

CELL BIOLOGY, GENETICS AND EVOLUTION

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FUNCTIONS OF BIOMOLECULES

LECTURE: 2

By: Shozab Seemab Khan (PhD Scholar)

ABAIIDULLAH COLLEGE, PAKPATTAN

Functions of Biomolecules

- ❖ Carbohydrates provide the body with source of fuel and energy, it aids in proper functioning of our brain, heart and nervous, digestive and immune system. Deficiency of carbohydrates in the diet causes fatigue, poor mental function.
- ❖ Each protein in the body has specific functions, some proteins provide structural support, help in body movement, and also defense against germs and infections. Proteins can be antibodies, hormonal, enzymes and contractile proteins.
- ❖ Lipids, the primary purpose of lipids in body are energy storage. Structural membranes are composed of lipids which form a barrier and controls flow of material in and out of the cell. Lipid hormones, like sterols, help in mediating communication between cells.
- ❖ Nucleic Acids are the DNA and RNA; they carry genetic information in the cell. They also help in synthesis of proteins, through the process of translation and transcription.

Functions of Carbohydrates

- ❖ Carbohydrates are chief energy source, in many animals; they are instant source of energy. Glucose is broken down by glycolysis/ krebs cycle to yield ATP.
- ❖ Glucose is the source of storage of energy. It is stored as glycogen in animals and starch in plants.
- ❖ Stored carbohydrates act as energy source instead of proteins.
- ❖ Carbohydrates are intermediates in biosynthesis of fats and proteins.
- ❖ Carbohydrates aid in regulation of nerve tissue and are the energy source for brain.
- ❖ Carbohydrates get associated with lipids and proteins to form surface antigens, receptor molecules, vitamins and antibiotics.

Functions of Carbohydrates

- ❖ They form structural and protective components, like in cell wall of plants and microorganisms.
- ❖ In animals they are important constituent of connective tissues (cartilage, bone, blood, adipose etc.)
- ❖ They participate in biological transport, cell-cell communication and activation of growth factors.
- ❖ Carbohydrates those are rich in fiber content help to prevent constipation.
- ❖ Also they help in modulation of immune system.

Example of Carbohydrates

- ❖ Monosaccharides Glucose, galactose, erythrose, ribose, ribulose, fructose.
- ❖ Oligosaccharides Maltose, lactose, sucrose, raffinose, stachyose.
- ❖ Polysaccharides Starch, glycogen, cellulose, pectin
- ❖ Foods rich in carbohydrates are referred to as starchy foods.
- ❖ They are found in legumes, starchy vegetables, whole-grain breads and cereals.
- ❖ They also occur naturally with vitamins and minerals in foods like milk, fruits, and milk products.
- ❖ They are also found in refined and processed products like candy, carbonated beverages, and table sugar.

Functions of Lipids

- ❖ 1. Food material: Lipids provide food, highly rich in calorific value. One gram lipid produces about 9.3 kilocalories of energy (heat).
- ❖ 2. Food reserve: Lipids provide are insoluble in aqueous solutions and hence can be stored readily in the body as a food reserve.
- ❖ 3. Structural component: Lipids are an important constituent of the cell membrane.
- ❖ 4. Heat insulation: The fats are characterized for their high insulating capacity. Great quantities of fat are deposited in the subcutaneous layers in aquatic mammals such as whale and in animals living in cold climates.
- ❖ 5. Fatty acid absorption: Phospholipids play an important role in the absorption and transportation of fatty acids.
- ❖ 6. Hormone synthesis: The sex hormones, adrenocorticoids, cholic acids and also vitamin D are all synthesized from cholesterol, a steroidal lipid.
- ❖ 7. Vitamin carriers: Lipids act as carriers of natural fat-soluble vitamins such as vitamin A, D and E.
- ❖ 8. Blood cholesterol lowering.
- ❖ Antibiotic agent. Squalamine, a steroid from the blood of sharks, has been shown to be an antibiotic and antifungal agent of intense activity. This seems to explain why sharks rarely contract infections and almost never get cancer.

Functions of Proteins

- ❖ Proteins are seen in muscles, hair, skin and other tissues; they constitute the bulk of body's non-skeletal structure.
- ❖ Example: The protein keratin is present in nails and hair.
- ❖ Some proteins are hormones and regulate many body functions. Example: Insulin hormone is a protein and it regulated the blood sugar level.
- ❖ Some proteins act enzymes, they catalyze or help in biochemical reactions. Example: Pepsin and Trypsin.
- ❖ Some proteins act as antibodies; they protect the body from the effect of invading species or substances.
- ❖ Proteins transport different substances in blood of different tissues. Example: Haemoglobin is an oxygen transport protein.
- ❖ Contractile proteins help in contraction of muscle and cells of our body. Example: Myosin is contractile protein.
- ❖ Fibrinogen a glycoprotein helps in healing of wounds. It prevents blood loss and inhibits passage of germs.

FUNCTION OF PROTEINS

Class of Protein	Function in the Body	Examples
Structural	Provide structural components	<i>Collagen</i> is in tendons and cartilage. <i>Keratin</i> is in hair, skin, wool, and nails.
Contractile	Movement of muscles	<i>Myosin</i> and <i>actin</i> contract muscle fibers.
Transport	Carry essential substances throughout the body	<i>Hemoglobin</i> transports oxygen. <i>Lipoproteins</i> transport lipids.
Storage	Store nutrients	<i>Casein</i> stores protein in milk. <i>Ferritin</i> stores iron in the spleen and liver.
Hormone	Regulate body metabolism and nervous system	<i>Insulin</i> regulates blood glucose level. <i>Growth hormone</i> regulates body growth.
Enzyme	Catalyze biochemical reactions in the cells	<i>Sucrase</i> catalyzes the hydrolysis of sucrose. <i>Trypsin</i> catalyzes the hydrolysis of proteins.
Protection	Recognize and destroy foreign substances	<i>Immunoglobulins</i> stimulate immune responses.

Functions of Nucleic Acids

- ❖ Nucleic Acids are the DNA and RNA; they carry genetic information in the cell. They also help in synthesis of proteins, through the process of translation and transcription.
- ❖ Nucleic acids are responsible for the transmission of inherent characters from parent to offspring.
- ❖ Stores genetic information that determines the hereditary characteristics of organisms. The sequence of nucleotides in DNA encodes the instructions for building and maintaining the organism.
- ❖ They are responsible for the synthesis of protein in our body by translation.
- ❖ DNA fingerprinting is a method used by forensic experts to determine paternity. It is also used for the identification of criminals and rapist. It has also played a major role in studies regarding biological evolution and genetics.
- ❖ Nucleic acids are involved in various repair mechanisms that maintain the integrity of the genetic material by correcting damaged DNA.