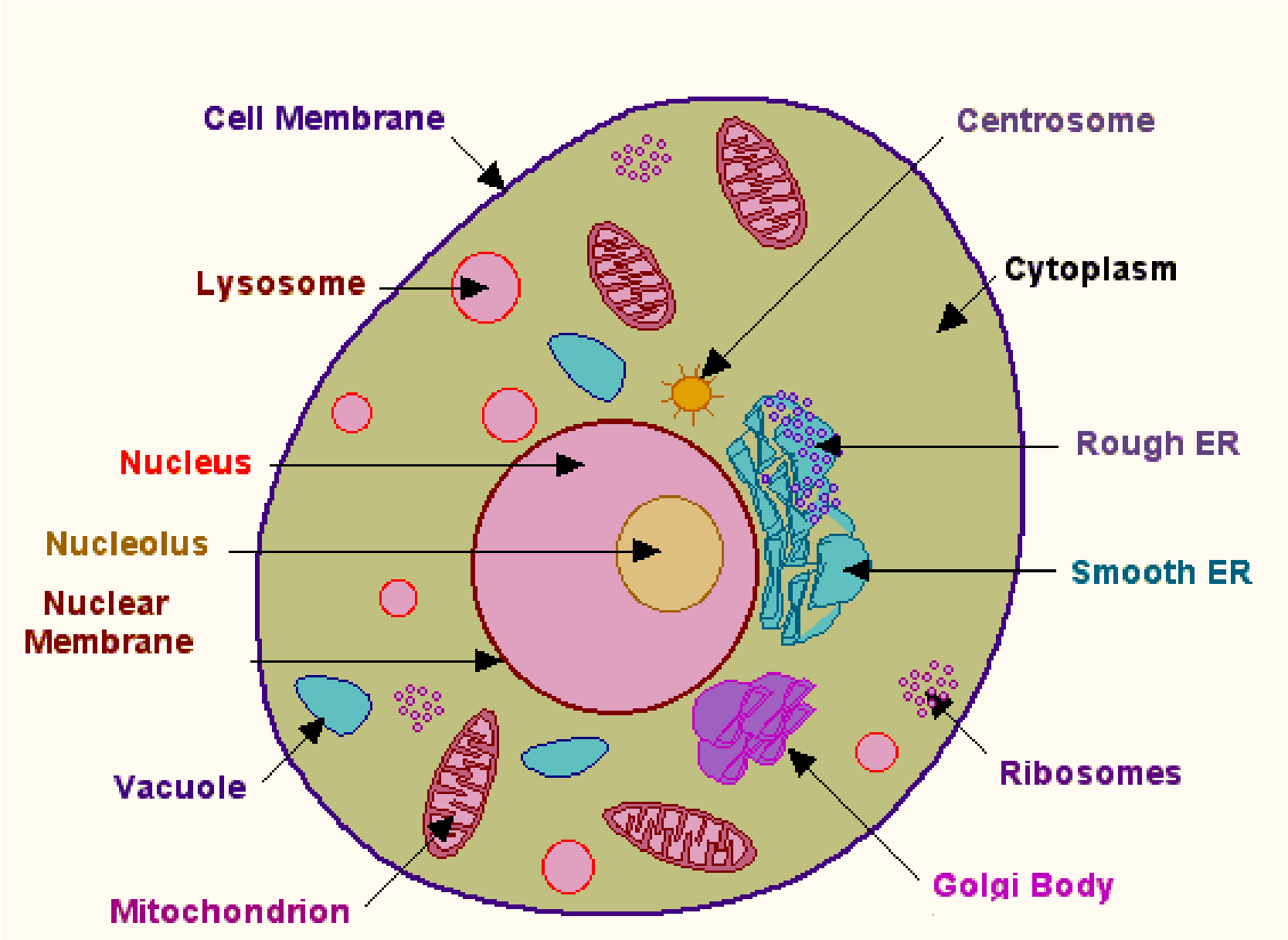
The pain and shock produced by a dental operation may cause considerable disturbance in the action of the heart or in the distribution of blood in the body, and this disturbance, especially in cases in which the heart and the blood vessels are diseased, may become so pronounced as to render a certain amount of medical skill necessary.

