Cell components and functions in metabolism

A Cell is the elementary structure, function and biological unit of an organism.

NUCLEUS: The nucleus is the master control centre of the cell. It gives command to the cell to grow, divide, mature or die. It contains genes, stores the DNA (deoxyribonucleic acid), which determines every aspect of human anatomy and physiology. The DNA is arranged into chromosomes which also contains the outlines specific use for each type of cell and also allows for replication of the cell.

Nuclear Envelope: The nucleus is surrounded by a membrane called the nuclear envelope, which protects the DNA and separates the nucleus from the rest of the cell.

Nucleolus: The nucleolus is a round body located inside the nucleus. Ribosomal subunits from proteins and ribosomal RNA, also called rRNA are both proteins made by the nucleolus. These subunits are then sent out to the other parts of the cell where they merge into whole ribosome.

Plasma Membrane: The cell membrane is the outer covering of the cell and contains the cytoplasm, substances within it are organelle. It is a double-layered membrane composed of proteins and lipids. The lipid molecules on the outer and inner part (lipid bilayer) allow it to selectively transport substances in and out of the cell.

Endoplasmic Reticulum: The endoplasmic reticulum (ER) is a membranous structure that contains a network of tubules and vesicles. It is structured that

substances can move through it and be kept in isolation from the rest of the cell until the manufacturing processes conducted within are completed.

There are two types of endoplasmic reticulum – Rough (granular) and Smooth (granular).

Rough Endoplasmic: contains a combination of proteins and enzymes. These parts of the endoplasmic reticulum contain a number of ribosomes giving it a rough appearance. Its purpose is to synthesise new proteins.

Smooth Endoplasmic: does not have any attached ribosomes. Its purpose is to synthesise different types of lipids (fats). The smooth ER also plays a role in drug and carbohydrate metabolism.

Golgi apparatus: is a packed collection of flat vesicles. It receives substances produced from the endoplasmic reticulum which are transported as vesicles and fuses with the Golgi apparatus. They are stored in the Golgi apparatus and converted into different substances that are necessary for the cell's various functions.

Lysosomes: are vesicles that break off from the Golgi apparatus. They differ in size and function depending on the type of cell. Lysosomes contain enzymes that help with the digestion of nutrients in the cell and help breakdown any cellular debris or invading microorganisms like bacteria.

Ribosomesa minute particle consisting of RNA and associated proteins found in large numbers in the cytoplasm of living cells. They bind messenger RNA and transfer RNA to synthesize polypeptides and proteins.

Mitochondria: These are the powerhouses of the cell which help to breakdown nutrients to produce energy. It also produces a high-energy compound called ATP (adenosine triphosphate) which can be used as a simple energy source elsewhere. Mitochondria are composed of two membranous layers – an outer membrane that surrounds the structure and an inner membrane that provides the physical sites of energy production. The inner membrane has many in folding layers that form shelves where enzymes attach and oxidize nutrients. The mitochondria also contain DNA which allows it to replicate and to be used where necessary.

Centrioles: They are spindle fibres which move chromosomes during nuclear division. Centriole are made protein strands known as microtubules which are arranged in a specific way. There are nine groups of microtubules. When two centrioles are found next to each other, they are usually at right angles. The centrioles are found in pairs and move towards the poles (opposite ends) of the nucleus when it is time for cell division.

Cytoplasm: The cytoplasm is made up of a jelly-like fluid (called the cytosol) which contains enzymes, salts, amino- acids and sugar which are important for the function and other structures that are in the cell

Microfilaments and Microtubules: Microfilaments and microtubules are rigid protein substances that form the internal skeleton of the cell known as the cytoskeleton. Some of the microtubules also make up the centrioles and mitotic spindles within the cell which are responsible for the division of the cytoplasm when the cell divides. The microtubules are the central component of cilia, small hair-like projections that protrude from the surface

of certain cells. It is also the central component of specialised cilia like the tail of the sperm cells which beats in a manner to allow the cell to move in a fluid medium.

Insight into the cell organelles in metabolism,

Individual organelle cannot function on its own, all the cell organelles are essential for the cell to perform all of its functions.

