Function organization of the human body

The goal of physiology is to explain the physical and chemical factors that are responsible for the origin, development, and progression of life. Each type of life, from the simple virus to the largest tree or the complicated human being, has its own functional characteristics. Therefore, the vast field of physiology can be divided into viral physiology, bacterial physiology, cellular physiology, plant physiology, human physiology, and many more subdivisions.

Human Physiology:

In human physiology, we attempt to explain the specific characteristics mechanisms of the human body that make it a living being

The basic living unit of the body is the cell. Each organ is an aggregate of many different cells held together by intercellular supporting structures.

Extracellular Fluid—The "Internal Environment"

About 60 per cent of the adult human body is fluid, mainly a water solution of ions and other substances. Although most of this fluid is inside the cells and is called intracellular fluid, about one third is in the spaces outside the cells and is called extracellular fluid. This extracellular fluid is in constant motion throughout the body. It is transported rapidly in the circulating blood and then mixed between the blood and the tissue fluids by diffusion through the capillary walls. In the extracellular fluid are the ions and nutrients needed by the cells to maintain cell life. Thus, all cells live in essentially the same environment—the extracellular fluid. For this reason, the extracellular fluid is also called the internal environment of the body.

The extracellular fluid contains large amounts of sodium, chloride, and bicarbonate ions plus nutrients for the cells, such as oxygen, glucose, fatty acids, and amino acids. It also contains carbon dioxide that is being transported from the cells to the lungs to be excreted, plus other cellular waste products that are being transported to the kidneys for excretion.

The intracellular fluid differs significantly from the extracellular fluid; specifically, it contains large amounts of potassium, magnesium, and phosphate ions instead of the sodium and chloride ions found in the extracellular fluid. Special mechanisms for transporting ions through the cell membranes maintain the ion concentration differences between the extracellular and intracellular fluids.

"Homeostatic" Mechanisms of the Major Functional Systems

The term homeostasis is used by physiologists to mean maintenance of nearly constant conditions in the internal environment. Essentially all organs and tissues of the body perform functions that help maintain these constant conditions.

Origin of Nutrients in the Extracellular Fluid

Respiratory System. Each time the blood passes through the body, it also flows through the lungs. The blood picks up oxygen in the alveoli, thus acquiring the oxygen needed by the cells. The membrane between the alveoli and the lumen of the pulmonary capillaries, the alveolar membrane, is only 0.4 to 2.0 micrometers thick, and oxygen diffuses by molecular motion through the pores of this membrane into the blood in the same manner that water and ions diffuse through walls of the tissue capillaries.

Gastrointestinal Tract.

A large portion of the blood pumped by the heart also passes through the walls of the gastrointestinal tract. Here different dissolved nutrients, including carbohydrates, fatty acids, and amino acids, are absorbed from the ingested food into the extracellular fluid of the blood.

Liver and Other Organs That Perform Primarily Metabolic Functions. Not all substances absorbed from the gastrointestinal tract can be used in their absorbed form by the cells. The liver changes the chemical compositions of many of these substances to more usable forms, and other tissues of the body—fat cells, gastrointestinal mucosa, kidneys, and endocrine glands—help modify the absorbed substances or store them until they are needed.

Musculoskeletal System. Sometimes the question is asked, how does the musculoskeletal system fit into the homeostatic functions of the body? The answer is obvious and simple: Were it not for the muscles, the body could not move to the appropriate place at the appropriate time to obtain the foods required for nutrition. The musculoskeletal system also provides motility for protection against adverse surroundings, without which the entire body, along with its homeostatic mechanisms, could be destroyed instantaneously.

Removal of Metabolic End Products

Removal of Carbon Dioxide by the Lungs. At the same time that blood picks up oxygen in the lungs, carbon dioxide is released from the blood into the lung alveoli; the respiratory movement of air into and out of the lungs carries the carbon dioxide to the atmosphere. Carbon dioxide is the most abundant of all the end products of metabolism.

