Graduate Certificate in Biohacking

Human Physiology and Biochemistry

Human Physiology and Biochemistry Key Terms and Vocabulary

Cell: The basic structural and functional unit of all living organisms. Cells are the smallest units of life that can carry out all the processes necessary for life.

Organelle: Specialized structures within a cell that have specific functions. Examples include the nucleus, mitochondria, and endoplasmic reticulum.

Cell Membrane: The semipermeable membrane that surrounds the cell and controls the passage of substances in and out of the cell.

Nucleus: The central organelle in a eukaryotic cell that contains the cell's genetic material and controls the cell's activities.

Mitochondria: Organelles responsible for producing energy in the form of ATP through cellular respiration.

Endoplasmic Reticulum: A network of membranes within the cell involved in protein synthesis and lipid metabolism.

Golgi Apparatus: An organelle that processes and packages proteins for transport within the cell or secretion outside the cell.

Lysosome: An organelle containing enzymes that break down cellular waste and debris.

Cytoskeleton: A network of protein filaments within the cell that provides structure and support and helps with cell movement.

Homeostasis: The body's ability to maintain a stable internal environment despite external changes. Examples include temperature regulation and blood glucose levels.

Feedback Mechanism: A regulatory process in which the output of a system affects the input, either amplifying (positive feedback) or reducing (negative feedback) the original stimulus.

Enzyme: Proteins that act as biological catalysts, speeding up chemical reactions in the body.

Substrate: The molecule that an enzyme acts upon in a chemical reaction.

Active Site: The region of an enzyme where the substrate binds and the chemical reaction takes place.

Cofactor: A non-protein molecule or ion that is required for the proper functioning of an enzyme.

Coenzyme: A type of cofactor that is an organic molecule, often derived from vitamins.

Metabolism: The sum of all chemical reactions that occur in an organism, including energy production, biosynthesis, and waste elimination.

Anabolism: The metabolic pathways that build molecules, requiring energy input.

Catabolism: The metabolic pathways that break down molecules, releasing energy.

ATP (Adenosine Triphosphate): The energy currency of the cell, produced during cellular respiration in mitochondria.

Glycolysis: The first stage of cellular respiration, in which glucose is broken down into pyruvate.

Krebs Cycle: The second stage of cellular respiration, where pyruvate is further broken down to produce energy-rich molecules.

Electron Transport Chain: The final stage of cellular respiration, where electrons are transferred along a series of proteins to generate ATP.

Photosynthesis: The process by which plants, algae, and some bacteria convert light energy into chemical energy in the form of glucose.

Chlorophyll: The pigment in chloroplasts that absorbs light energy for photosynthesis.

Carbohydrate: A macromolecule made of carbon, hydrogen, and oxygen, used as a primary source of energy in the body.

Protein: A macromolecule made of amino acids, with various functions in the body, including structure, enzymes, and hormones.

Lipid: A macromolecule made of fats and oils, important for energy storage, insulation, and cell membrane structure.

Nucleic Acid: A macromolecule made of nucleotides, including DNA and RNA, responsible for genetic information storage and protein synthesis.

Gene: A segment of DNA that contains the instructions for making a specific protein.

Transcription: The process by which DNA is copied into mRNA in the cell nucleus.

Translation: The process by which mRNA is read by ribosomes to synthesize proteins.

RNA (Ribonucleic Acid): A nucleic acid that plays a crucial role in protein synthesis.

DNA (Deoxyribonucleic Acid): The molecule that carries genetic information in cells.

Chromosome: A structure made of DNA and proteins that carries genetic information in the cell nucleus.

Genome: The complete set of an organism's genetic material.

Epigenetics: The study of changes in gene expression that do not involve alterations in the DNA sequence.

Antioxidant: A molecule that inhibits the oxidation of other molecules, protecting cells from damage.

Free Radical: A highly reactive molecule with an unpaired electron that can damage cells and DNA.

Acid-Base Balance: The regulation of the pH in the body to maintain homeostasis.

Buffer: A substance that resists changes in pH by accepting or donating protons.