The cell takes in nutrients in a vesicle. This vesicle then combine with thelysosome, which contains digestive enzymes. The enzymes will break down the nutrients into smaller, usable pieces. Large carbohydrates are broken down into glucose, and proteins are broken down into amino acids.

The pieces then go to themitochondria, the powerhouses of the cell which help to breakdown nutrients to produce energy. It also produces a high-energy compound called ATP (adenosine triphosphate) which can be used as a simple energy source for many different cellular reactions.

In the meantime, thenucleusstores the DNA (deoxyribonucleic acid), which has the data for making proteins. The nucleus codes a piece of messenger RNA to be made, which will then go to theribosome, the organelle that makes proteins.

If the protein is going to be secreted from the cell, this ribosome will be part of therough endoplasmic reticulum(rough ER).

The ribosome (made in thenucleolus, which is inside the nucleus), interprets the messenger RNA into protein. Amino acids, which may have come from

the food the cell brought in earlier will be used. The protein travels from the roughERto theGolgi body, where it receives and puts touches it might need. The Golgi then sends the protein out of the cell, to wherever it needs to be.

None of these cell organelles can perform its task without help from others. Protein will not be made by the nucleus without the ribosomes,

Cellular respiration will not be performed by the mitochondria if the lysosomes don’t break down the food,

The ribosomes cannot add amino acids without help from the nucleus, mitochondrion, and lysosomes.

Ciliated Columnar Epithelium is not really stratified since it does not have more than one layer. The cells are positioned in opposite directions, so it looks like more than one layer.

Cilia is on the surface of most of this tissue. Ciliaare structures shaped hair-like at the top end of a tissue that wave forwards and backwards to help move things.

Its functions are to secrete and propel mucus. This helps in protection for the organs of the upper respiratory tract. Can also be found in some tubules and organs of the male reproduction tract, in this instance the tissue does not contain cilia and functions to secrete.

When we breathe in a particle that shouldn’t be in our lungs, the cilia in our respiratory tract catch these particles and move them out, making us sneeze.

Ciliated epithelium can be found in ourrespiratory tract lining, theesophagus, the skin’s surface. It is also found in thefallopian. The cilia aids in moving egg from the ovary into the uterus each month.

Ciliated epithelium contains special cells calledgoblet cells. The reason of these cells is mucous creation. This mucous enclose particles that shouldn’t be in our body, and the cilia move them out. A lot of harmful bacteria would remain in our lungs if we do not have these cells and tissues, this will make us sick.

Skeletal muscle is known asstriated muscle, they have striations that run across their muscle fibers. The striations are end-to-end junctions of repeating units that are referred to as sarcomeres. Asarcomereis a functional unit of striated muscle, as it contains all the tools necessary for contraction. Skeletal muscle fibers are long and linear.

Skeletal muscle fibers are stacked neatly together in a parallel arrangement, these fibers are long, and they run the entire length of the muscle organ. I guess this is what my mother expected my room to look like – nice and orderly.

Skeletal muscleis a contractile organ that is directly or indirectly attached to bone. Skeletal muscles serve a variety offunctionsincluding support and movement and homeostasis. Skeletal muscle contraction can result inmuscle shorteningand thus movement of the bone to which it is attached. Additionally, skeletal muscle contraction can maintain posture and position. Sphincters, composed of skeletal muscles, regulate movement through our digestive and urinary systems, thus, controlling swallowing, defecation and

even urination. Skeletal muscle contractiongenerates heat, which helps to maintain body temperature. Finally, muscle proteinscan be converted into glucose by the liver for homeostatic regulation of blood glucose.

Neuronsare specialized cells of the nervous system that transmit signals throughout the body. They have long extensions that extend out from the cell body calleddendritesandaxons. Dendrites are extensions of neurons that receive signals and conduct them toward the cell body. Axons are extensions of neurons that conduct signals away from the cell body to other cells.

When a neuron is in its resting state, the membrane is said to bepolarizedbecause negative and positive charges exist on opposite sides. When a neuron receives a signal, sodium channels in the membrane are opened and allow a localized influx of positive sodium ions inside the cell, which causesdepolarization, or a reduction of the difference in charge across the membrane. The localized depolarization also triggers nearby sodium channels to open up and depolarize the membrane nearby, which then causes more sodium channels to open up further away and depolarize the membrane there, and so a chain reaction is started. Depolarization occurs in a wave across the membrane, starting at the dendrite that received the signal, moving toward the cell body, moving across the cell body, and then away from the cell down the axon.