Kidneys. Passage of the blood through the kidneys removes from the plasma most of the other substances besides carbon dioxide that are not needed by the cells. These substances include different end products of cellular metabolism, such as urea and uric

acid; they also include excesses of ions and water from the food that might have accumulated in the extracellular fluid. The kidneys perform their function by first filtering large quantities of plasma through the glomeruli into the tubules and then reabsorbing into the blood those substances needed by the body, such as glucose, amino acids, appropriate amounts of water, and many of the ions. Most of the other substances that are not needed by the body, especially the metabolic end products such as urea, are reabsorbed poorly and pass through the renal tubules into the urine.

Regulation of Body Functions

Nervous System. The nervous system is composed of three major parts: the sensory input portion, the central nervous system (or integrative portion), and the motor output portion. Sensory receptors detect the state of the body or the state of the surroundings.

receptors in the skin apprise one whenever an object touches the skin at any point. The eyes are sensory organs that give one a visual image of the surrounding area. The ears also are sensory organs. The central nervous system is composed of the brain and spinal cord. The brain can store information, generate thoughts, create ambition, and determine reactions that the body performs in response to the sensations. Appropriate signals are then transmitted through the motor output portion of the nervous system to carry out one's desires. A large segment of the nervous system is called the autonomic system. It operates at a subconscious level and controls many functions of the internal organs, including the level of pumping activity by the heart, movements of the gastrointestinal tract, and secretion by many of the body's glands.

Hormonal system of Regulation

Located in the body are eight major endocrine glands that secrete chemical substances called hormones. Hormones are transported in the extracellular fluid to all parts of the body to help regulate cellular function. For instance, thyroid hormone increases the rates of most chemical reactions in all cells, thus helping to set the tempo of bodily activity. Insulin controls glucose metabolism; adrenocortical hormones control sodium ion, potassium ion, and protein metabolism; and parathyroid hormone controls bone calcium and phosphate. Thus, the hormones are a system of regulation that complements the nervous system. The nervous system regulates mainly muscular and secretory activities of the body, whereas the hormonal system regulates many metabolic functions.

Reproduction

Sometimes reproduction is not considered a homeostatic function. It does, however, help maintain homeostasis by generating new beings to take the place of those that are

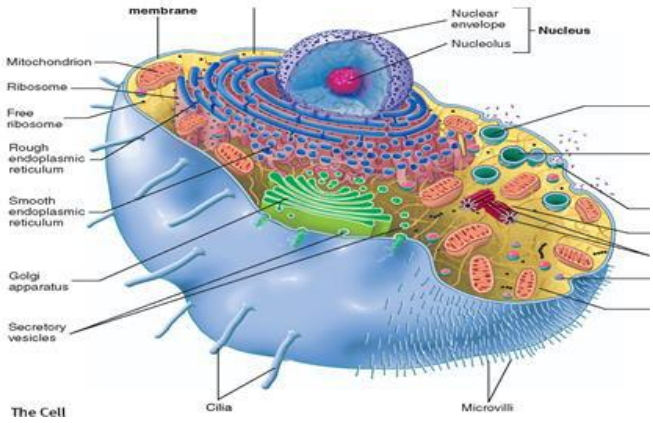
dying. This may sound like a permissive usage of the term homeostasis, but it illustrates that, in the final analysis, essentially all body structures are organized such that they help maintain the automaticity and continuity of life.

Control Systems of the Body

The human body has thousands of control systems in it. The most intricate of these are the genetic control systems that operate in all cells to help control intracellular function as well as extracellular function.

CELL

Cell is defined as the structural and functional unit of the living body because it has all the characteristics of life.



TISSUES The tissue is defined as the group of cells having similar function. The tissues are classified into four major types which are called the primary tissues.

1- The primary tissues include1. Muscle tissue – skeletal muscle, smooth muscle and cardiac muscle

2. Nervous tissue – neurons and supporting cells

3. Epithelial tissue – squamous, columnar and cuboidal epithelial cells

4. Connective tissue – connective tissue proper, cartilage, bone and blood.

ORGANS An organ is defined as the structure that is formed by two or more primary tissues. Some organs are composed of all the four types of primary tissues. The organs may be tubular like intestine or hollow like stomach.

SYSTEMS

The system is defined as group of organs functioning together to perform a specific function of the body. For example, digestive system is made out of groups of organs like esophagus, stomach, intestine etc., which is concerned with digestion of food particles.

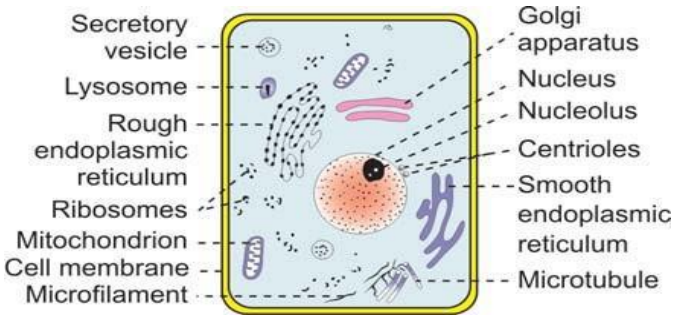
STRUCTURE OF THE CELL

Each cell is formed by a cell body and a cell membrane or plasma membrane that covers the cell body. The important parts of the cell are :

a. Cell membrane

b. Nucleus

c. Cytoplasm with organelles



CELL MEMBRANE

The cell membrane is a protective sheath that envelops the cell body. It separates the fluid outside the cell called extracellular fluid (ECF) and the fluid inside the cell called intracellular fluid (ICF). It is a semipermeable membrane and allows free exchange of certain substances between ECF and ICF .

COMPOSITION OF CELL MEMBRANE The cell membrane is composed of three types of substances:

1. Proteins (55%)

2. Lipids (40%)

3. Carbohydrates (5%).

STRUCTURE OF CELL MEMBRANE

The cell membrane is a unit membrane having the ‘fluid mosaic model’ i.e., the membrane is a fluid with mosaic of proteins (mosaic means pattern formed by arrangement of different colored pieces of stone, tile, glass or other such materials) **lipids and carbohydrates**. The electron microscopic study reveals three layers in the cell membrane namely, one electron lucent lipid layer in the center and two electron

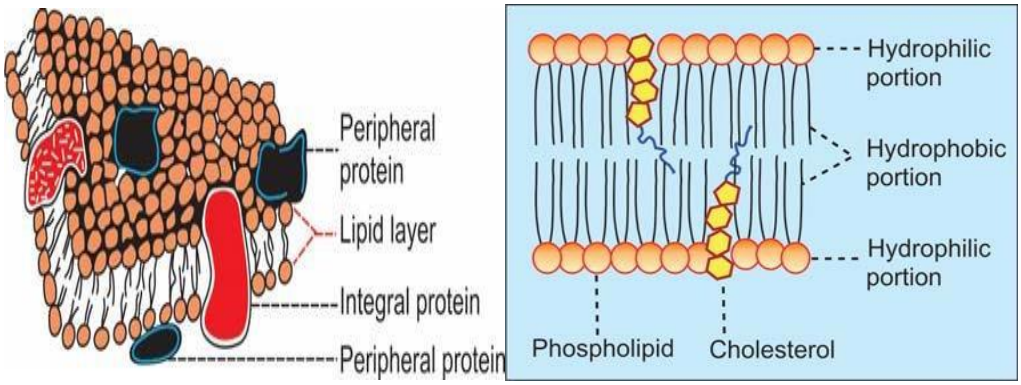
dense layers on either side of the central layer. **Carbohydrate molecules are found on the surface of the cell membrane.**

Lipid Layer of Cell Membrane:

It is a bi-layered structure formed by a thin film of lipids. It is fluid in nature and the portions of the membrane along with the dissolved substances move to all areas of the cell membrane.