Hormone: Chemical messengers produced by endocrine glands that regulate various physiological processes in the body.

Insulin: A hormone produced by the pancreas that regulates blood glucose levels.

Glucagon: A hormone produced by the pancreas that raises blood glucose levels.

Adrenaline: A hormone produced by the adrenal glands that initiates the fight-or-flight response.

Thyroid Hormone: Hormones produced by the thyroid gland that regulate metabolism, growth, and development.

Testosterone: The primary male sex hormone responsible for male characteristics and reproductive function.

Estrogen: The primary female sex hormone responsible for female characteristics and reproductive function.

Progesterone: A hormone involved in the menstrual cycle and pregnancy.

Homeostasis: The body's ability to maintain a stable internal environment despite external changes. Examples include temperature regulation and blood glucose levels.

Digestion: The process of breaking down food into smaller molecules that can be absorbed and used by the body.

Enzyme: Proteins that act as biological catalysts, speeding up chemical reactions in the body.

Salivary Amylase: An enzyme produced in the mouth that begins the digestion of carbohydrates.

Pepsin: An enzyme produced in the stomach that breaks down proteins.

Lipase: An enzyme produced in the pancreas that breaks down fats.

Intestinal Villi: Small finger-like projections in the lining of the small intestine that increase surface area for nutrient absorption.

Glucose: A simple sugar that is the primary source of energy for the body.

Amino Acid: The building blocks of proteins, essential for growth and repair in the body.

Fatty Acid: The building blocks of lipids, used for energy storage and cell membrane structure.

Vitamins: Essential organic compounds that the body needs in small amounts for various physiological functions.

Minerals: Inorganic substances that are essential for the body's normal functioning.

Electrolyte: Minerals in the body that carry an electric charge and are involved in various physiological processes, including nerve conduction and muscle contraction.

Water: The most abundant substance in the body, essential for life and involved in various physiological processes.

Dehydration: A condition in which the body loses more water than it takes in, leading to various health problems.

Immune System: The body's defense against pathogens and foreign substances that can cause disease.

Antigen: Molecules that trigger an immune response by the body.

Antibody: Proteins produced by the immune system that bind to specific antigens to neutralize them.

White Blood Cell: Cells of the immune system that defend the body against infections and foreign invaders.

Inflammation: The body's response to injury or infection, characterized by redness, swelling, heat, and pain.

Antibiotic: A substance that kills or inhibits the growth of bacteria.

Antiviral: A substance that inhibits the replication of viruses.

Antifungal: A substance that kills or inhibits the growth of fungi.

Antibacterial: A substance that kills or inhibits the growth of bacteria.

Antiseptic: A substance that prevents the growth of microorganisms.

Antimicrobial: A substance that kills or inhibits the growth of microorganisms.

Probiotic: Live beneficial bacteria that can improve gut health.

Prebiotic: Substances that promote the growth of beneficial bacteria in the gut.

Pathogen: A microorganism that causes disease.

Immunity: The body's ability to resist infection and disease.

Vaccination: The administration of a vaccine to stimulate the immune system to produce immunity against a specific disease.

Autoimmune Disease: A condition in which the immune system mistakenly attacks the body's own tissues.

Cancer: A group of diseases characterized by uncontrolled cell growth and spread.

Tumor: An abnormal mass of tissue caused by uncontrolled cell growth.

Malignant: Tumors that can invade nearby tissues and spread to other parts of the body.

Benign: Tumors that are not cancerous and do not invade nearby tissues.

Metastasis: The spread of cancer cells from one part of the body to another.

Chemotherapy: The use of drugs to kill cancer cells.

Radiation Therapy: The use of high-energy radiation to kill cancer cells.

Surgery: The removal of cancerous tissue.

Biopsy: The removal of a small sample of tissue for examination under a microscope to diagnose cancer.

Genetics: The study of genes, heredity, and variation in living organisms.

Genetic Mutation: A change in the DNA sequence that can lead to genetic disorders or cancer.

Genetic Testing: The analysis of an individual's DNA to detect genetic disorders or assess disease risk.

Gene Therapy: A treatment that involves altering genes to treat or prevent disease.

