DOWNLOAD PDF CELL BASIC UNIT OF LIFE

Chapter 1 : "Cells: The Basic Units Of Life" Quiz - ProProfs Quiz

Many of the basic structures found inside all types of cells, as well as the way those structures work, fundamentally are very similar, so the cell is said to be the fundamental unit of life. The most important characteristic of a cell is that it can reproduce by dividing.

They occur in the cytoplasm and are the sites where protein synthesis occurs. Ribosomes may occur singly in the cytoplasm or in groups or may be attached to the endoplasmic reticulum thus forming the rough endoplasmic reticulum. Ribosomes are important for protein production. Together with a structure known as messenger RNA a type of nucleic acid ribosomes form a structure known as a polyribosome which is important in protein synthesis. Free ribosomes found within cytoplasm. Diagram of several ribosomes joined together on a strand of mRNA to form a polyribosome. The Golgi body consists of a stack of flat membrane-bound sacs called cisternae. The cisternae within the Golgi body consist of enzymes which modify the packaged products of the Golgi body proteins. Schematic Diagram Micrograph Figure 2. Diagram showing Golgi bodies found in animal cells. TEM Micrograph of Golgi body, visible as a stack of semicircular black rings near the bottom. The Golgi body was discovered by the Italian physician Camillo Golgi. Functions of the Golgi body It is important for proteins to be transported from where they are synthesised to where they are required in the cell. The organelle responsible for this is the Golgi Body. The Golgi body is the sorting organelle of the cell. Proteins are transported from the rough endoplasmic reticulum RER to the Golgi. In the Golgi, proteins are modified and packaged into vesicle. The Golgi body therefore receives proteins made in one location in the cell and transfers these to another location within the cell where they are required. Vesicles and lysosomes ESG57 Vesicles are small, membrane-bound spherical sacs which facilitate the metabolism, transport and storage of molecules. Many vesicles are made in the Golgi body and the endoplasmic reticulum, or are made from parts of the cell membrane. Vesicles can be classified according to their contents and function. Transport vesicles transport molecules within the cell. Lysosomes are formed by the Golgi body and contain powerful digestive enzymes that can potentially digest the cell. Lysosomes are formed by the Golgi body or the endoplasmic reticulum. These powerful enzymes can digest cell structures and food molecules such as carbohydrates and proteins. Lysosomes are abundant in animal cells that ingest food through food vacuoles. When a cell dies, the lysosome releases its enzymes and digests the cell. Vacuoles ESG58 Vacuoles are membrane-bound, fluid-filled organelles that occur in the cytoplasm of most plant cells, but are very small or completely absent from animal cells. A selectively permeable membrane called the tonoplast, surround the vacuole. The vacuole contains cell sap which is a liquid consisting of water, mineral salts, sugars and amino acids. Functions of the vacuole The vacuole plays an important role in digestion and excretion of cellular waste and storage of water and organic and inorganic substances. The vacuole takes in and releases water by osmosis in response to changes in the cytoplasm, as well as in the environment around the cell. The vacuole is also responsible for maintaining the shape of plant cells. When the cell is full of water, the vacuole exerts pressure outwards, pushing the cell membrane against the cell wall. This pressure is called turgor pressure. If there is not sufficient water, pressure exerted by the vacuole is reduced and the cells become flaccid causing the plant to wilt. Centrioles ESG59 Animal cells contain a special organelle called a centriole. The centriole is a cylindrical tube-like structure that is composed of 9 microtubules arranged in a very particular pattern. Two centrioles arranged perpendicular to each other are referred to as a centrosome. The centrosome plays a very important role in cell division. The centrioles are responsible for organising the microtubules that position the chromosomes in the correct location during cell division. You will learn more about their function in the following chapter on Cell Division. A TEM micrograph of a cross-section of a centriole in an animal rat cell. There are three different types: White plastids found in roots. Green-coloured plastids found in plants and algae. Contain red, orange or yellow pigments and are common in ripening fruit, flowers or autumn leaves. Plastids perform a variety of functions in plants, including storage and energy production. The colour of plant flowers such as an orchid is controlled by a specialised organelle in a cell known as the chromoplast. Chloroplast The chloroplast is a double-membraned organelle. Within the double membrane is a gel-like substance called stroma. Stroma contains enzymes for photosynthesis. Each granum is a stack of thylakoid discs. The chlorophyll molecules green pigments are found on the surface of the thylakoid discs. Chlorophyll absorbs energy from the sun in order for photosynthesis to take place in the chloroplasts. The grana are connected by lamellae intergrana. The lamellae keep the stacks apart from each other. The structure of the chloroplast is neatly adapted to its function of trapping and storing energy in plants. For example, chloroplasts contain a high density of thylakoid discs and numerous grana to allow for increased surface area for the absorption of sunlight, thus producing a high quantity of food for the plant. Additionally, the lamellae keeping the thylakoids apart maximise chloroplast efficiency, thus allowing as much light as possible to be absorbed in the smallest surface area. Schematic Diagram Figure 2. Electron micrograph of chloroplast with grana and thylakoids. The differences between plant and animal cells ESG5C Now that we have looked at the basic structures and functions of the organelles in a cell, you would have noticed that there are key differences between plant and animal cells. The table below summarises these differences.

