

Biologia

I. The Cellular Basis of Life and Levels of Biological Organisation

- **Biodiversity:** Covering ecological, species (richness and relative abundance) and genetic diversity (richness and relative abundance) and genetic (variety within a species).
- **Extinction and Conservation:** Extinction is mainly caused by alteration and destruction of habitats, introduction of exotic species and overexploitation of biological resources.
- **The Cell as a Fundamental Unit:** The cell is the basic unit of structure and function of all living things.
- **Types of Cells:** Distinction between prokaryotic and eukaryotic cells (animal and plant).
- **Chemical Constituents of the Cell:**
 - **Water:** Essential for life, acting as a reagent (hydrolysis), diffusion medium, temperature control and solvent.
 - **Organic Compounds:** Organised into monomers that polymerise to form polymers. polymerise to form polymers, in a process of condensation process with the release of water. Hydrolysis breaks down the polymers with the addition of water.
 - **Glycides:** Energy and structural functions (monosaccharides - glucose, fructose; oligosaccharides - maltose, sucrose; polysaccharides - starch, glycogen).
 - **Lipids:** Energetic, structural, protective, vitamin and hormonal functions. They include fats, waxes, oils, cholesterol and phospholipids (triglycerides formed by esters between fatty acids and glycerol).
 - **Proteids:** Polymers of amino acids (20 different types) linked by peptide bonds. Oligopeptides (2-9), polypeptides (10-100), proteins (>100). Structural functions, enzymatic, hormonal, transport, motor and defence functions.
 - **Nucleic acids:** DNA and RNA, responsible for genetic information. information, polymers of nucleotides (5 different types). DNA (deoxyribose, thymine, double-stranded) vs. RNA (ribose, uracil, single-stranded).

II. Cell Structure and Function

- **Bacterial morphology:** Various ultrastructural components.
- **Morphology of Eukaryotic Cells:**
 - **Nucleus**
 - **Cytoplasm**
 - **Endoplasmic reticulum:** Rough and smooth.
 - **Golgi Apparatus**
 - **Mitochondria and Chloroplasts:** Energy-producing organelles with two membranes and energy-producing organelles with two membranes and their own genetic material, supporting the endosymbiotic theory.
 - **Lysosomes and Peroxisomes**
 - **Ribosomes:** Free or associated with the RER, ribonucleoproteins (80S), two subunits (40S and 60S).
 - **Cytoskeleton**

III. Ingestion, Digestion, Absorption and Transport Processes

- **Cellular Organisation:** Unicellular vs. Pluricellular.
- **Ingestion, Digestion and Absorption:** Intracellular and extracellular digestion.
- **Membrane Transport:** Osmosis, transport of small molecules, transport of large molecules. molecules, transport of large molecules.
- **Circulation in Animals:** Single (fish - one passage through the cycle) and Double (incomplete - amphibians and reptiles; complete - birds and mammals; double passage through the heart per cycle, pulmonary and systemic circulation).
 - **Heart:** Cardiac muscle tissue (myocardium), irrigation coronary arteries, movements (contraction - systole, relaxation - diastole), valves (bicuspid, tricuspid, semilunar and venous).
 - **Blood vessels:** Arteries > arterioles > capillaries > venules > veins.
 - **Blood Pressure**

- **Circulation in the veins:** Action of skeletal muscles, venous valves block backflow, respiratory respiratory movements, reduction of blood pressure in the auricles.

IV. Energy Metabolism

- **Anaerobiosis and Aerobiosis.**
- **Alcoholic Fermentation**
- **Food Preservation**
- **Aerobic Respiration:**
 - **Glycolysis:** Partial degradation of glucose to pyruvic acid.
 - **Krebs Cycle:** Mitochondrial matrix, decarboxylation and oxidation reactions. decarboxylation and oxidation reactions.
 - **Respiratory chain**
- **Anaerobic respiration:** Denitrifying bacteria, sulphate-reducing bacteria. bacteria.
- **Respiratory system:** Gaseous exchange by diffusion, direct or diffusion. Haematosis. Characteristics of the respiratory surfaces.

V. Regulation in Living Beings

- **Homeostasis:** Maintaining the balance of the internal environment in the face of variations in the external environment (e.g. body temperature, blood concentration).
- **Nervous Impulse Transmission**
 - **Neuron structure**
 - **Synapse:** Region of contact between neurons or between neurone and effector cell. Neurotransmitters.
- **Hormone regulation:**
 - **Hormones:** Chemical messengers, synthesised by endocrine released into the blood, act on target cells with specific receptors. specific receptors.
 - **Nervous and Hormonal Interaction:** Hypothalamus controls part of the endocrine system.
 - **Feedback:** Negative (increase in end product inhibits production) and inhibits production) and Positive (increase in final product stimulates production).
- **Thermoregulation:**
 - **Classification:** Homeothermic vs. Poikilothermic; Endothermic vs. Exo/Ectothermic.
 - **Mechanisms:** Behavioural and Physiological.
 - **Human Thermoregulation:** Thermoreceptors in the skin, sensory nerves, hypothalamus nerves, hypothalamus, motor nerves, effector organs. In the event of temperature rises: vasodilation, sweating, decrease in metabolic rate. metabolic rate. If it decreases: vasoconstriction, shivering, increased metabolism, hair erection.
- **Osmoregulation:** Maintaining the balance of water and solutes.
 - **Osmoregulatory animals:** Internal concentration differs from that of the environment. of the environment, they control the entry and exit of water by osmosis.
 - **Osmoconforming animals:** Internal concentration varies with that of the medium. of the medium.
 - **Freshwater fish (hypotonic):** Water enters by osmosis, salts leave by diffusion. Dilute urine, salt uptake in the gills. gills, do not ingest water.
 - **Saltwater fish (hypertonic):** Lose water by osmosis, gain salts by diffusion. osmosis, gain salts by diffusion. They ingest a lot of salt water, little concentrated urine, eliminate salts through the gills.
 - **Birds:** High metabolism causes water loss, compensated for by little concentrated urine and nasal glands (salt glands). glands).
 - **Terrestrial Animals:** Reduced water filtration in the kidneys, high water reabsorption, production of poorly soluble nitrogenous excreta soluble (urea, uric acid), water intake, active excretion of salt. of salt.
 - **Mammals:** R Kidneys, and constituents.
 - Urine formation: Filtration
 - Reabsorption
 - Secretion
 - Antidiuretic hormone (ADH) controls the permeability of the distal and collecting tubules to water.

VI. Cell Growth and Renewal

- **Nucleic Acids:** DNA, RNA.
- **Nucleotide:** Nitrogenous base + pentose (β -D-ribose in RNA, β -D-deoxyribose in DNA) + phosphate group.

- **DNA structure:** Double helix (two helical chains, hydrogen bridge bonds between complementary bases: A-T (2 bridges), C-G (3 bridges), antiparallel chains (5' → 3' and 3' → 5')). Chargaff's rule: (A+G) / (T+C) = 1; A=T, C=G.
- **RNA:** mRNA (messenger), tRNA (transfer), rRNA (ribosomal).
- **DNA function:** Storing information for proteins and RNAs.
- **DNA localisation:** Eukaryotes, Prokaryotes.
- **DNA replication:** Semi-conservative duplication, specific enzymes, DNA-polymerase.
- **Protein Synthesis:**
 - **Transcription (Nucleus):** Synthesis of mRNA from DNA by RNA-polymerase.
 - **Tradução (Citoplasma):** Protein synthesis under the command of the mRNA. Codons (mRNA), anticodons (tRNA), amino acids. Genetic code: universal, redundant, unambiguous. Initiation codon (AUG - methionine at the beginning), termination codons (UAA, UAG, UGA).
- **Gene mutations:** Change in the sequence of DNA bases.
- **Cell Cycle (Eukaryotes):** Growth and regeneration. DNA condensed into chromosomes.
 - **Chromosomes**
 - **Cell Cycle Phases:** Interphase and Mitotic Phase.
 - **Mitosis**
 - Prophase
 - Metaphase
 - Anaphase
 - Telophase
 - Cytokinesis
 - **Cell Cycle Regulation:** Control at specific points.
 - **Apoptosis:** Programmed cell death.
- **Tissue Growth and Regeneration:** Cell division. Cell differentiation.