CRISPR: A technology that allows scientists to edit genes by removing, adding, or altering DNA sequences.

Stem Cell: Cells that have the potential to develop into different cell types in the body.

Regenerative Medicine: A field of medicine that aims to repair, replace, or regenerate damaged tissues and organs.

Biotechnology: The use of living organisms or their products to develop new technologies.

Pharmacology: The study of drugs and their effects on the body.

Pharmacokinetics: The study of how drugs are absorbed, distributed, metabolized, and excreted in the body.

Pharmacodynamics: The study of how drugs interact with their targets in the body to produce a response.

Drug Interaction: The effects that occur when two or more drugs are taken together.

Drug Tolerance: The reduced response to a drug after repeated use.

Drug Addiction: A condition characterized by compulsive drug-seeking and use despite harmful consequences.

Drug Overdose: The ingestion of a drug in quantities greater than the body can metabolize, leading to toxic effects.

Pharmaceutical: A drug or medication used for medical treatment.

Placebo: A substance with no therapeutic effect used as a control in clinical trials.

Pharmacogenomics: The study of how an individual's genetic makeup affects their response to drugs.

Drug Delivery: The method by which a drug is administered to the body to achieve the desired effect.

Biodegradable: Capable of being broken down by biological processes.

Nanotechnology: The manipulation of matter on an atomic and molecular scale to create new materials and devices.

Bioinformatics: The application of computer science and information technology to the field of biology.

Big Data: Large and complex data sets that require advanced technologies to analyze and interpret.

Artificial Intelligence: The simulation of human intelligence by machines, including learning, reasoning, and problem-solving.

Machine Learning: A subset of artificial intelligence that allows computers to learn from data without being explicitly programmed.

Quantum Computing: A type of computing that uses quantum-mechanical phenomena to perform operations on data.

Cybersecurity: The practice of protecting systems, networks, and data from digital attacks.

Ethics: The moral principles that govern human behavior.

Privacy: The right of individuals to control their personal information and data.

Consent: Permission given for something to happen, often in the context of medical treatment or research.

Confidentiality: The protection of sensitive information from unauthorized access or disclosure.

Biohacking: The practice of biology in a DIY (do-it-yourself) setting, often using technology and genetic engineering to enhance human capabilities.

Quantified Self: The self-tracking of biological, physical, and behavioral data to improve health and performance.

Optimization: The process of making something as effective or functional as possible.

Wellness: The state of being in good health, especially as an actively pursued goal.

Longevity: The state or quality of having a long life.

Personalized Medicine: Medical treatment tailored to the individual characteristics of each patient.

Biofeedback: The process of gaining greater awareness of physiological functions using electronic devices.

Neurofeedback: Biofeedback that focuses on monitoring brain waves to improve brain function.

Microbiome: The collection of microorganisms that live in and on the human body.

Gut-Brain Axis: The bidirectional communication between the gut and the brain, involving the nervous system, hormones, and the immune system.

Brain Plasticity: The brain's ability to change and adapt in response to experience and learning.

Cognitive Enhancement: The improvement of cognitive functions such as memory, attention, and problem-solving.

Sleep Hygiene: Practices and habits that promote healthy sleep.

Chronobiology: The study of biological rhythms and their influence on behavior and physiology.

Intermittent Fasting: A dietary pattern that involves cycling between periods of fasting and eating.

Ketogenic Diet: A high-fat, low-carbohydrate diet that induces a metabolic state called ketosis.

Bioavailability: The proportion of a drug or other substance that enters the bloodstream when introduced into the body.

Detoxification: The process of removing toxins from the body.

Supplement: A product taken orally that contains one or more ingredients intended to supplement the diet.

Biohacking Tools: Devices, apps, and technologies used to monitor and optimize health and performance.

Biohacking Community: A group of individuals interested in self-experimentation and optimization using biohacking techniques.

Challenges of Biohacking: Ethical considerations, safety concerns, and the need for scientific validation in biohacking practices.

Conclusion: A summary of the key terms and concepts related to human physiology and biochemistry in the context of the Graduate Certificate in Biohacking course.