Chapter 2 : Basic Unit of Life: Plant Cell Structure and Functions

The cell is the structural and functional unit of life. It may be also regarded as the basic unit of biological activity. The concept of cell originated from the contributions of Schleiden and Schwann ().

Mitochondria are site of aerobic respiration. The matrix also possesses single circular DNA molecule, a few RNA molecules, ribosomes 70S and the components required for the synthesis of proteins. The mitochondria divide by fission and produce new mitochondria. Plastids Found in all plant cells and in euglenoides. They bear some specific pigments, thus imparting specific colours to the plants. Chloroplasts are mainly found in the mesophyll cells of the leaves. These are various shaped like lens, oval, spherical, discoid, ribbon. Double membrane bound Cell organelle. Inner is less permeable than outer. There are also stroma lamellae connecting the thylakoids of the different grana. Stroma also contains small, double-stranded circular DNA molecules and ribosomes 70S. Endoplasmic Reticulum a network or reticulum of tiny tubular structures scattered in the cytoplasm that is called the endoplasmic reticulum ER Hence, ER divides the intracellular space into two distinct compartments, i. Discovered by Camillo Golgi. They consist of many flat, disc-shaped sacs or cisternae stacked parallely. The Golgi cisternae are concentrically arranged near the nucleus with distinct convex cis or the forming face and concave trans or the maturing face, which are interconnected. The golgi apparatus principally performs the function of packaging materials. A number of proteins synthesised by ribosomes on the endoplasmic reticulum are modified in the cisternae of the golgi apparatus before they are released from its trans Golgi apparatus is the important site of formation of glycoproteins and glycolipids Lysosomes These are membrane bound vesicular structures formed by the process of packaging in the golgi apparatus. The isolated lysosomal vesicles have been found to be very rich in almost all types of hydrolytic enzymes hydrolases â€" lipases, proteases, carbohydrases optimally active at the acidic pH. These enzymes are capable of digesting carbohydrates, proteins, lipids and nucleic acids. Vacuoles Membrane-bound space found in the cytoplasm. Membrane known as tonoplast. It contains water, sap, excretory product and other materials not useful for the cell. In plant cells the vacuoles are very large. In plants, the tonoplast facilitates the transport of a number of ions and other materials against concentration gradients into the vacuole. In Amoeba the contractile vacuole is important for excretion. In many cells food vacuoles are formed by engulfing the food particles. They are composed of ribonucleic acid RNA and proteins. Not Bounded by any membrane. The eukaryotic ribosomes are 80S while the prokaryotic ribosomes are 70S. An elaborate network of filamentous proteinaceous structures present in the cytoplasm Functions are mechanical support, motility, maintenance of the shape of the cell. Cilia and Flagella They are hair like outgrowths of cell membrane responsible for locomotion and movement of cell. Cilia are small structures which work like oars, causing the movement of either the cell or the surrounding fluid. Flagella are comparatively longer. Eukaryotic cilium and flagellum are covered with plasma membrane. Their core called the axoneme, possesses a number of microtubules running parallel to the long axis. The axoneme usually has nine pairs of doublets of radially arranged peripheral microtubules, and a pair of centrally located microtubules. Centrosome and centriole Centrosome is an organelle usually containing two perpendicularly lying centrioles surrounded by amorphous pericentriolar materials. Centriole has an organisation like the cartwheel. They are made up of nine evenly spaced triplet peripheral fibrils of tubulin. The central part of the centriole is also proteinaceous and called the hub, connected with peripheral tubules by radial The centrioles form the basal body of cilia or flagella, and spindle fibres that give rise to spindle apparatus during cell division in animal cells. Many membrane bound minute vesicles called microbodies that contain various enzymes. They are present in both plant and animal cells. Nucleus first described by Robert Brown. The interphase nucleus has nucleoprotein fibres called chromatin, nuclear matrix and one or more spherical bodies called the nuclear envelope is consists of two parallel membranes with a space inbetween called perinuclear space. The outer membrane usually remains continuous with the endoplasmic reticulum and also bears ribosomes on it. At a number of places the nuclear envelope is interrupted by minute pores. These nuclear pores provide passages for movement of RNA and protein molecules. Normally, there is only one nucleus per cell. Some mature cells even lack nucleus, e. The nuclear matrix or the nucleoplasm contains nucleolus and chromatin. The nucleoli are spherical structures present in the nucleoplasm. It is non-membrane bound. It is a site for active ribosomal RNA synthesis. During cell division, chromatin network condenses into c Chromatin contains DNA and some basic proteins called histones, some non-histone proteins and also RNA. Every chromosome essentially has a primary constriction or the centromere on the sides of which disc shaped structures called kinetochores are present. Sometimes a few chromosomes have non-staining secondary constrictions at a constant location. This gives the appearance of a small fragment called the satellite.

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Chapter 3 : Cell Organelles | Cells: The Basic Units Of Life | Siyavula

The basic unit of life is the cell. In , scientists Theodor Schwann and Matthias Schleiden came up with the original version of the cell theory, which concluded that the basic unit of living things is the cell.

