Molecules at Work

Trace how molecular structure supports life inside a cell.

BIO.1B.1 "Develop and use models to compare and contrast the structure and function of carbohydrates, lipids, proteins, and nucleic acids (DNA and RNA) in organisms."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline a structure clue and circle a function clue for each of the four molecule groups. Number the DNA-to-RNA-to-protein sequence to trace how information guides a cell's work.

What Happens After Oatmeal?

1. After a bowl of oatmeal, your body has new materials to sort. Oats contain starch, a carbohydrate built from many linked glucose units. Digestion breaks starch into glucose, which cells can use to release energy. Cells also link glucose units into glycogen for short-term energy storage. Lipids have a different structure: many fats contain glycerol joined to three fatty acids. Their long, mostly water-repelling chains help store energy densely. Other lipids, called phospholipids, have water-attracting heads and water-repelling tails. In water, they arrange into a double layer that forms the boundary around each cell.

2. Energy alone cannot do every job inside a cell. Proteins are chains of amino acids that fold into particular shapes. A protein's shape helps determine its function: some proteins form parts of muscle fibers, while others act as enzymes that speed up chemical reactions. For example, digestive enzymes help break starch down until glucose can be absorbed. Unlike a carbohydrate chain, a protein chain uses amino acids as its building blocks, not sugar units. Unlike the fatty acid chains in many lipids, a protein's folded shape can create a specific working site for a chemical reaction.

3. Where do cells get the instructions for those protein chains? DNA and RNA are nucleic acids made of linked nucleotides, not amino acids. DNA usually forms a double-stranded helix and stores instructions in the order of its nucleotides. RNA is usually single-stranded. A cell uses an RNA copy of a gene's information to guide the assembly of a protein. In a simple model, arrows can show information moving from DNA to RNA to protein. Other arrows can show how a protein enzyme helps turn starch into glucose. These arrows show relationships, not that one molecule always becomes the next.

2 ANSWER WITH EVIDENCE

Use the passage

1. How do the structures and energy-storage roles of glycogen and fats differ?

2. Compare the building blocks of proteins and carbohydrates. How does a protein's structure help it do a job described in the passage?

3. How do DNA and RNA differ in structure and in their roles in making a protein?

4. In a model of starch digestion, how should you connect a protein enzyme to starch and glucose? Explain what that connection means.

3 YOUR TURN

Your own words

Draw your own model of a cell after an oatmeal meal. Label carbohydrates, lipids, proteins, DNA, and RNA; show a structure clue and a function for each of the four molecule groups, use arrows to connect at least two groups, and make the difference between DNA and RNA clear.

Molecules at Work

PART 1 · READ AND MARK

Underline a structure clue and circle a function clue for each of the four molecule groups. Number the DNA-to-RNA-to-protein sequence to trace how information guides a cell's work. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	How do the structures and energy-storage roles of glycogen and fats differ?	**Glycogen is made of linked glucose units and stores energy for the short term. Many fats contain glycerol joined to three fatty acids and store energy densely.**
2	Compare the building blocks of proteins and carbohydrates. How does a protein's structure help it do a job described in the passage?	**Proteins are chains of amino acids, while carbohydrates such as starch are built from sugar units. A protein can fold into a shape with a working site that helps it act as an enzyme.**
3	How do DNA and RNA differ in structure and in their roles in making a protein?	**DNA is usually double-stranded and stores instructions. RNA is usually single-stranded and carries a copy of a gene's information that guides protein assembly.**
4	In a model of starch digestion, how should you connect a protein enzyme to starch and glucose? Explain what that connection means.	**Show the protein enzyme acting on starch as it is broken down until glucose can be absorbed. The connection does not mean that protein becomes starch.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

At the cell's edge: lipid phospholipids (water-attracting heads and water-repelling tails) form a membrane boundary. Inside the cell: DNA (double-stranded nucleotides; stores instructions) → RNA (single-stranded nucleotides; carries a copy of the instructions) → protein enzyme (folded amino acid chain; helps break down starch). Carbohydrate starch (linked glucose units; source of usable energy) → glucose → energy for the cell. An arrow from the protein enzyme points to starch and is labeled 'acts on.'

Accept accurate models with clear structure-function clues for all four groups and a meaningful connection between groups. DNA and RNA should be distinguished, and an arrow must not imply that protein becomes starch.