Axons terminate at junctions with their target cells calledsynapses. At the synapse, there is a small gap between the terminal end of the axon and the target cell. When the depolarizing signal reaches the synapse, it triggers the release of signaling molecules calledneurotransmitters. These

neurotransmitters diffuse across the very short gap from the axon to the surface of the target cell and bind to receptors that control ion channels, causing the ion channels to open. If the signaling neuron is excitatory, the ion channel will allow sodium ions to enter the cell and cause depolarization at the target cell. However, if the signaling neuron is inhibitory, a different ion channel will be opened that will allow inhibitory ions, like negatively charged chloride ions, into the cell that will increase polarization of the target cell and decrease the chances of depolarization even if the cell receives an excitatory signal at the same time.

Adipose tissueis termed a loose connective tissue. It is composed of fat-storage cells which can be seen under the skin and between the muscles, around the kidneys and heart, behind the eyeballs, and abdominal membranes. It helps as a sheet of protection, absorbing shock sustained by the tissue. It seals up space between organs and tissues.

It also provides structural and metabolic support. Adipose tissue has a number of important functions. It is a source of energy and serves as a buffer, protecting our internal organs from trauma. This buffering is provided byvisceral fat, which is fat enclosing our internal organs. Visceral fat can be helpful, but too much of it can be life threatening and increase risk of diabetes and heart disease.

It also provides us with the thermal insulation needed to maintain our body temperature and may provide endocrine function like the production of the hormoneleptin, which helps in the regulation of fat storage and body weight.

Babies have a continuous layer of adipose tissue for protection while learning to walk, this thin as they develop into adolescence. The sheet gives them that plumb appearance. The sheet also help in insulating the body thereby keeping the essential body temperature at 37 degree centigrade.

The three types of body system that will be considered are; the circulatory, respiratory and the digestive System

These three systems interrelate for the completion of the body function. The circulatory and the respiratory systems collaborate to perform the gas exchange function. Gas exchange is very important, without the gas exchange the cells of the body will die, therefore it is very important for these systems to work together.

Thedigestive systemis tasked with the duty of bringing food into the body and breaking it down into protein, vitamins, minerals, carbohydrates, and fats, which the body needs for energy, growth, and repair. From the diagram below, digestion starts from the mouth, where we swallow our food and use our saliva, teeth and tongue to bite and chew it. The food then makes its way to the stomach through the esophagus, where powerful acids break it down even further into nutrients. These nutrients enter the bloodstream through tiny hair-like projections. Any residual wastes are stored in the rectum and ejected through the anus.

Thecirculatory systemis tasked with the duty of transporting blood all over the body. It is made up of the heart and blood vessels known as veins, arteries and capillaries. Let us visualize the blood vessels as the motorways of the body, bringing vital goods to and from the cells. In the circulatory

system, blood is pumped from the heart to the lungs, so they’ll get oxygen, and then pumped to the body’s cells.

Therespiratory system, take in oxygen through the lungs and the oxygen then mixes with the blood in the circulatory system and then it is transported as ox haemoglobin to the cells by the circulatory system.

Thecirculatory systemalso transport the waste product carbon dioxide from the cells back to the respiratory system which expels it out of the body.

Therefore, without the respiratory system, oxygen would not be able to enter the body and carbon dioxide would not be able to be expelled out of the body as waste. Also without the circulatory system, oxygen and carbon dioxide would not be able to transport round the body thereby keeping the cells of the body alive.

The circulatory system interrelates with digestive system for a maximum heart rate.

Thedigestive systemproduces nutrients that is needed by the cells of the body for proper metabolism. Thecirculatory systemtransports these nutrients produced by thedigestive systemthrough the body cellsand alsotransport toxins that are harmful to the body out of the cells into the kidney to be destroyed and expelled out of the body.

If the circulatory system fails to function the body systems will shut down causing damage to the organs of the body and finally causing death.

Every system is important because without the function of one system the other system cannot function properly and therefore causing organ damage that would eventually lead to death.