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| **Medical Biology and Genetics - Part I: BIOLOGY** |
| **1** | **Biomacromolecules**, basic four types, their structures and functions, mutual interactions in a cell; Transcription factors (including examples) |
| **2** | **Proteins**, basic structural organization; Domain structure of proteins; Basic functions of proteins; Protein families; Examples |
| **3** | **Nucleic acids**, basic structure and functions; Differences and similarities between DNA and RNA; NA interactions with proteins |
| **4** | **Biomembranes**, basic structure, properties and functions |
| **5** | **Transport across biomembranes**, types, examples |
| **6** | **Glucose transport** in cells |
| **7** | **Cell; Comparison of eukaryotic and prokaryotic cells**, with a special emphasis on structure of a typical eukaryotic and prokaryotic gene and its expression |
| **8** | **Prokaryotic cell**, structure, examples; Classification according to the cell shape and cell wall structure (staining); Examples of pathogens, diseases; Antibiotics |
| **9** | **Eukaryotic cell**; Comparison of animal and plant cells; Membrane and non-membrane structures |
| **10** | **Cytoskeletal system of eukaryotic cells**, components, their structures and functions; Focus in detail on intermediate filaments; Comparison of cytoskeleton (eukaryotic/human) with prokaryotic cells |
| **11** | **Microtubules** (structure, functions, localization, dynamics), microtubule associated proteins; Substances influencing their dynamics |
| **12** | **Microfilaments** (structure, functions, localization, dynamics), microfilament associated proteins; Intermediate filaments (structure, functions, localization, dynamics) |
| **13** | **Extracellular matrix**, composition, relevance, receptors for extracellular matrix; Examples; Cell adhesion, cell junctions |
| **14** | **Plastids and mitochondria**, structure, function, origin; Two basic functions of mitochondria |
| **15** | **Endoplasmic reticulum and Golgi complex**, structure and functions; Secretion pathway and vesicular transport; Examples |
| **16** | **Lysosomes, peroxisomes**, their structure and function; Autophagy; Diseases |
| **17** | **Intracellular transport and molecular motors**; Types, examples |
| **18** | **Cell nucleus**, structure and function; Chromatin organization; Why is it problematic to hold that cell nucleus contains chromosomes? |
| **19** | **Gene expression**, regulation in eukaryotes |
| **20** | **DNA synthesis, repair and degradation** |
| **21** | **Make a schematic drawing of a typical human protein coding gene**; Explain functions of all its parts |
| **22** | **Gene expression**, regulation in prokaryotes |
| **23** | **Telomeres**, telomerase and immortalization |
| **24** | **Transcription**, basic outlines, relevance and regulation; Differences between prokaryotic and eukaryotic transcription |
| **25** | **RNA processing and degradation**; Why is it not always true: one gene one protein one trait? Nonsense-mediated decay and its relevance for human diseases |
| **26** | **Non-coding RNAs**, their types, structure and functions; Focus on regulatory RNAs |
| **27** | **Ribosomes**, structure, function, biogenesis, cellular locations; Protein trafficking |
| **28** | **Genetic code**, synthesis of proteins - translation |
| **29** | **Protein modifications, protein folding**; Molecular chaperones and cellular response to protein misfolding |
| **30** | **Intracellular degradative processes of proteins**; Two basic compartments of their degradation; Examples |
| **31** | **Signal transduction**, basic types of signalling; Molecules and molecular complexes involved in particular types; Cell responses to these signals; Examples |
| **32** | **Signal transduction - kinases and phosphatases**; Examples and relevance to human diseases |
| **33** | **Make a schematic drawing of a typical signal transduction pathway**, explain |
| **34** | **Signal transduction involving second messengers and G-proteins**; Examples and relevance to human diseases |
| **35** | **Steroid hormones**, their signal transduction and malfunction in human diseases |
| **36** | **Genome**, with focus on human genome, its size and structure |
| **37** | **Cell cycle and its regulation** (focus on molecular level); Main checkpoints |
| **38** | **Cyclins and cyclin dependent kinases**; Cellular CDK inhibitors |
| **39** | **Mitosis**, relevance, course of basic events; Possibilities of pharmacologic interventions targeting mitotic spindle |
| **40** | **Cell death**, basic types and their comparison on morphological and molecular level |
| **41** | **Intrinsic and extrinsic pathway of apoptosis initiation;** Physiologic and pathologic apoptosis and its consequences |
| **42** | **Caspases** |
| **43** | **Identification and clearance of apoptotic cells and apoptotic bodies**, and its malfunction in human diseases |
| **44** | **Immune system**, its role in the organism; Basic terms; Two basic types of immune responses; Production of cells of the human immune system |
| **45** | **Innate and adaptive immunity**, highlight differences; Focus on **innate immunity** mechanisms, cellular and humoral components |
| **46** | **Innate and adaptive immunity**, highlight differences; Focus on **adaptive immunity** mechanisms - cellular and humoral components; TCR and BCR receptors |
| **47** | **Viruses**, life cycle and molecular biology; Examples of viruses and viral diseases |
| **48** | **DNA and RNA viruses**, their structure, genome, life cycle; