THE MOLECULES OF LIFE pdf

1: The Molecules of Life - Molecular Cell Biology - NCBI Bookshelf

Proteins are the first of the molecules of life and they are really the building blocks of life. Proteins are the most common molecules found in cells. If all the water is removed from a cell, proteins make up more than half of the remaining weight.

The Molecules of Life The elements involved in life processes can, and do, form millions of different compounds. Thankfully, these millions of compounds fall into four major groups: Though all of these groups are organized around carbon, each group has its own special structure and function. Carbohydrates Carbohydrates are compounds that have carbon, hydrogen, and oxygen atoms in a ratio of about 1: Carbohydrates are often sugars, which provide energy for cellular processes. Like all of the biologically important classes of compounds, carbohydrates can be monomers, dimers, or polymers. Monosaccharides Carbohydrate monomers are known as monosaccharides. This group includes glucose, C6H12O6, which is a key substance in biochemistry. Glucose has a cousin called fructose with the same chemical formula. But these two compounds have different structures: Glucose and fructose differ in one important way: This difference is most apparent when the two monosaccharides are in their ring forms. Glucose generally forms a hexagonal ring six sided , while fructose forms a pentagonal ring five sided. Whereas fructose is the sugar most often found in fruits, glucose is most often used as the major source of energy for cellular activities. Disaccharides Disaccharides are carbohydrate dimers. These dimers are formed from two monomers by dehydration synthesis. Any two monosaccharides can form a disaccharide. For example, maltose is formed by the dehydration synthesis of two glucose molecules. Sucrose, common table sugar, comes from the linkage of one molecule of glucose and one of fructose. Polysaccharides Polysaccharides can consist of as few as three and as many as several thousand monosaccharides. Depending on their structure and the monosaccharides they contain, polysaccharides can function as a means of storing excess energy or provide structural support. When cells ingest more carbohydrates than they need for fuel, they link the sugars together to form polysaccharides. The structure of these polysaccharides is different in plants and animals: Polysaccharides can also have structural roles in plants and animals. Cellulose, which forms the cell walls of plant cells, is a structural polysaccharide. In animals, the polysaccharide chitin forms the hard outer armor of insects, crabs, spiders, and other arthropods. Many fungi also use chitin as a structural carbohydrate. Proteins More than half of the organic compounds in cells are proteins, which play an important function in almost every cellular process. Proteins, for example, provide structural support to the cell in the cytoskeleton and make up many of the hormones that send messages around the body. Enzymes, which regulate chemical reactions in the cell, are also proteins. Amino Acids Proteins are made up of monomers called amino acids. The names of many, but not all, amino acids end in -ine: Each amino acid consists of a central carbon atom attached to a set of three designated groups: The final group, designated â€”R in the diagram below, varies between different amino acids. It is possible to make an infinite number of amino acids by attaching different compounds to the R position of the central carbon. However, only 20 types of R groups exist in nature, so there are only 20 naturally occurring amino acids. Polypeptides All proteins are made of chains of some or all of these 20 amino acids. The bond formed between two amino acids by dehydration synthesis is known as a peptide bond. A particular protein has a specific sequence of amino acids, which is known as its primary structure. Every protein also winds, coils, and folds in three-dimensional space in specific and predetermined ways, taking on a unique secondary initial winding and coiling and tertiary structure overall folding. In harsh conditions, such as high temperature or extreme pH, proteins can lose their normal tertiary shape and cease to function properly. They are distinguished from other macromolecules by characteristic hydrocarbon chainsâ€”long strings of carbon molecules with hydrogens attached. Such chains do not dissolve well in water because they are nonpolar. Triglycerides Triglycerides consist of three long hydrocarbon chains known as fatty acids attached to each other by a molecule called glycerol. Because they include three fatty acids, fats and oils are also known as triglycerides. As you might expect by this point, glycerol and each fatty acid chain are joined to each other by dehydration synthesis. Some fats are saturated, while others are unsaturated. These terms refer to the presence or absence of double bonds in the fatty acids of fats. Saturated fats have no double bonds, whereas unsaturated fats contain one or more such bonds. In general, plant fats are unsaturated and animal fats are saturated. Saturated fats are generally solid at room temperature, while unsaturated fats are typically liquid. Phospholipids Phospholipids, which are important components of cell membranes, consist of a glycerol molecule attached to two fatty acid chains and one phosphate group PO4â€”2: Like all fats, the hydrocarbon tails of phospholipids do not dissolve in water. However, phosphate groups do dissolve in water because they are polar. The different solubilities of the two ends of phospholipid molecules allow them to form the bilayers that make up the cell membrane. Steroids Steroids are the primary structure in hormones, substances that play important signaling roles in the body. Structurally, steroids are made up of four fused carbon rings attached to a hydrocarbon chain. The linked rings indicate that each carbon atom is attached to other carbon atoms that form multiple loops. Cholesterol, the steroid in the image above, is the central steroid from which other steroids, such as the sex hormones, are synthesized. Cholesterol is only found in animal cells. Nucleic Acids Cells use a class of compounds called nucleic acids to store and use hereditary information. Individual nucleic acid monomers, known as nucleotides, consist of three main units: There are two main types of nucleotides, differentiated by their sugars: In terms of function, DNA molecules store genetic information for the cell, while RNA molecules carry genetic messages from the DNA in the nucleus to the cytoplasm for use in protein synthesis and other processes. For DNA, there are four kinds of nitrogenous bases: RNA also has four nitrogenous bases. Threeâ€”adenine, guanine, and cytosineâ€”are identical to those found in DNA. The fourth, uracil, replaces thymine. Watson and Crick hypothesized that DNA nucleotides are organized into a polymer that looks like a ladder twisted into a coil. They called this structure the double helix. Two separate DNA polymers make up each side of the ladder. The sugar and phosphate molecules of the DNA form the vertical supports, while the nitrogenous bases stick out to form the rungs. The rungs attach to each other by hydrogen bonding. The nitrogen bases attach to each other according to two simple rules: The exclusivity of the attachments between nitrogen bases is known as base pairing. It looks like a ladder cut down the middle. As you will see when we discuss protein synthesis in the chapter on Cell Processes, this structure of RNA is very important to its functions as a messenger from the DNA in the nucleus to the cytoplasm.