Cell membrane and membrane-bound organelles Subcellular components All cells, whether prokaryotic or eukaryotic , have a membrane that envelops the cell, regulates what moves in and out selectively permeable , and maintains the electric potential of the cell. There are also other kinds of biomolecules in cells. This article lists these primary cellular components , then briefly describes their function. Cell membrane Detailed diagram of lipid bilayer cell membrane The cell membrane , or plasma membrane, is a biological membrane that surrounds the cytoplasm of a cell. In animals, the plasma membrane is the outer boundary of the cell, while in plants and prokaryotes it is usually covered by a cell wall. This membrane serves to separate and protect a cell from its surrounding environment and is made mostly from a double layer of phospholipids , which are amphiphilic partly hydrophobic and partly hydrophilic. Hence, the layer is called a phospholipid bilayer , or sometimes a fluid mosaic membrane. Embedded within this membrane is a variety of protein molecules that act as channels and pumps that move different molecules into and out of the cell. Cell surface membranes also contain receptor proteins that allow cells to detect external signaling molecules such as hormones. Cytoskeleton A fluorescent image of an endothelial cell. Nuclei are stained blue, mitochondria are stained red, and microfilaments are stained green. The eukaryotic cytoskeleton is composed of microfilaments , intermediate filaments and microtubules. The subunit of microtubules is a dimeric molecule called tubulin. Intermediate filaments are heteropolymers whose subunits vary among the cell types in different tissues. But some of the subunit protein of intermediate filaments include vimentin , desmin , lamin lamins A, B and C , keratin multiple acidic and basic keratins , neurofilament proteins NFâ€”L, NFâ€”M. Genetic material Two different kinds of genetic material exist: Cells use DNA for their long-term information storage. The biological information contained in an organism is encoded in its DNA sequence. Prokaryotic genetic material is organized in a simple circular bacterial chromosome in the nucleoid region of the cytoplasm. Eukaryotic genetic material is divided into different, [3] linear molecules called chromosomes inside a discrete nucleus, usually with additional genetic material in some organelles like mitochondria and chloroplasts see endosymbiotic theory. A human cell has genetic material contained in the cell nucleus the nuclear genome and in the mitochondria the mitochondrial genome. In humans the nuclear genome is divided into 46 linear DNA molecules called chromosomes , including 22 homologous chromosome pairs and a pair of sex chromosomes. Although the mitochondrial DNA is very small compared to nuclear chromosomes, [3] it codes for 13 proteins involved in mitochondrial energy production and specific tRNAs. Foreign genetic material most commonly DNA can also be artificially introduced into the cell by a process called transfection. Certain viruses also insert their genetic material into the genome. There are several types of organelles in a cell. Some such as the nucleus and golgi apparatus are typically solitary, while others such as mitochondria , chloroplasts , peroxisomes and lysosomes can be numerous hundreds to thousands. The cytosol is the gelatinous fluid that fills the cell and surrounds the organelles. The central and rightmost cell are in interphase , so their DNA is diffuse and the entire nuclei are labelled. The cell on the left is going through mitosis and its chromosomes have condensed. The nucleus is spherical and separated from the cytoplasm by a double membrane called the nuclear envelope. This mRNA is then transported out of the nucleus, where it is translated into a specific protein molecule. The nucleolus is a specialized region within the nucleus where ribosome subunits are assembled. In prokaryotes, DNA processing takes place in the cytoplasm. Mitochondria are self-replicating organelles that occur in various numbers, shapes, and sizes in the cytoplasm of all eukaryotic cells. Mitochondria multiply by binary fission , like prokaryotes. Diagram of the endomembrane system Endoplasmic reticulum: The endoplasmic reticulum ER is a transport network for molecules targeted for certain modifications and specific destinations, as compared to molecules that float freely in the cytoplasm. The ER has two forms: The primary function of the Golgi apparatus is to process and package the macromolecules such as proteins and lipids that are synthesized by the cell. Lysosomes contain digestive enzymes acid hydrolases. They digest excess or worn-out organelles , food particles, and engulfed viruses or bacteria. Peroxisomes have enzymes that rid the cell of toxic peroxides. The cell could not house these destructive enzymes if they were not contained in a membrane-bound system. The centrosome produces the microtubules of a cell â€" a key component of the cytoskeleton. It directs the transport through the ER and the Golgi apparatus. Centrosomes are composed of two centrioles , which separate during cell division and help in the formation of the mitotic spindle. A single centrosome is present in the animal cells. They are also