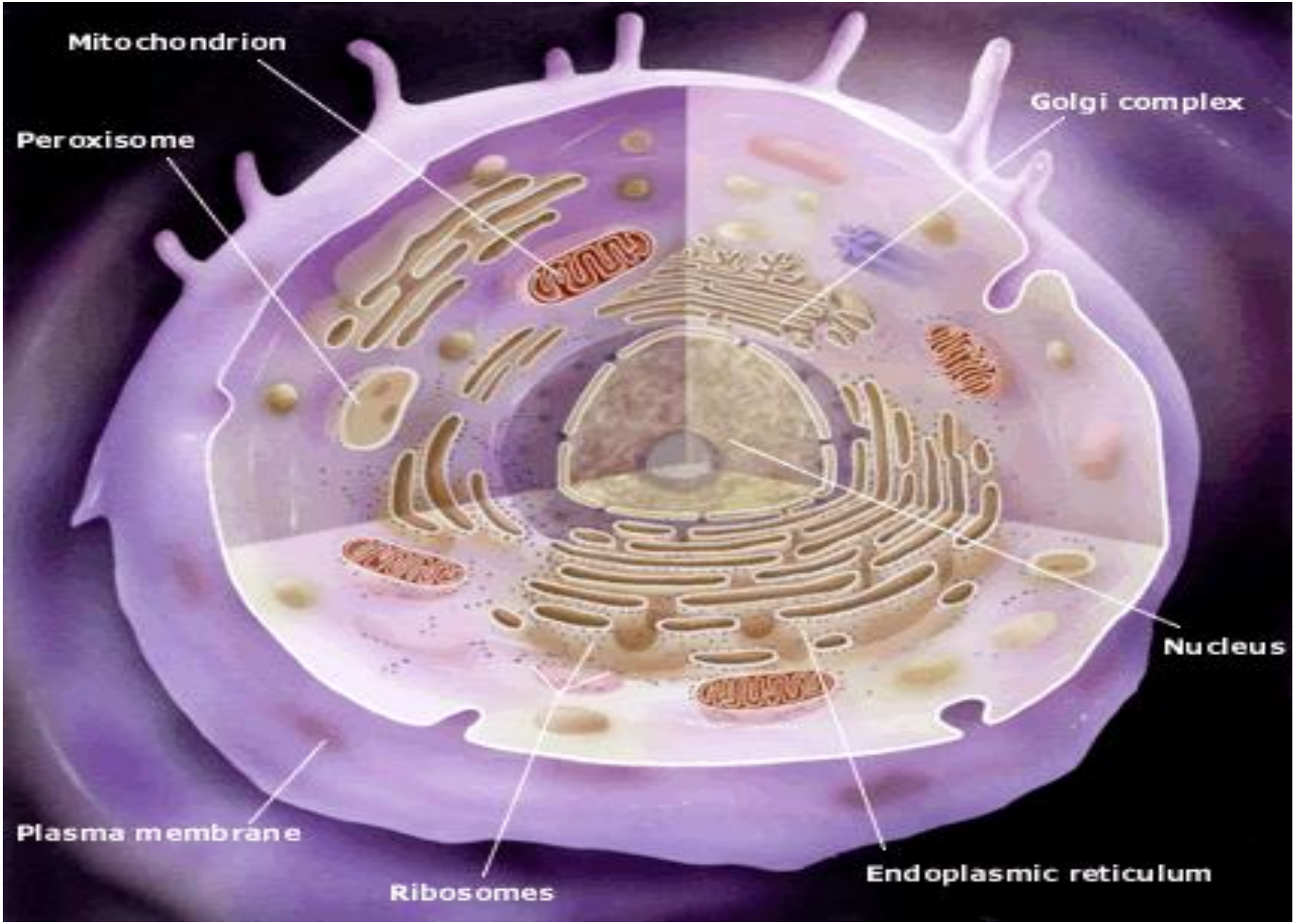
the dentist must be particularly familiar with the local physiology of the mouth, such as the finely coordinated nervous mechanisms involved in the acts of mastication and swallowing and the secretion of saliva.

