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|  | The Molecules of Life  Within all cells, small organic molecules are joined together to form larger molecules.  All living things are made up of four main classes of macromolecules: |
| Three of the Macromolecules are \_\_\_\_\_\_\_\_\_\_\_\_\_\_, built from \_\_\_\_\_\_\_\_\_\_\_\_\_.  What is a polymer? What are the specific monomers?  The chemical mechanisms which cells use to make and break polymers are similar for all classes of macromolecules.  Dehydration reaction.  Hydrolysis reaction. |
| Carbohydrates serve as fuel and building material  The simplest carbohydrates are monosaccharides, or simple \_\_\_\_\_\_\_.  Disaccharides  Polysaccharides |
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|  | **Monosaccharides**  Molecular formulas that are some multiple of the unit \_\_\_\_\_.    Two major functional groups:  Naming Sugars:  Two monosaccharides can join with a **\_\_\_\_\_\_\_\_\_\_\_\_ linkage** to form a **disaccharide** via  \_\_\_\_\_\_\_\_\_\_\_\_\_.  Examples: |
| \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the polymers of sugars, have storage and structural roles.  **Polysaccharides** are polymers of hundreds to thousands of monosaccharides joined by glycosidic linkages.  Storage: Structure:  **Starch** is a storage polysaccharide composed entirely of \_\_\_\_\_\_\_\_\_\_\_\_\_ monomers.   * Most of the glucose monomers in starch are joined by \_\_\_\_\_\_\_\_ linkages (number 1 carbon to number 4 carbon). * Two forms of Starch:   Animals store glucose in a polysaccharide called **\_\_\_\_\_\_\_\_\_\_\_\_**.   * Glycogen is similar to \_\_\_\_\_\_\_\_\_\_\_\_ , but more highly branched. * Humans and other vertebrates store a day’s supply of glycogen in the \_\_\_\_\_\_\_\_ and muscles, hydrolyzing it to release glucose to meet the body’s demand for sugar. |
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|  | **Cellulose** is a major component of the tough walls of \_\_\_\_\_\_\_\_\_ cells.  Like starch, cellulose is a polymer of \_\_\_\_\_\_\_\_\_\_\_\_. However, the glycosidic linkages in these two polymers differ.  How are the structures of starch and cellulose different, and what kind of implications does that have for living organisms?  Another important structural polysaccharide is **\_\_\_\_\_\_\_**, found in the exoskeletons of arthropods (including insects, spiders, and crustaceans).  Chitin is similar to \_\_\_\_\_\_\_\_\_\_\_\_, except that it has a nitrogen-containing appendage on each glucose monomer. |
| Lipids are a diverse group of \_\_\_\_\_\_\_\_\_\_\_\_\_ molecules  Unlike other macromolecules, lipids do not form polymers.  The unifying feature of **lipids** is that they: |
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|  | Fats store large amounts of energy.  A **\_\_\_\_\_\_\_\_\_\_\_**  is constructed from two kinds of smaller molecules:  **Glycerol**:  **Fatty acid**:  In a fat, \_\_\_\_\_\_\_\_ fatty acids are joined to glycerol by an \_\_\_\_\_\_\_\_\_\_\_ linkage, creating a **triacylglycerol**, or *triglyceride.*  **Saturated fatty acid**:  **Unsaturated fatty acid**: |
| Phospholipids are major components of cell \_\_\_\_\_\_\_\_\_\_\_\_\_.  **Phospholipids** have \_\_\_\_\_\_\_\_\_\_\_\_ fatty acids attached to \_\_\_\_\_\_\_\_\_ and a \_\_\_\_\_\_\_ group at the third position.   * The interaction of phospholipids with water is complex. * Phospholipids are arranged as a bilayer at the surface of a cell. |
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|  | Steroids include \_\_\_\_\_\_\_\_\_\_\_ and certain \_\_\_\_\_\_\_\_\_\_\_.  **Steroids** are lipids with a carbon skeleton consisting of \_\_\_\_\_\_\_\_ fused rings.  **Cholesterol**, an important steroid, is a component in animal cell \_\_\_\_\_\_\_\_\_\_.   * Cholesterol is the precursor from which all other \_\_\_\_\_\_\_\_\_\_ are synthesized. |
| Proteins include a diversity of structures, resulting in a wide range of functions  Proteins account for more than \_\_\_\_\_\_\_\_\_\_\_\_\_of the dry mass of most cells.  Protein functions include: |