found in some fungi and algae cells. Vacuoles sequester waste products and in plant cells store water. They are often described as liquid filled space and are surrounded by a membrane. Some cells, most notably Amoeba , have contractile vacuoles, which can pump water out of the cell if there is too much water. The vacuoles of plant cells and fungal cells are usually larger than those of animal cells. Eukaryotic and prokaryotic Ribosomes: The ribosome is a large complex of RNA and protein molecules. Ribosomes can be found either floating freely or bound to a membrane the rough endoplasmatic reticulum in eukaryotes, or the cell membrane in prokaryotes. These structures are notable because they are not protected from the external environment by the semipermeable cell membrane. In order to assemble these structures, their components must be carried across the cell membrane by export processes. Cell wall Further information: Cell wall Many types of prokaryotic and eukaryotic cells have a cell wall. The cell wall acts to protect the cell mechanically and chemically from its environment, and is an additional layer of protection to the cell membrane. Different types of cell have cell walls made up of different materials; plant cell walls are primarily made up of cellulose , fungi cell walls are made up of chitin and bacteria cell walls are made up of peptidoglycan. Prokaryotic Capsule A gelatinous capsule is present in some bacteria outside the cell membrane and cell wall. The capsule may be polysaccharide as in pneumococci , meningococci or polypeptide as Bacillus anthracis or hyaluronic acid as in streptococci. Capsules are not marked by normal staining protocols and can be detected by India ink or methyl blue ; which allows for higher contrast between the cells for observation. The bacterial flagellum stretches from cytoplasm through the cell membrane s and extrudes through the cell wall. They are long and thick thread-like appendages, protein in nature. A different type of flagellum is found in archaea and a different type is found in eukaryotes. Fimbria A fimbria also known as a pilus is a short, thin, hair-like filament found on the surface of bacteria. Fimbriae, or pili are formed of a protein called pilin antigenic and are responsible for attachment of bacteria to specific receptors of human cell cell adhesion. There are special types of specific pili involved in bacterial conjugation. Cellular processes Prokaryotes divide by binary fission , while eukaryotes divide by mitosis or meiosis. Cell division Cell division involves a single cell called a mother cell dividing into two daughter cells. This leads to growth in multicellular organisms the growth of tissue and to procreation vegetative reproduction in unicellular organisms. Prokaryotic cells divide by binary fission , while eukaryotic cells usually undergo a process of nuclear division, called mitosis , followed by division of the cell, called cytokinesis. A diploid cell may also undergo meiosis to produce haploid cells, usually four. Haploid cells serve as gametes in multicellular organisms, fusing to form new diploid cells. This occurs during the S phase of the cell cycle. In meiosis, the DNA is replicated only once, while the cell divides twice. DNA replication only occurs before meiosis I. DNA replication does not occur when the cells divide the second time, in meiosis II. This RNA is then subject to post-transcriptional modification and control, resulting in a mature mRNA red that is then transported out of the nucleus and into the cytoplasm peach , where it undergoes translation into a protein. Newly synthesized proteins black are often further modified, such as by binding to an effector molecule orange , to become fully active. Cell growth and Metabolism Between successive cell divisions, cells grow through the functioning of cellular metabolism. Cell metabolism is the process by which individual cells process nutrient molecules. Metabolism has two distinct divisions: Complex sugars consumed by the organism can be broken down into simpler sugar molecules called monosaccharides such as glucose. Once inside the cell, glucose is broken down to make adenosine triphosphate ATP , [3] a molecule that possesses readily available energy, through two different pathways. Protein synthesis Main article: Protein biosynthesis Cells are capable of synthesizing new proteins, which are essential for the modulation and maintenance of cellular activities. Protein synthesis generally consists of two major steps: The ribosome mediates the formation of a polypeptide sequence based on the mRNA sequence. The new polypeptide then folds into a functional three-dimensional protein molecule. Motility Unicellular organisms can move in order to find food or escape predators. Common mechanisms of motion include flagella and cilia. In multicellular organisms, cells can move during processes such as wound healing, the immune response and cancer metastasis. For example, in wound healing in animals, white blood cells move to the wound site to kill the microorganisms that cause infection. Cell motility involves many receptors, crosslinking, bundling, binding, adhesion, motor and other proteins. Each step is driven by physical forces generated by unique segments of the cytoskeleton.

Chapter 4 : Cells - The basic unit of life

1) All organisms are made from one or more cells 2) The cell is the basic unit of life 3) All cells come from cells.

In the first century BC, Romans were able to make glass, discovering that objects appeared to be larger under the glass. The expanded use of lenses in eyeglasses in the 13th century probably led to wider spread use of simple microscopes magnifying glasses with limited magnification. Hooke also used a simpler microscope with a single lens for examining specimens with directly transmitted light, because this allowed for a clearer image. At some point in his life before , he was able to learn how to grind lenses. This eventually led to Leeuwenhoek making his own unique microscope. His were a single lens simple microscope, rather than a compound microscope. This was because he was able to use a single lens that was a small glass sphere but allowed for a magnification of x. This was a large progression since the magnification before was only a maximum of 50x. After Leeuwenhoek, there was not much progress for the microscopes until the s, two hundred years later. Carl Zeiss , a German engineer who manufactured microscopes, began to make changes to the lenses used. But the optical quality did not improve until the s when he hired Otto Schott and eventually Ernst Abbe. Later in the s, the electron microscope was developed, making it possible to view objects that are smaller than optical wavelengths, once again, changing the possibilities in science. The cell was first discovered by Robert Hooke in , which can be found to be described in his book Micrographia. Hooke discovered a multitude of tiny pores that he named "cells". However, Hooke did not know their real structure or function. With microscopes during this time having a low magnification, Hooke was unable to see that there were other internal components to the cells he was observing. Therefore, he did not think the "cellulae" were alive. In Micrographia, Hooke also observed mould, bluish in color, found on leather. This led to Hooke suggesting that spontaneous generation, from either natural or artificial heat, was the cause. Since this was an old Aristotelian theory still accepted at the time, others did not reject it and was not disproved until Leeuwenhoek later discovers generation is achieved otherwise. He made use of a microscope containing improved lenses that could magnify objects almost fold, or x. In a letter to The Royal Society on October 9, , he states that motility is a quality of life therefore these were living organisms. Over time, he wrote many more papers in which described many specific forms of microorganisms. He also found for the first time the sperm cells of animals and humans. Once discovering these types of cells, Leeuwenhoek saw that the fertilization process requires the sperm cell to enter the egg cell. This put an end to the previous theory of spontaneous generation. After reading letters by Leeuwenhoek, Hooke was the first to confirm his observations that were thought to be unlikely by other contemporaries. Biologists believed that there was a fundamental unit to life, but were unsure what this was. It would not be until over a hundred years later that this fundamental unit was connected to cellular structure and existence of cells in animals or plants. In , Karl Rudolphi and J. Cell theory Theodor Schwann â€” Credit for developing cell theory is usually given to two scientists: Theodor Schwann and Matthias Jakob Schleiden. In , Schleiden suggested that every structural part of a plant was made up of cells or the result of cells. He also suggested that cells were made by a crystallization process either within other cells or from the outside. He claimed this theory as his own, though Barthelemy Dumortier had stated it years before him. This crystallization process is no longer accepted with modern cell theory. In , Theodor Schwann states that along with plants, animals are composed of cells or the product of cells in their structures. From these conclusions about plants and animals, two of the three tenets of cell theory were postulated. All living organisms are composed of one or more cells 2. In Latin, this tenet states Omnis cellula e cellula. All cells arise only from pre-existing cells However, the idea that all cells come from pre-existing cells had in fact already been proposed by Robert Remak; it has been suggested that Virchow plagiarized Remak and did not give him credit. He instead said that binary fission , which was first introduced by Dumortier, was how reproduction of new animal cells were made. Once this tenet was added, the classical cell theory was complete. Modern interpretation The generally accepted parts of modern cell theory include: All known living things are made up of one or more cells [17] All living cells arise from pre-existing cells by division. The cell is the fundamental unit of structure and function in all living organisms.

Energy flow occurs within cells. The first cell theory is credited to the work of Theodor Schwann and Matthias Jakob Schleiden in the s. In this theory the internal contents of cells were called protoplasm and described as a jelly-like substance, sometimes called living jelly. At about the same time, colloidal chemistry began its development, and the concepts of bound water emerged. A colloid being something between a solution and a suspension , where Brownian motion is sufficient to prevent sedimentation. The idea of a semipermeable membrane , a barrier that is permeable to solvent but impermeable to solute molecules was developed at about the same time. In this view, the cell was seen to be enclosed by a thin surface, the plasma membrane , and cell water and solutes such as a potassium ion existed in a physical state like that of a dilute solution. In Hamburger used hemolysis of erythrocytes to determine the permeability of various solutes. By measuring the time required for the cells to swell past their elastic limit, the rate at which solutes entered the cells could be estimated by the accompanying change in cell volume. Evolution of the membrane and bulk phase theories Two opposing concepts developed within the context of studies on osmosis , permeability, and electrical properties of cells. The membrane theory developed as a succession of ad-hoc additions and changes to the theory to overcome experimental hurdles. Overton a distant cousin of Charles Darwin first proposed the concept of a lipid oil plasma membrane in The major weakness of the lipid membrane was the lack of an explanation of the high permeability to water, so Nathansohn proposed the mosaic theory. In this view, the membrane is not a pure lipid layer, but a mosaic of areas with lipid and areas with semipermeable gel. Ruhland refined the mosaic theory to include pores to allow additional passage of small molecules. Since membranes are generally less permeable to anions , Leonor Michaelis concluded that ions are adsorbed to the walls of the pores, changing the permeability of the pores to ions by electrostatic repulsion. Michaelis demonstrated the membrane potential and proposed that it was related to the distribution of ions across the membrane. Loeb also studied gelatin extensively, with and without a membrane, showing that more of the properties attributed to the plasma membrane could be duplicated in gels without a membrane. Some criticisms of the membrane theory developed in the s, based on observations such as the ability of some cells to swell and increase their surface area by a factor of A lipid layer cannot stretch to that extent without becoming a patchwork thereby losing its barrier properties. Such criticisms stimulated continued studies on protoplasm as the principal agent determining cell permeability properties. In , Fischer and Suer proposed that water in the protoplasm is not free but in a chemically combined formâ€”the protoplasm represents a combination of protein, salt and waterâ€”and demonstrated the basic similarity between swelling in living tissues and the swelling of gelatin and fibrin gels. Dimitri Nasonov viewed proteins as the central components responsible for many properties of the cell, including electrical properties. By the s, the bulk phase theories were not as well developed as the membrane theories. This drove the concept that cells are in a state of dynamic equilibrium , constantly using energy to maintain ion gradients. In , Karl Lohmann discovered ATP and its role as a source of energy for cells, so the concept of a metabolically-driven sodium pump was proposed. The tremendous success of Hodgkin , Huxley , and Katz in the development of the membrane theory of cellular membrane potentials, with differential equations that modeled the phenomena correctly, provided even more support for the membrane pump hypothesis. The modern view of the plasma membrane is of a fluid lipid bilayer that has protein components embedded within it. The structure of the membrane is now known in great detail, including 3D models of many of the hundreds of different proteins that are bound to the membrane. These major developments in cell physiology placed the membrane theory in a position of dominance and stimulated the imagination of most physiologists, who now apparently accept the theory as factâ€”there are, however, a few dissenters. Troshin published a book, The Problems of Cell Permeability, in Russian in German, in Chinese, in English in which he found that permeability was of secondary importance in determination of the patterns of equilibrium between the cell and its environment. Troshin showed that cell water decreased in solutions of galactose or urea although these compounds did slowly permeate cells. Since the membrane theory requires an impermanent solute to sustain cell shrinkage, these experiments cast doubt on the theory. Such questions became even more urgent as dozens of new metabolic pumps were added as new chemical gradients were discovered. In , Gilbert Ling became the champion of the bulk phase theories and proposed his association-induction hypothesis of living cells.

Chapter 5 : Free Teacher Resources

Cell are considered the basic unit of life because all life forms are composed of them. Some forms of life are made of one cell; others contain trillions. The simplest forms of life on earth are bacteria. They are made of a single cell, and they are believed to be the first form of life to arise on.

Read this article to learn about the cell-structural and functional unit of life and also about the silent features of animal cell and plant cell. The cell is the structural and functional unit of life. It may be also regarded as the basic unit of biological activity. The concept of cell originated from the contributions of Schleiden and Schwann However, it was only after , the complexities of cell structure were exposed. Prokaryotic and Eukaryotic Cells: The cells of the living kingdom may be divided into two categories: These include the various bacteria. The higher organisms animals and plants are composed of eukaryotic cells. A comparison of the characteristics between prokaryotes and eukaryotes is listed in Table The salient features of an animal cell and a plant cell are briefly described: The human body is composed of about cells. A diagrammatic representation of a typical rat liver cell is depicted in Fig. The cell consists of well-defined subcellular organelles, enveloped by a plasma membrane. By differential centrifugation of tissue homogenate, it is possible to isolate each cellular organelle in a relatively pure form. Nucleus is the largest cellular organelle, surrounded by a double membrane nuclear envelope. The outer membrane is continuous with the membranes of endoplasmic reticulum. At certain intervals, the two nuclear membranes have nuclear pores with a diameter of about 90 nm. These pores permit the free passage of the products synthesized in the nucleus into the surrounding cytoplasm. Nucleus contains DNA, the repository of genetic information. Eukaryotic DNA is associated with basic protein histones in the ratio of 1: An assembly of nucleosomes constitutes chromatin fibres of chromosomes Greek: Thus, a single human chromosome is composed of about a million nucleosomes. The number of chromosomes is a characteristic feature of the species. Humans have 46 chromosomes, compactly packed in the nucleus. The nucleus of the eukaryotic cell contains a dense body known as nucleolus. The ground material of the nucleus is often referred to as nucleoplasm. To the surprise of biochemists, the enzymes of glycolysis, citric acid cycle and hexose monophosphate shunt have also been detected in the nucleoplasm. They are regarded as the power houses of the cell with variable size and shape. Mitochondria are rod-like or filamentous bodies, usually with dimensions of 1. The mitochondria are composed of a double membrane system. The outer membrane is smooth and completely envelops the organelle. The inner membrane is folded to form cristae Latin-crests which occupy a larger surface area. The internal chamber of mitochondria is referred to as matrix. The components of electron transport chain and oxidative phosphorylation flavoprotein, cytochromes b, c1; c, a and a3 and coupling factors are buried in the inner mitochondrial membrane. The matrix contains several enzymes concerned with the energy metabolism of carbohydrates, lipids and amino acids e. The matrix enzymes also participate in the synthesis of heme and urea. Mitochondria are the principal producers of ATP in the aerobic cells. ATP, the energy currency, generated in mitochondria is exported to all parts of the cell to provide energy for the cellular work. Thus, the mitochondria are equipped with an independent protein synthesizing machinery. The structure and functions of mitochondria closely resemble prokaryotic cells. It is hypothesized that mitochondria have evolved from aerobic bacteria. Further, it is believed that during evolution, the aerobic bacteria developed a symbiotic relationship with primordial anaerobic eukaryotic cells that ultimately led to the arrival of aerobic eukaryotes. The network of membrane enclosed spaces that extends throughout the cytoplasm constitutes endoplasmic reticulum ER. A large portion of the ER is studded with ribosomes to give a granular appearance which is referred to as rough endoplasmic reticulum. Ribosomes are the factories of protein biosynthesis. During the process of cell fractionation, rough ER is disrupted to form small vesicles known as microsomes. It may be noted that microsomes as such do not occur in the cell. The smooth endoplasmic reticulum does not contain ribosomes. Eukaryotic cells contain a unique cluster of membrane vesicles known as dictyosomes which, in turn, constitute Golgi apparatus or Golgi complex. The newly synthesized proteins are handed over to the Golgi apparatus which catalyse the addition of carbohydrates, lipids or sulfate moieties to the proteins. These chemical modifications are necessary for the transport of proteins across the plasma membrane. Certain proteins and enzymes are enclosed in membrane vesicles of Golgi apparatus and secreted from the cell after the appropriate signals. The digestive enzymes of pancreas are produced in this fashion. Golgi apparatus are also involved in the membrane synthesis, particularly for the formation of intracellular organelles e. Lysosomes are spherical vesicles enveloped by a single membrane. Lysosomes are regarded as the digestive tract of the cell, since they are actively involved in digestion of cellular substancesâ€” namely proteins, lipids, carbohydrates and nucleic acids. Lysosomal enzymes are categorized as hydrolases. These include the following enzymes with substrate in brackets: The lysosomal enzymes are responsible for maintaining the cellular compounds in a dynamic state, by their degradation and recycling. The degraded products leave the lysosomes, usually by diffusion, for reutilization by the cell. Sometimes, however, certain residual products, rich in lipids and proteins, collectively known as lipofuscin accumulate in the cell. Lipofuscin is the age pigment or wear and tear pigment which has been implicated in ageing process. The digestive enzymes of cellular compounds are confined to the lysosomes in the best interest of the cell. Escape of these enzymes into cytosol will destroy the functional macromolecules of the cell and result in many complications. The occurrence of several diseases e. Peroxisomes, also known as micro bodies, are single membrane cellular organelles. They are spherical or oval in shape and contain the enzyme catalase. Plants contain glyoxysomes, a specialized type of peroxisomes, which are involved in the glyoxylate pathway. The cellular matrix is collectively referred to as cytosol. Cytosol is basically a compartment containing several enzymes, metabolites and salts in an aqueous gel like medium. More recent studies however, indicate that the cytoplasm actually contains a complex network of protein filaments, spread throughout, that constitutes cytoskeleton. The cytoplasmic filaments are of three types- microtubules, actin filaments and intermediate filaments. The filaments which are polymers of proteins are responsible for the structure, shape and organization of the cell. A diagrammatic representation of a typical plant cell is depicted in Fig. The cell wall, chloroplasts and vacuoles are the most important and distinguishing components of plant cells when compared to animal cells. In the Table The salient features of plant cell organelles are briefly described. The plant cell wall is usually rigid, non-living and permeable component, surrounding the plasma membrane. Cell walls are of two types â€” primary and secondary. The primary cell wall is the one that is formed during the course of cell division. It is mainly composed of cellulose, and is flexible in nature. The secondary cell wall is rigid and more complex in nature. Chemically, it is made up of more cellulose, and high content of lignin. Lignin is the major component of wood. The secondary cell wall is inextensible and determines the final shape and size of the plant cell. Besides cellulose and lignin, hemicelluloses, pectins, and extensins oligosaccharides are also present in the cell wall. The chloroplasts are found only in the plant cells, and are the sites of photosynthesis. The general term plastids is often used to collectively represent chloroplasts green plastids containing chlorophylls , chromoplasts yellow to reddish colour plastids containing carotenoids and leucoplasts colourless plastids. Chloroplasts have a double membrane system. Internally, chloroplasts contain a system of flattened membranous discs called thylakoids. Piles of thylakoids are located in the central region called stroma. Chlorophyll, the sunlight-capturing green pigment is present in the thylakoids. The vacuoles may contain wide range of dissolved molecules such as salts, sugars, pigments and toxic wastes. The pigments of vacuoles contribute to the colours of flowers and leaves. The physical support of plant tissues comes from the high internal pressure of water maintained within the vacuoles.

Chapter 6 : Anatomy and Physiology - Cells: The Basic Unit of Life

-it is the basic unit of function, acting as a biochemical factory to perform all the basic metabolic functions of life. -cell is also a basic unit of growth, increasing in size and multiplying to form an organism of specific size and shape.

Check new design of our homepage! Basic Unit of Life: Plant Cell Structure and Functions The cells in a plant are the most basic units of life that come together to form its different parts such as the leaves, stems, roots etc. These plant parts, work together in coordination, to carry out the normal physiological and biochemical processes of the plant. BiologyWise Staff Last Updated: Mar 19, Types and Functions Plant cells are of three basic types namely, parenchyma, collenchyma and sclerenchyma. These cells have different structures and perform varied roles in the overall functioning of the plant. The parenchyma cells are living and perform multiple functions including food storage, light harvesting, and gas exchange. Some of them have the ability to differentiate and re-differentiate into different types of cells totipotent as per the requirements of the plant. Parenchyma cells are present in the leaves, tubers, and seeds. Collenchyma cells are living only during maturity and possess two walls primary and secondary. Initially, they are similar to parenchyma cells, which later differentiates into specific collenchyma cells. They are present in the vascular bundles and stems, and aid in supporting the plant during the active growing phase. Sclerenchyma cells are dead at maturity and have thick secondary walls with lignin deposition. These cells function exclusively as mechanical support of the plant. A typical example of sclerenchyma cells in plants is fiber. Parts and Functions The plant cell organelles play an essential role in carrying out the regular activities of the cell. For example, photosynthesis which is a characteristic of the plants is performed in the chloroplast; while synthesis of ATP adenosine triphosphate , a form of energy, takes place in the mitochondria. The outermost covering of the plant cell is the protective layer, the cell wall. Its main function includes giving support, maintaining the cell shape, and controlling the growth of the cell. Next to the cell wall, lies the cell membrane that comprises a protein and lipid bilayer. Its main function is selective transport of nutrients, wherein some are allowed to enter the cell, while others are restricted. Vacuoles are organelles whose shape and structure, alters with respect to the cell requirements. They are filled with a water-like solution that contains enzymes, organic and inorganic molecules. The cell nucleus is simply the control center of the plant cell, as it contains hereditary material, along with other essential cell components. Overall, the nucleus is responsible for protein synthesis, cell growth, division, and development. The portion of the plant cell excluding the nucleus is called cytoplasm, which is filled with jelly-like cytoplasmic fluid and in which the majority of cell organelles are present. These are the organelles which perform the function of photosynthesis and storage of starch molecules. Plastids are of different types and contain photosynthetic pigments. Mitochondria, also known as powerhouse of the cell, plays the crucial role of generating chemical energy for proper functioning of the plant cell. They are present in many numbers and contain hereditary material. Ribosomes are of two types, attached and free. The former is found attached to the endoplasmic reticulum, while the latter is suspended freely in the cytoplasm. Both types of ribosomes are responsible for protein synthesis. Golgi bodies are made up of stacks called cisternae , and are useful for packaging macromolecules that are synthesized by the cell. They are also responsible for transportation of nutrients. This is the organelle that connects the nucleus and cytoplasm. It performs the function of synthesizing and storing steroids and glycogen. Endoplasmic reticulum with attached ribosomes are called rough endoplasmic reticulum RER. These are microbodies of the plant cells that contain various degradation enzymes. Peroxisomes play the major role of digesting complex fatty acids including aiding in photosynthesis. Thus, a plant cell functions smoothly with the help of its various structural components. Though it is eukaryotic like that of animals, it differs significantly from an animal cell. While there may be a few similarities between plant and animal cells , the key distinguishing feature between the two is the presence of a cell wall and chloroplast in plant cells, both of which are absent in animal cells. If viewed under the microscope, one can see large, prominent vacuoles at the center of a plant cell, whereas an animal cell comprises only a small, inconspicuous vacuole.

DOWNLOAD PDF CELL BASIC UNIT OF LIFE

Chapter 7 : Cell-The basic unit of life

Cell is the structural and functional unit of life. Cell is a small unit which made the body of an organism which perform most of metabolic processes which are vital to organism like respiration, protein synthesis and secretion and excretion of materials.

All known living things are made up of cells. All cells come from preexisting cells by division. The cell is structural and functional unit of all living things. The major parts of a cell are the nucleus, cytoplasm, and cell membrane. The nucleus contains a nucleolus and is separated from the cytoplasm by the nuclear envelope. It contains RNA, a type of nucleic acid. The nucleus communicates through holes in the envelope called nuclear pores. The nucleus decides what the cell needs and uses DNA to print out instructions for the rest of the cell to produce that need. The nucleus contains genetic information in the form of DNA the universal genetic code. The DNA does not hang around loosely in the nucleus. The DNA is packaged with proteins and wound up. These wound up DNAprotein structures are called chromosomes. Are compartmentalized structures that perform a specialized function within a cell. The golgi is made up of flattened, folded sacs. The golgi receives an incoming vesicle, tags the package, and sends the vesicle to its final destination. Lysosomes contain an environment made to destroy waste. Vesicles carry the waste bacteria, old organelles, etc. Once inside, the waste is destroyed and its parts recycled. The two types of ER make different building blocks for the cell. Smooth ER synthesizes carbohydrates sugars and lipids fats. The mitochondria convert carbohydrates sugar taken from food into ATP. The mitochondria are unique in that it has two protective shells. The ribosome reads the DNA strand instructions to make proteins for the cell to use in its normal activities. The units clasp around a strand of nucleic acid instructions from the nucleus. Each ribosome is made of two protein subunits. Rough ER is found attached to the outside of the nucleus. It appears rough because of the ribosomes on its surface. Rough ER helps the attached ribosomes in finishing protein synthesis. Embedded proteins are anchored to the cell membrane. Exterior of the plasma membrane touches water; polar heads touch water on the inside of the cell and water on the outside of the cell. Interior Blocks Passage However, water and other molecules cannot pass through to either side because of the nonpolar tails. Proteins embedded into the membrane send and receive signals to communicate with other cells. Transport across the cell membrane: The cell exchanges materials through the cell membrane using passive and active transport. Three types of passive transport are osmosis, diffusion, and facilitated diffusion. Osmosis is the natural movement of water from a high concentration of water to a lower concentration of water. Diffusion is the natural movement of molecules from a higher concentration to a lower concentration. Facilitated Diffusion is the natural movement of molecules from a higher concentration to a lower concentration with the help of a transporter protein embedded on the cell membrane. Active transport requires energy to occur. The most common type of active transport is a pump. Pumps are proteins embedded in the cell membrane, which use ATP energy to work. Bacteria and other microscopic organisms are made up of prokaryotic cells. Prokaryotic cells do not have any complex organelles not even a nucleus. However, prokaryotes do have ribosomes. Two types of eukaryotic cells are plant and animal cells. Rapid Study Kit for "Title":

Chapter 8 : CH 8 â€“ CELL: THE UNIT OF LIFE â€“ Biology for medical entrance exams

The cell (from Latin cella, meaning "small room") is the basic structural, functional, and biological unit of all known living organisms.A cell is the smallest unit of life.

Chapter 9 : Cell: The basic Unit of Life - NEET Biology MCQs, Study Notes, Important Topics, Study Tips

A cell is the basic unit of life structural, functional, and biological all known living organisms. A cell is the smallest and most all living things called organisms have something in common.