He must understand the nature of the sensations of the teeth and buccal mucosa, and be on the lookout for any lesions of the cranial nerves that supply the muscles and other tissues adjacent to the mouth cavity.

The chemistry of the saliva has demanded special attention because of the very interesting scientific investigations which are being prosecuted 'regarding the nature of the undoubted relationship that exists between changes in the saliva and the incidence of dental caries.

Cell structure
&
Physiology

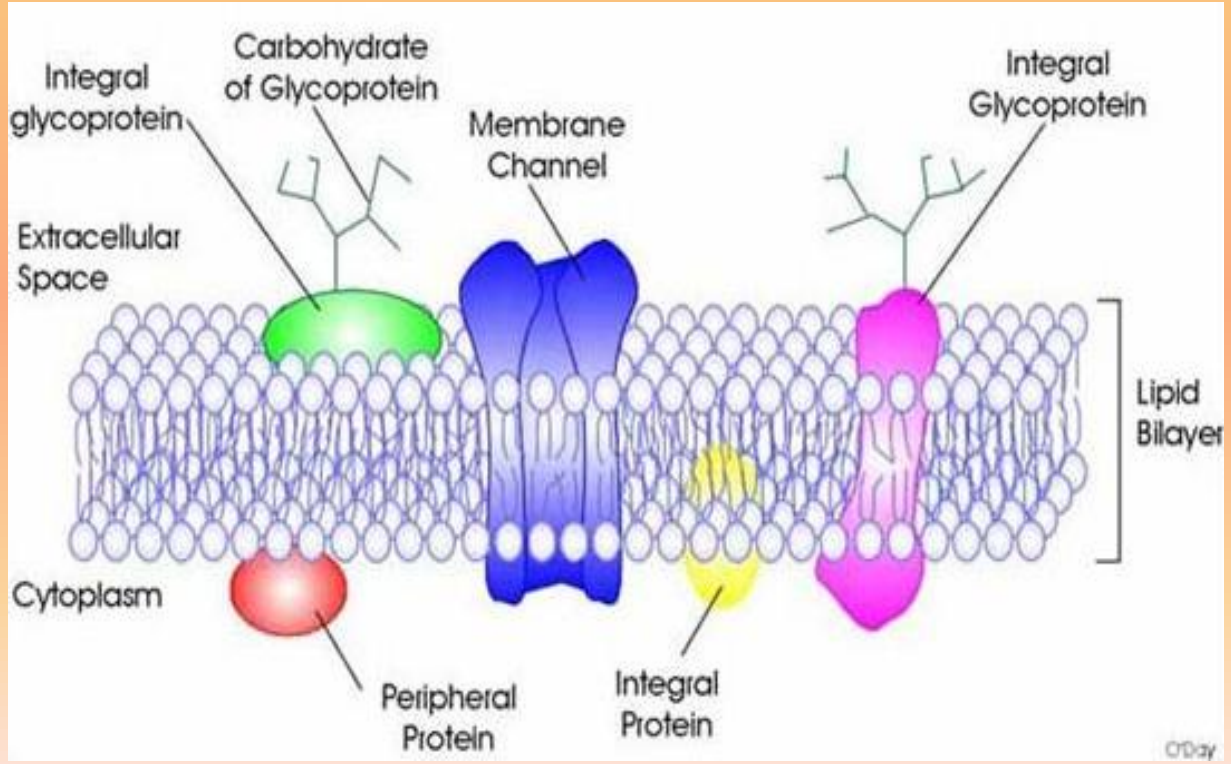

Cell Membrane
Centrosome
Lysosome
Cytoplasm
Nucleus
Rough ER
Nucleolus
Smooth ER
Nuclear Membrane
Vacuole
Ribosomes
Mitochondrion
Golgi Body