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2: Bradykinin | Molecules of Life

Among the many events that occur in the life of a cell are a multitude of specific chemical transformations, which provide the cell with usable energy and the molecules needed to form its structure and coordinate its activities.

Organic Molecules The Chemistry of Life: Life is based on carbon ; organic chemistry studies compounds in which carbon is a central element. The properties of carbon make it the backbone of the organic molecules which form living matter. Carbon is a such a versatile element because it can form four covalent bonds. Carbon skeletons can vary in length, branching, and ring structure. The functional groups of organic molecules are the parts involved in chemical reactions. Organic molecules important for life include relatively small monomers as well as large polymers. Carbohydrates are a class of important organic molecules that provide energy and structure. Sugars are the building blocks of carbohydrates. There are 4 types of complex carbohydrates found in animals or plants. Lipids are a large class of hydrophobic organic molecules. Triglycerides typically called fats are made of glycerol plus fatty acids; saturated fats have been linked to heart disease. Phospholipids contain a polar group and are amphipathic; they form cellular membranes. Proteins are crucial to life and perform a wide range of functions. Amino acids are the building blocks of polypeptide chains which fold to form proteins. Shape is critical for protein function and creates specific regions called domains ; a protein that is denatured loses its domains and the ability to function. Protein denaturation causes proteins to unfold and clump in a random configuration; understanding the denaturation process helps in understanding the structure of intact proteins. Proteins can combine with other macromolecules to form lipoproteins and glycoproteins. Nucleic acids are the primary information-bearing molecules of life. Nucleotides , the building blocks of nucleic acids, are also important as energy carriers. The nucleic acid DNA is composed of two chains of nucleotides in a helical structure; RNA is a similar nucleic acid of equal importance.

3: Organic Molecules of Life

Paul Andersen describes the macromolecules that make up living organisms. He starts with a brief description of organic chemistry and the importance of functional groups.