The major lipids are:

1. Phospholipids
2. Cholesterol



Functions of lipid layer: The lipid layer is semi permeable in nature and allows only the fat-soluble substances like oxygen, carbon dioxide and alcohol to pass through it. It does not allow the water-soluble materials like glucose, urea and electrolytes to pass through it.

Protein Layers of the Cell Membrane: The protein layers of the cell membrane are the electron dense layers situated on either side of the central lipid layer. The protein substances present in these layers are mostly glycoproteins. These protein molecules are classified into two categories:

a. Integral proteins

b. Peripheral proteins

Functions of protein layers

1. Integral proteins provide structural integrity of the cell membrane
2. Channel proteins provide route for diffusion of water-soluble substances like glucose and electrolytes
3. Carrier proteins help in transport of substances across the cell membrane
4. Receptor proteins serve as receptor sites for hormones and neurotransmitters

5. Enzymes: some of the protein molecules form the enzymes which control chemical reactions within the cell membrane

6. Antigens: Some proteins act as antigens and induce the process of antibody formation.

Carbohydrates of the Cell Membrane Carbohydrate molecules form a thin loose covering over the entire surface of the cell membrane called glycocalyx. Some carbohydrate molecules are attached with proteins and form glycoproteins and some are attached with lipids and form glycolipids.

Functions of carbohydrates

1. The carbohydrate molecules are negatively charged and do not permit the negatively charged substances to move in and out of the cell.

2. The glycocalyx from the neighboring cells helps in the tight fixation of cells with one another.

3. Some of the carbohydrate molecules form the receptors for some hormones.

FUNCTIONS OF CELL MEMBRANE

1. Protective function: Cell membrane protects the cytoplasm and the organelles present in the cytoplasm.

2. Selective permeability: Cell membrane acts as a semipermeable membrane which allows only some substances to pass through it and acts as a barrier for other substances.
3. Absorptive function: Nutrients are absorbed into the cell through the cell membrane.
4. Excretory function: Metabolites and other waste products from the cell are excreted out through the cell membrane.

5. Exchange of gases: Oxygen enters the cell from the blood and carbon dioxide leaves the cell and enters the blood through the cell membrane. 6. Maintenance of shape and size of the cell: Cell membrane is responsible for the maintenance of shape and size of the cell.

CYTOPLASM: The cytoplasm is the fluid present inside the cell. It contains a clear liquid portion called cytosol which contains various substances like proteins, carbohydrates, lipids and electrolytes. Apart from these substances, many organelles are also present in cytoplasm. The cytoplasm is distributed as peripheral ectoplasm just beneath the cell membrane and inner endoplasm between the ectoplasm and the nucleus.

ORGANELLES IN CYTOPLASM

All the cells in the body contain some common structures called organelles in the cytoplasm. Some organelles are bound by limiting membrane and others do not have limiting membrane. The organelles carry out the various functions of the cell.

1. ENDOPLASMIC RETICULUM

Endoplasmic reticulum is made up of tubules and microsomal vesicles. These structures form an interconnected network which acts as the link between the organelles and cell membrane. Types of Endoplasmic Reticulum The endoplasmic reticulum is of two types namely, rough endoplasmic reticulum and smooth endoplasmic reticulum.

Functions of rough endoplasmic reticulum

It is concerned with the protein synthesis in the cell, especially those secreted from the cell leukocytes.

It also plays an important role in degradation of worn out cytoplasmic organelles like mitochondria. It wraps itself around the worn out organelles and forms a vacuole which is often called the autophagosome. It is digested by lysosomal enzymes.