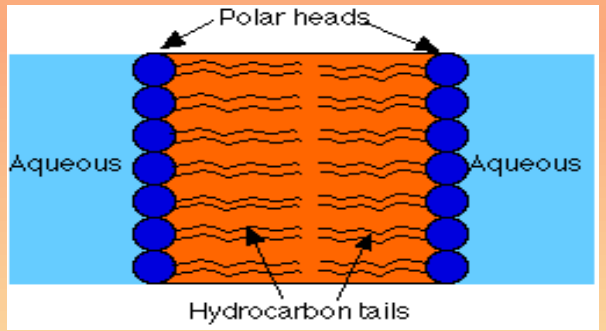

Mitochondrion
Peroxisome
Golgi complex
Nucleus
Plasma membrane
Ribosomes
Endoplasmic reticulum

1- Cell Membrane

Consists of:

- **Lipid Bilayer** (hydrophilic heads to outside and hydrophobic tails to inside).
- **Proteins** (integral proteins and peripheral proteins).
- **Carbohydrates** (in Glycoprotein & Glycolipids).



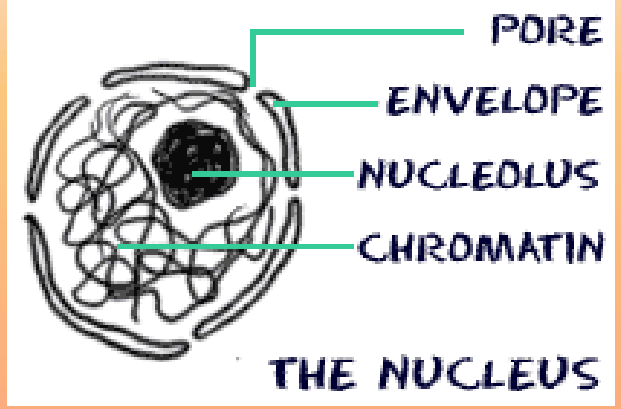


2- Protoplasm

Cytoplasm + Nucleus + Cell organelles

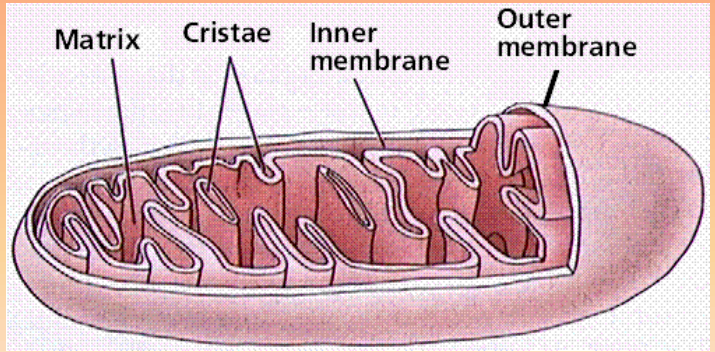
Nucleus

consists of nuclear membrane and chromatin which contain the genetic materials.



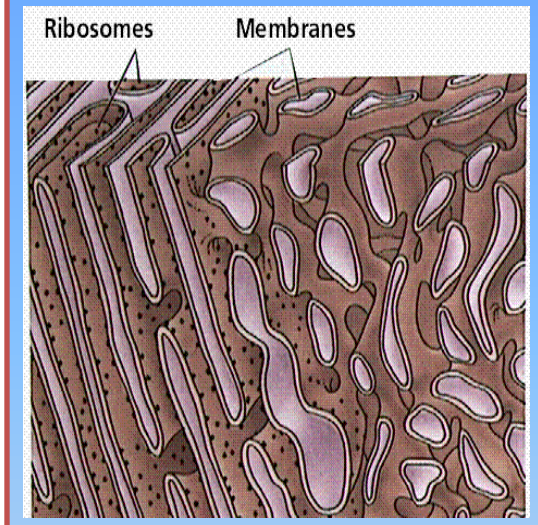
Mitochondria

Production of ATP by a process of oxidative phosphorylation.