VII. Reproduction in Living Beings

- **Types of Reproduction:** Asexual and Sexual, Life Cycles.
- **Asexual Reproduction**
 - **Bipartition:** Cell division into two.
 - **Gemulation:** Formation of a bud that separates or remains attached.
 - **Sporulation:** Formation of spores.
 - **Vegetative Multiplication:** New plants from parts of the mother plant.
 - **Parthenogenesis:** Development of an unfertilised ovule.
 - **Cloning:** In plants and animals.
- **Sexual reproduction:** Two parents, fertilisation (union of gametes resulting from gametes resulting from meiosis - chromosome reduction)
 - **Meiosis:** Two successive divisions (Meiosis I and Meiosis II) resulting in four genetically different haploid cells.
 - Prophase I, Metaphase I, Anaphase I, Telophase I, Prophase II, Metaphase II, Anaphase II and Telophase II
- **Meiosis and Genetic Variability:** Crossing-over, random separation of homologous chromosomes in Meiosis I, fertilisation.
- **Comparison of Mitosis and Meiosis**
- **Mutations**
 - **Gene:** Change in the nucleotide sequence of a gene.
 - **Cromossómicas:** Chromosomal:
- **Sexual reproduction in animals:** Gonads, hermaphroditic species, unisexual species.
- **Life Cycles:** Haplont, Diplont, Haplo-diplont.

VIII. Biological Evolution

- **Origin of the Eukaryotic Cell:** Increase in complexity due to invaginations of the cell membrane, endosymbiotic hypothesis.

- **Origin of Multicellularity:** Advantages of greater size, limits to unicellular size. Advantages of multicellularity.
- **Fixism vs. Evolutionism:**
 - **Fixism:** Species created as they are, unchanging. Creationism.
 - **Evolutionism:** Species gradually change over time, giving rise to others. time, giving rise to others.
- **Lamarckism (Jean-Baptiste Lamarck):** First theory of theory. Law of use and disuse. Law of inheritance of inheritance.
- **Darwinism (Charles Darwin):** Voyage on the HMS Beagle. Artificial Selection. Theory of Natural Selection:
 - Variation between individuals of the same species.
 - Overproduction of offspring.
 - Struggle for survival.
 - Differential survival and reproduction.
 - Gradual accumulation of variations over generations leads to transformation and the emergence of new species.
- **Lamarck vs. Darwin:**
 - **Arguments for Evolutionism:**
 - **Comparative Anatomy:** Homologies, Analogies, vestigial organs.
 - **Palaeontology:** Fossils show transitional forms and changes over time.
 - **Cytology:** Basic cellular unit, structural similarities in eukaryotic cells.
 - **Biochemistry:** Similarities in biomolecules, metabolism. Suggest common origin.
 - **Neodarwinism (Synthetic Theory of Evolution - 1940s):** Fusion of of Darwinism with Mendelian Genetics. Mutations. Natural Natural selection acts on genetic variation, fitter individuals reproduce more, the frequency of favourable genes increases in the population.

IX. Systematics of Living Creatures

- **Diversity of Living Creatures**
- **Systematics:** Scientific study of the diversity and evolutionary evolutionary relationships of living beings, developing classification systems.
- **Taxonomy:** Classification of living beings and nomenclature of groups. groups.
- **Practical classifications:** linked to basic needs.
- **Rational classifications:** Based on characteristics of living beings. living beings.
- **Horizontal (Phenetic) classifications:** Favour observable/morphological characters, similarity characters, phenotypic similarity (quantitative), time factor not considered, classification by similarity.
- **Vertical Classifications (Phylogenetic or Cladistic):** Emphasis on evolutionary relationships (phylogeny), importance of importance of kinship, time factor considered, dynamic classifications.

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