Functions of smooth endoplasmic reticulum

i. It is responsible for synthesis of cholesterol and steroid

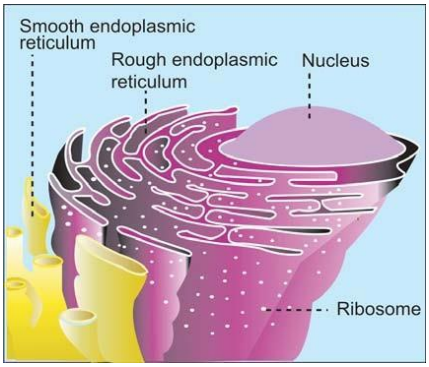
ii. It is concerned with various metabolic processes of the cell because of the presence of many enzymes on the outer surface

iii. It is concerned with the storage and metabolism of calcium

iv. It is also concerned with catabolism and detoxification of toxic substances like some drugs and carcinogens (cancer producing substances) in liver.

Rough endoplasmic reticulum and smooth endoplasmic reticulum

are interconnected and continuous with one another. Depending upon the activities of the cells, the rough endoplasmic reticulum changes to smooth endoplasmic reticulum and vice versa



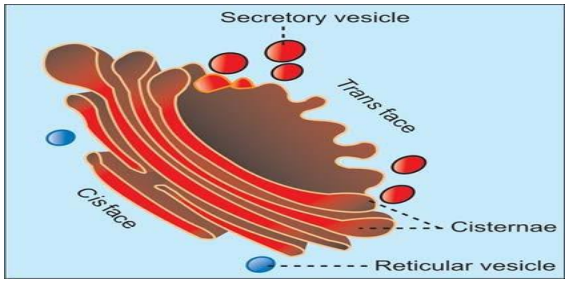
GOIGI APPARATUS

The Golgi apparatus is situated near the nucleus. It has two ends or faces namely, *cis* face and *trans* face. The *cis* face is positioned near the endoplasmic reticulum. The reticular vesicles from endoplasmic reticulum enter the Golgi apparatus through *cis* face. The *trans* face is situated near the cell membrane. The processed substances make their exit from Golgi apparatus through *trans* face.

Functions of Golgi Apparatus

i. It is concerned with the processing and delivery of substances like proteins and lipids to different parts of the cell.

ii. It functions like a post office because, it packs the processed materials into the secretory granules, secretory vesicles, and lysosomes
iii. It also functions like a shipping department of the cell because it sorts out and labels the materials for distribution to their proper destinations.



Lysosomes
These are small globular structures filled with enzymes. These enzymes are synthesized in rough endoplasmic reticulum and transported to the Golgi apparatus.
Lysosomes are of two types:
i. Primary lysosome which is pinched off from Golgi apparatus. It is inactive in spite of having the hydrolytic enzymes.
ii. Secondary lysosome which is active lysosome formed by the fusion of a primary lysosome with phagosome or endosome.
Functions of Lysosomes
i. Digestion of unwanted substances with the help of hydrolytic enzymes like proteases, lipases, amylases and nucleases, lysosome digests and removes the unwanted substances.

ii. Removal of excess secretory products in the cells
Lysosomes in the cells of the secretory glands play an important role in the removal of excess secretory products by degrading the secretory granules.
iii. Secretory function – Secretory lysosomes
Recently, lysosomes having secretory function called secretory lysosomes are found in some of the cells, particularly in the cells of immune system. The conventional lysosomes are modified into secretory lysosomes by combining with secretory granules
Peroxisomes
Peroxisomes are otherwise called as microbodies. These are pinched off from endoplasmic reticulum. Peroxisomes contain some oxidative enzymes such as catalase, urate oxidase and D-amino acid oxidase.

Functions of Peroxisomes
i. Degrade the toxic substances like hydrogen peroxide and other metabolic products by means of detoxification
ii. Form the major site of oxygen utilization in the cells
iii. Break down the excess fatty acids
iv. Accelerate gluconeogenesis from fats
v. Degrade purine to uric acid
vi. Participate in the formation of myelin and bile acids.

Centrosome AND CENTRIOLES

The centrosome is situated near the center of the cell close to the nucleus. It consists of two cylindrical structures called centrioles which are responsible for the movement of chromosomes during cell division.