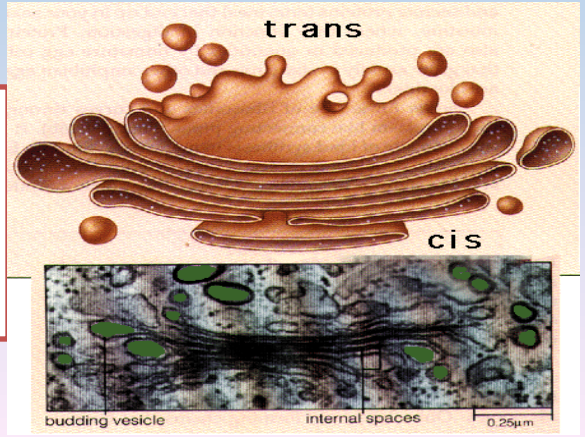
Endoplasmic reticulum (ER)

(1) Rough ER (in which ribosomes are attached on cytoplamic side) is concerned mainly with synthesis and initial folding of polypeptides.
(2) Smooth ER (ribosomes are absent) is concerned with steroid synthesis in steroid-secreting cells.
- ER in muscles are named sarcoplasmic reticulum and has an important role in muscle contraction.



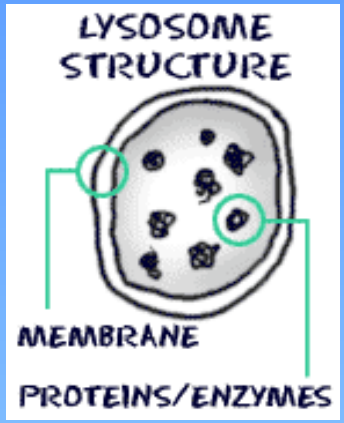
Golgi bodies

are composed of dumbell shaped sacs and found near the nucleus and its main function is modification of proteins formed by RER.



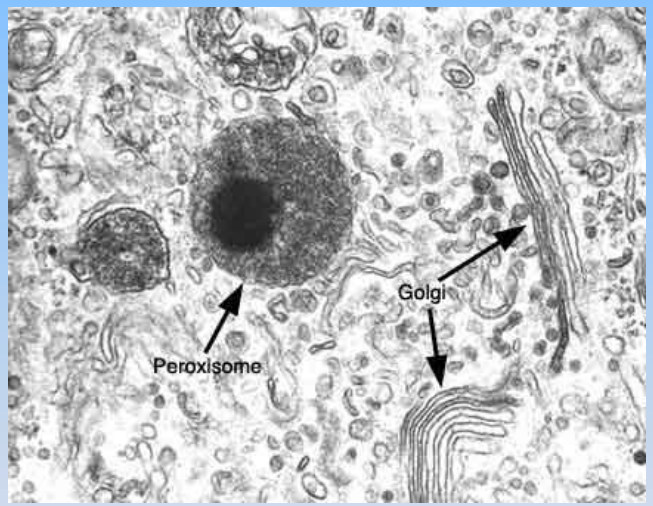
Lysosomes

contain lytic enzymes



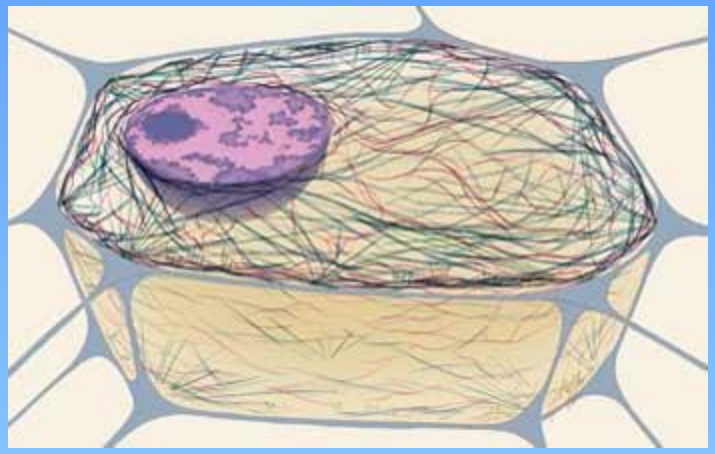
Peroxisomes

contains enzymes that catalyze various anabolic and catabolic reactions. The most important action is the catabolism of very long-long-chain fatty acids. Thus, drugs, that are peroxisome proliferators, produce hypolipidemic action.



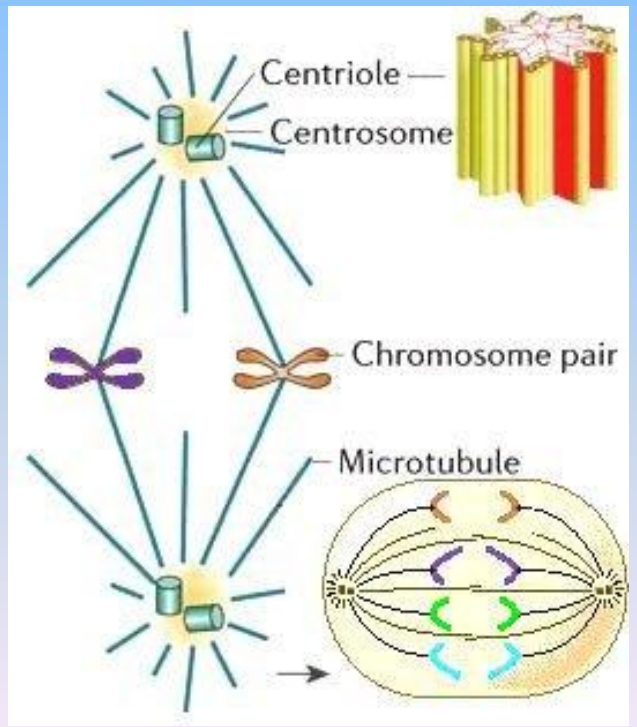
Cytoskeleton

is composed of microfilaments and microtubules, supports cell and provides shape and aids movement of materials in and out of cells.



Centrosomes

paired cylindrical organelles near nucleus, are at right angles to each other and involved in cellular division.



Body composition

In average young adult male,

- **18% of the body weight is protein and related substances,**
- **7% is mineral,**
- **15% is fat.**
- **The remaining 60% is water. The intracellular component of water accounts for about 40% of the body weight and the extracellular component for about 20%.**

Body fluids and homeostasis

Homeostasis is the various physiological arrangements which serve to restore the normal state.

Many of these regulatory mechanisms operate on the principle of negative feedback.

- Examples:
1) Maintaining of normal water content of the blood
2) Maintaining of normal sodium chloride content of the blood.

Transport across cell membrane

Simple diffusion

is not carrier mediated, occurs down the concentration gradient i.e. downhill, and does not require energy, i.e. it is passive.

Facilitated diffusion

is carrier mediated, occurs down the concentration gradient i.e. downhill, and does not require energy, i.e. it is passive).
It is more rapid than simple diffusion. Examples are GLUT1-4.

Active transport

is carrier mediated, occurs against the concentration gradient i.e. uphill, and requires energy.

Osmosis and Osmolarity

Osmolarity is the concentration of osmotically active particles in the solution.

It can be calculated using equation.
Osmolarity (osmol/L) = g X C
g: concentration in mol/L,
C: number of particles in the solution in osmol/mol

Two solutions having the same calculated osmolarity or osmotic pressure are **isosmotic or isotonic**.

- The solution with higher osmolarity or osmotic pressure are said to be **hyperosmotic or hypertonic**.

- The solution with lower osmolarity or osmotic pressure are said to be **hyposmotic or hypotonic**.

Everything in this world can be seen as you wish to.
Good or Bad; Simple or
Complicated; Easy or Difficult.

Its not how things are;
its about how you look up to them.
...and how you look up to them is all up to you.

Have a cheerful day !!!