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|  | Amino acids are the monomers from which proteins are constructed.  **Amino acids** are organic molecules with both carboxyl and amino groups.  Four components are attached to the α carbon:  The physical and chemical properties of the R group determine the unique characteristics of a particular amino acid.   * One group of amino acids has nonpolar R groups, which are \_\_\_\_\_\_\_\_. * Another group of amino acids has polar R groups, which are \_\_\_\_\_\_\_\_. * A third group of amino acids has functional groups that are charged (ionized) at cellular pH. * Amino acids are joined together when a \_\_\_\_\_\_\_\_\_\_\_ reaction removes a hydroxyl group from the carboxyl end of one amino acid and a hydrogen atom from the amino group of another. * The resulting covalent bond is called a **\_\_\_\_\_\_\_\_\_\_ bond.** * Repeating the process over and over creates a \_\_\_\_\_\_\_\_\_\_\_\_\_ chain. * At one end is an amino acid with a free amino group (the \_\_\_\_\_\_\_\_\_\_), and at the other end is an amino acid with a free carboxyl group (the \_\_\_\_\_\_\_\_\_\_\_). |
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|  | Protein \_\_\_\_\_\_\_\_\_\_\_ (shape) determines protein function.  It is the order of amino acids that determines the three-dimensional structure of the protein under normal cellular conditions.   * Three levels of structure—primary, secondary, and tertiary structures—organize the folding within a single polypeptide. Quaternary structure arises when two or more polypeptides join to form a protein.   The **primary structure** of a protein is its unique sequence of amino acids.  **Secondary structure** and result from hydrogen bonds between:   * One secondary structure is the **\_\_\_\_\_\_\_\_\_\_\_\_\_.** * The other main type of secondary structure is the **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.   **Tertiary structure** is determined by interactions among:  **Quaternary structure** results from: |
| Protein structure also depends on the \_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_ conditions of the protein’s environment.  How do the following alterations affect proteins: pH, salt concentration, temperature, nonpolar solvents? |
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|  | There are two types of nucleic acids: \_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_.  The two types of nucleic acids are:    Organisms inherit DNA from their \_\_\_\_\_\_\_\_\_\_\_\_.   * Each \_\_\_\_\_\_\_\_\_\_\_\_ along a DNA molecule directs the synthesis of a specific type of RNA called *\_\_\_\_\_\_\_\_\_\_\_\_\_ RNA* (*mRNA*).   The flow of genetic information is: |
| A nucleic acid strand is a polymer of \_\_\_\_\_\_\_\_\_\_\_\_\_\_.  Nucleic acids are polymers made of **\_\_\_\_\_\_\_\_\_\_\_\_\_** monomers organized as **polynucleotides**.  Each **nucleotide** consists of three parts:                  The nitrogenous bases are rings of carbon and nitrogen that come in two types:  1) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:    2) \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_:  The pentose joined to the nitrogenous base is **\_\_\_\_\_\_\_\_\_\_\_\_** in nucleotides of RNA and **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_** in DNA. |
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|  | Because the atoms in both the nitrogenous base and the sugar are numbered, the sugar atoms are distinguished by a prime (′) after the number.  The addition of a phosphate group creates a nucleoside monophosphate or *\_\_\_\_\_\_\_\_\_\_.*  Polynucleotides are synthesized when adjacent nucleotides are joined by covalent bonds called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ linkages that form between the —OH group on the 3′ of one nucleotide and the phosphate on the 5′ carbon of the next.   * The two free ends of the polymer are distinct. * One end has a phosphate attached to a 5′ carbon; this is the \_\_\_\_\_\_\_\_\_\_\_. * The other end has a hydroxyl group on a 3′ carbon; this is the \_\_\_\_\_\_\_\_\_. |
| Inheritance is based on replication of the DNA double helix.  An RNA molecule is usually a \_\_\_\_\_\_\_\_\_\_\_\_ polynucleotide chain.  DNA molecules have \_\_\_\_\_\_\_\_\_\_ polynucleotide strands that spiral around an imaginary axis to form a **double helix**.  The two backbones run in opposite 5′ 🡪 3′ directions from each other, an arrangement referred to as **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**.  The two polynucleotides or strands are held together by \_\_\_\_\_\_\_\_\_\_\_\_ bonds between the paired bases.   * With these base-pairing rules, if we know the sequence of bases on one strand, we know the sequence on the opposite strand. * The two strands are *\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.* |
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