Search term Section 1. These biochemical reactions and other cellular processes are governed by basic principles of chemistry reviewed in Chapter 2. Here we briefly describe the functions of the main types of chemicals that compose cells. Throughout many later chapters we will focus on the interactions and transformations of these molecules. Water, inorganic ions, and a large array of relatively small organic molecules e. Of these small molecules, water is by far the most abundant. The remainder of living matter consists of macromolecules , including proteins, polysaccharides, and DNA Figure Cells acquire and use these two size classes of molecules in fundamentally different ways. Ions, water, and many small organic molecules are imported into the cell. Cells also make and alter many small organic molecules by a series of different chemical reactions. In contrast, cells can obtain macromolecules only by making them. Their synthesis entails linking together a specific set of small molecules monomers to form polymers through repetition of a single type of chemical- linkage reaction. Figure Cells are filled with molecules large and small. Nevertheless, most of more Some small molecules function as precursors for synthesis of macromolecules, and the cell is careful to provide the appropriate mix of small molecules needed. Small molecules also store and distribute the energy for all cellular processes; they are broken down to extract this chemical energy, as when sugar is degraded to carbon dioxide and water with the release of the energy bound up in the molecule Chapter Other small molecules e. Macromolecules, though, are the most interesting and characteristic molecules of living systems; in a true sense the evolution of life as we know it is the evolution of macromolecular structures. Proteins, the workhorses of the cell, are the most abundant and functionally versatile of the cellular macromolecules. To appreciate the abundance of protein within a cell, we can estimate the number of protein molecules in a typical eukaryotic cell, such as a hepatocyte in the liver. Assuming a cell density of 1. Assuming this value is typical of eukaryotic proteins, we can calculate the total number of protein molecules per liver cell as about 7. To carry this calculation one step further, consider that a liver cell contains about 10, different proteins; thus, a cell contains close to a million molecules of each protein on average. Many of the proteins within cells are enzymes , which accelerate catalyze reactions involving small molecules. Other proteins allow cells to move and do work, maintain internal cell rigidity, and transport molecules across membranes. Proteins even direct their own synthesis and that of other macromolecules. Reflecting their numerous functions, proteins come in many shapes and sizes Figure The elucidation of the structure of proteins and the relation of protein structure to function remain active areas of scientific investigation Chapter 3. Proteins are formed from only 20 different monomers, the amino acids. That such a limited set of building blocks can do so much is a continuous marvel, even to researchers who work with proteins every day. They are the true glory of the biological world. Figure Models of some representative proteins pink drawn to a common scale and compared with a small portion of a lipid bilayer sheet yellow and a DNA molecule blue. Each protein has a defined three-dimensional shape held together by numerous chemical more Watson and Francis H. Crick about 50 years ago, consists of two long helical strands that are coiled around a common axis forming a double helix Figure Figure James D. Watson left and Francis H. Crick right with the double-helical model of DNA they constructed in â€” Their model ultimately proved correct in all its essential aspects. Watson, , The Double more Each strand of DNA is composed of just four different types of monomers called nucleotides. Since cells use proteins enzymes to make other molecules like sugars or fats, DNA indirectly directs the synthesis of many small molecules as well as proteins. DNA also contains a coded set of instructions about when various proteins are to be made and in what quantities. But a third macromolecule , ribonucleic acid RNA , is necessary in the process. The central dogma of biology states that the coded genetic information hard-wired into DNA is transcribed into individual transportable cassettes, composed of messenger RNA mRNA ; each mRNA cassette contains the program for synthesis of a particular protein or small number of proteins. The mechanism whereby the information encoded in DNA is deciphered into proteins is now understood quite well and explained in Chapter 4. By agreement with the publisher, this book is accessible by the search feature, but cannot be browsed.

4: The Molecules of Life (grades)

molecules that have the same molecular formula but different structures starch a storage polysaccharide found in the roots of plants and certain other cells; a polymer of glucose.