Secretory VESICLES

The secretory vesicles are globular structures, formed in the endoplasmic reticulum, and processed and packed in Golgi apparatus. When necessary, the secretory vesicles rupture and release the secretory substances into the cytoplasm.

MITOCHONDRION

The mitochondrion is a rod or oval shaped structure with a diameter of 0.5 to 1 μ. It is covered by a double layered membrane.

Functions of Mitochondrion

i. The mitochondrion is called the 'power house of the cell' because it produces the energy required for the cellular functions. The energy is produced by oxidation of the food substances like proteins, carbohydrates and lipids by the oxidative enzymes in cristae. During oxidation, water and carbon dioxide are produced with release of energy. The released energy is stored in mitochondria and used later for synthesis of ATP.

ii. The components of respiratory chain in the mitochondrion are responsible for the synthesis of ATP by utilizing the energy through oxidative phosphorylation. The ATP molecules defuse throughout the cell from mitochondrion. Whenever energy is needed for cellular activity, the ATP molecules are broken down

ORGANELLES WITHOUT LIMITING MEMBRANE

RIBOSOMES

The ribosomes are small granular structures with a diameter of 15 nm. The ribosomes are made up of proteins (35%) and RNA (65%). The RNA present in ribosomes is called ribosomal RNA (rRNA).

Functions of Ribosomes

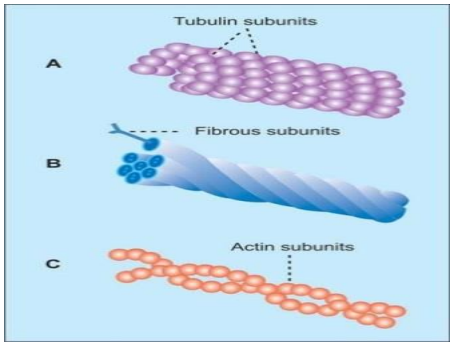
Ribosomes are called protein factories because of their role in the synthesis of proteins. Messenger RNA (mRNA) passes the genetic code for protein synthesis from nucleus to the ribosomes. The ribosomes, in turn arrange the amino acids into small units of proteins. The ribosomes attached with endoplasmic reticulum are involved in the synthesis of proteins like the enzymatic proteins, hormonal proteins, lysosomal proteins and the proteins of the cell membrane. The free ribosomes are responsible for the synthesis of proteins in hemoglobin, peroxisome and mitochondria.

Cytoskeleton

The cytoskeleton of the cell is a complex network that gives shape, support and stability to the cell. It is also essential for the cellular movements and the response of the cell to external stimuli. The cytoskeleton consists of three major protein components viz.

a. Microtubules
b. Intermediate filaments
c. Microfilaments

Microtubules
Microtubules are straight and hollow tubular structures formed by bundles of globular
Functions of microtubules
Microtubules:
i. Determine the shape of the cell
ii. Give structural strength to the cell
iii. Responsible for the movements of centrioles and the complex cellular structures like cilia
iv. Act like conveyer belts which allow the movement of granules, vesicles, protein molecules and some organelles like mitochondria to different parts of the cell
v. Form the spindle fibers which separate the chromosomes during mitosis
Intermediate Filaments
The intermediate filaments form a network around the nucleus and extend to the periphery of the cell. These filaments are formed by fibrous proteins and help to maintain the shape of the cell. The adjacent cells are connected by intermediate



filaments by desmosomes.

Microfilaments
Microfilaments are long and fine thread like structures which are made up of non-tubular contractile proteins called actin and myosin. Actin is more abundant than myosin.

Functions of microfilaments
Microfilaments:
i. Give structural strength to the cell
ii. Provide resistance to the cell against the pulling forces
iii. Responsible for cellular movements like contraction, gliding and cytokinesis (partition of cytoplasm during cell division).

NUCLEUS

Nucleus is present in those cells which divide and produce enzymes. The cells with nucleus are called eukaryotes and those without nucleus are known as prokaryotes (e.g. red blood cells). Prokaryotes do not divide or synthesize the enzymes.
Most of the cells have only one nucleus (uninucleated). Few types of cells like skeletal muscle cells have many nuclei (multinucleated). Generally the nucleus is located near the center of the cell. It is mostly spherical in shape. However, the shape and situation of nucleus vary in different cells.

Nuclear Membrane

The nucleus is covered by a double layered membrane called nuclear membrane. It encloses the fluid called nucleoplasm. Nuclear membrane is porous and permeable in nature and it allows nucleoplasm to communicate with the cytoplasm

Nucleoplasm

It is a gel like ground substance and contains large quantities of the genetic material in the form of DNA. The DNA is made up of chromatin threads. These chromatin threads become the rod shaped chromosomes just before the cell division.

Nucleoli

One or more nucleoli are present in each nucleus. The nucleolus contains RNA and some proteins, which are similar to those found in ribosomes. The RNA is synthesized by chromosomes and stored in the nucleolus.

FUNCTIONS OF NUCLEUS

1. Controls all the activities of the cell
2. Synthesizes RNA
3. Forms subunits of ribosomes
4. Sends genetic instruction to the cytoplasm for protein synthesis through mRNA
5. Controls the cell division through genes
6. Stores the hereditary information (in genes) and transforms this information from one generation of the species to the next.

Functions OF NUCLEUS

Nucleus:

1. Controls all the activities of the cell 2. Synthesizes RNA 3. Forms subunits of ribosomes

4. Sends genetic instruction to the cytoplasm for protein synthesis through mRNA

5. Controls the cell division through genes 6. Stores the hereditary information (in genes) and transforms this information from one generation of the species to the next. CELL DEATH The cell death occurs by two distinct processes:

1. Necrosis 2. Apoptosis.

APOPTOSIS Apoptosis is defined as the programmed cell death under genetic control. Originally apoptosis (means ‘falling leaves’ in Greek) refers to the process by which the leaves fall from trees in autumn. It is also called ‘cell suicide’ since the genes of the cell play a major role in the death. This type of programmed cell death is a normal phenomenon and it is essential for normal development of the body. The main function of apoptosis is to remove unwanted cells without causing any stress or damage to the neighboring cells.

The functional significance of apoptosis:

1. Plays a vital role in cellular homeostasis. About 10 million cells are produced every day in human body by mitosis. An equal number of cells die by apoptosis. This helps in cellular homeostasis

2. Useful for removal of a cell that is damaged by a virus or a toxin beyond repair

3. An essential event during the development and in adult stage.

i. A large number of neurons are produced during the development of central nervous system. But up to 50% of the neurons are removed by apoptosis during the formation of synapses between neurons

ii. Apoptosis is responsible for the removal of tissues of webs between fingers and toes during developmental stage in fetus

iii. It is necessary for regression and disappearance of duct systems during sex differentiation in fetus iv. The cell that looses the contact with neighboring cells or basal lamina in the epithelial tissue dies by apoptosis. This is essential for the death of old enterocytes shed into the lumen of intestinal glands v. It plays an important role in the cyclic sloughing of the inner layer of endometrium resulting in menstruation vi. Apoptosis removes the auto-aggressive T cells and prevents autoimmune diseases.

NECROSIS

Necrosis (means 'dead' in Greek) is the uncontrolled and unprogrammed death of cells also called 'cell murder' because the cell is killed by extracellular or external events. after necrosis,

Causes for Necrosis Common causes of necrosis are injury, infection, inflammation, infarction and cancer. Necrosis is induced by both physical and chemical events such as heat, radiation, trauma, hypoxia due to lack of blood flow, and exposure to toxins.

Cell Junctions

DEFINITION AND CLASSIFICATION

The connection between the cells or the contact between the cell and extracellular matrix is called the cell junction. It is also called as membrane junction. It is generally classified into three types:

1. Occluding junction
2. Communicating junction
3. Anchoring junction

OCCLUDING JUNCTION

The junction which prevents the movement of ions and molecules from one cell to another cell is called the occluding junction. Tight junctions belong to this category.

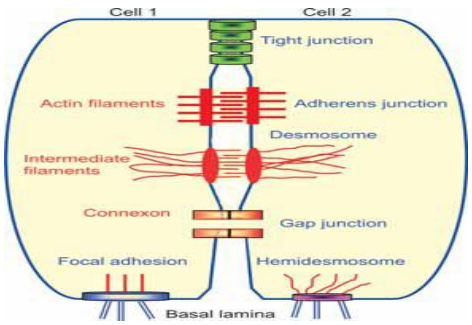
TIGHT JUNCTION

It is formed by the tight fusion of the cell membranes from the adjacent cells. The area of the fusion is very tight and forms a ridge. This type of junction is present in the apical

margins of epithelial cells in intestinal mucosa, wall of renal tubule, capillary wall and choroid

Functions of Tight Junctions

1. The tight junctions hold the neighboring cells of the tissues firmly and thus provide strength and stability to the tissues.
2. It provides the barrier or gate function by which the interchange of ions, water and macromolecules between the cells is regulated.
3. It acts like a fence by preventing the lateral movement of integral membrane proteins and lipids from cell membrane
4. By the fencing function, the tight junctions maintains the cell polarity by keeping the proteins in the apical region of the cell membrane.
5. Tight junctions in the brain capillaries form the blood-brain barrier (BBB) which prevents the entrance of many harmful substances from the blood into the brain tissues.



Different types of cell junctions

COMMUNICATING JUNCTIONS

The junctions, which permit the movement of ions and molecules from one cell to another cell, are called communicating junctions. Gap junction and chemical synapse are the communicating junctions.

GAP JUNCTION OR NEXUS

The gap junction is also called nexus. It is present in heart, basal part of epithelial cells of intestinal mucosa, etc.

Structure of Gap Junction

The membranes of the two adjacent cells lie very close to each other and the intercellular space becomes a narrow channel. The cytoplasm of the two cells is interconnected and the molecules move from one cell to another cell through these channels without having contact with ECF. The channel is surrounded by 6 subunits of proteins which are called connexins or connexons.

Functions of Gap Junction

1. The diameter of the channel in the gap junction is about 1.5 to 3 nm. So, the substances having molecular weight less than 1000 such as glucose also can pass through this junction easily
2. It helps in the exchange of chemical messengers between the cells
3. It helps in rapid propagation of action potential from one cell to another cell.

CHEMICAL SYNAPSE

Chemical synapse is the junction between a nerve fiber and a muscle fiber or between two nerve fibers, through which the signals are transmitted by the release of chemical transmitter.

ANCHORING JUNCTIONS

Anchoring junctions are the junctions, which provide firm structural attachment between two cells or between a cell and the extracellular matrix. There are four types of anchoring junctions

i. Adherens junctions (cell to cell)
ii. Focal adhesions (cell to matrix)
iii. Desmosomes (cell to cell)
iv. Hemidesmosomes (cell to matrix)

ADHERENS JUNCTIONS

These are cell to cell junctions that is the junctions found between the cells. The connection occurs through the actin filaments. Adherens junctions are present in the intercalated discs of cardiac muscles and epidermis of the skin.

FOCAL ADHESIONS

These are cell to matrix junctions that is junctions between the cell and the extracellular matrix. The connection occurs through the actin filaments. This type of junction is seen in epithelia of various organs.

DESMOSOME

Desmosome is also cell to cell junction, but here the membranes of the cells are thickened and connected by intermediate filaments. So, desmosome functions like tight junction. This type of junction is found in areas subjected for stretching such as the skin

.

HEMIDESMOSOME

Hemidesmosome is also cell to matrix junction and the connection is through intermediate filaments. It is like half desmosome because here, the membrane of only one cell thickens. So, this is known as hemidesmosome or half desmosome. Mostly, the hemidesmosome connects the cells with their basal lamina.