These four types of molecules are often referred to as the molecules of life. The four molecules of life are proteins, carbohydrates, lipids and nucleic acids. Each of the four groups is vital for every single organism on Earth. Without any of these four molecules, a cell and organism would not be able to live. All of the four molecules of life are important either structurally or functionally for cells and, in most cases, they are important in both ways. Proteins Proteins are the first of the molecules of life and they are really the building blocks of life. If all the water is removed from a cell, proteins make up more than half of the remaining weight. They come in a huge variety of forms and perform a massive range of functions. They are involved in muscle movement, storage of energy, digestion, immune defence and much more. The primary structure of a protein is a long chain made of many smaller molecules called amino acids. There are 20 different amino acids that are used to build proteins. The different amino acids can be arranged into trillions of different sequences that each creates a unique protein. The long chain of amino acids twists and folds on itself to produce the final shape of a protein. Amino acids contain nitrogen. Nitrogen-based compounds are an essential part of the diet of all organism so they can produce new proteins for their cells. This is why farmers often add nitrogen-based fertilisers to help their crops grow and why it is important for humans to eat foods that contain proteins. For more on proteins, click here. Carbohydrates The next of the four molecules of life are carbohydrates. Carbohydrates are an important source of energy. They also provide structural support for cells and help with communication between cells. A carbohydrate molecule is made of atoms of carbon, hydrogen and oxygen. They are found in the form of either a sugar or many sugars linked together. A single sugar molecule is known as a monosaccharide. Two sugar molecules bonded together is a disaccharide and many sugar molecules make a polysaccharide. The three different types of carbohydrates are all important for different reasons. Carbohydrates are the most important sources of energy for many organisms. The energy of these carbohydrates later allows plants to grow and reproduce. Many organisms have what is known as a cell wall that surrounds their cell. The cell walls of plants and fungi are made from carbohydrates. Cell walls provide important protection for the cells of plants and fungi. You can learn more about carbohydrates here. Lipids Lipids are a highly variable group of molecules that include fats, oils, waxes and some steroids. These molecules are made mostly from chains of carbon and hydrogen called fatty acids. Fatty acids bond to a range of other types of atoms to form many different lipids. Cells require lipids for a number of reasons. Probably the most important role of lipids is the main component of cell membranes. A type of lipid called a phospholipid is the primary molecule found in the membranes of cells. Other important functions lipids have include insulation of heat, storing energy, protection and cellular communication. The importance of these various functions is why lipids are classed as one of the four molecules of life. Almost all lipids are insoluble in water. The structure of lipid molecules means they are repelled by water. This is why oils and fats form globules in water and why the vinegar and oil of vinaigrette separate if the mixture is left for a while. Click here to learn more about lipids. Nucleic acids The final of the four molecules of life are the nucleic acids. There are two types of nucleic acids that are essential to all life. DNA is a very well-known type of molecule that makes up the genetic material of a cell. DNA is responsible for carrying all the information an organism needs to survive, grow and reproduce. RNA is a lesser-known molecule but it also plays an important role in cells. RNA molecules are used to translate the information stored in DNA molecules and use the information to help build proteins. Nucleic acids are long chains made from many smaller molecules called nucleotides. Each nucleotide is made of a sugar, a base and a phosphate group. RNA has three of the same bases but the thymine base is replaced with a base called uracil U. Video produced by The Science Channel Last edited: Easy and enjoyable to read, the book introduces topics such as genetics, cells, evolution, basic biochemistry, the broad categories of organisms, plants, animals, and taxonomy.

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5: The Molecules of Life by John Kuriyan

Molecules of Life -- The Energy Rich Molecules All cells require a constant supply of energy to generate and maintain their e biological function. This energy comes from the chemical bond energy in food molecules, which serve as the source of fuel for cells.

6: Molecules of Life | Basic Biology

The Molecules of Life The elements involved in life processes can, and do, form millions of different compounds. Thankfully, these millions of compounds fall into four major groups: carbohydrates, proteins, lipids, and nucleic acids.

7: The Molecules of Life | W. W. Norton & Company

5 Macromolecules â€¢LARGE organic molecules. â€¢Also called POLYMERS (poly- means "many") -Made up of smaller "building blocks" called MONOMERS (mono- means "one").

8: The Molecules of Life

The Molecules of Life. All living organism pass information from one generation to the next with genetic material containing the information needed to construct a complete organism.

9: The Molecules of Life â€" bozemanscience

One of two or more molecules with the same molecular formula but different structures and thus different properties. Lipids An organic compound consisting mainly of carbon and hydrogen atoms linked by nonpolar convalent bonds and therefore mostly hydrophobic and insoluble in water.

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Creating a self-narrative of strength, purpose, and possibility Vol. 17. March 1, 1781-August 31, 1781 Your business structure An ordinance of the Lodrs [sic and Commons assembled in Parliament Politics and society under the Bolsheviks Downtown Black-Jewish DC: From the Library to the YMHA.38 The European competitive environment Going the Extra Mile Adventures of a Gentlemans Gentleman Marilou, Iguana Hunter (First Novel Series) Star wars trilogy hunsberger flute General knowledge mcqs with answers 2015 Life and public services of James Buchanan Explosions are exciting Steaming to Bamboola The World of a Tramp Freighter Pleasuring painting IEEE 1996 Microwave and Millimeter-Wave Monolithic Circuits Symposium Heir of fire sarah j maas Permutations of a twelve-tone row, by G. Lefkoff. Info Trail Emergent Stage the Great Fire of London I think I hear middle age knocking, should I get the door? Humphreys Homeopathic mentor or family advisor in the use of specific homeopathic medicine by F. Humphrey Control of Mechanical Systems With Constraints A syllable of water New Jerusalem scroll from Qumran Major-General McClellan and the campaign on the Yorktown Peninsula Mechanisms of Resistance to Plant Diseases New perspectives on state socialism of China The holocaust a new history Voa special english word list You can choose to be rich Avs video editor 7.1 tutorial V. 1-2. Alphabetical catalogue Strangers in the forest Lawrence Osborne The Public Role of Religion in Post-Colonial Hong Kong Longman standard history of philosophy Lewis edition 9 STEP SIX: THE RIGHT WAY TO SHAMPOO 53 University of oklahoma application Many faces of France.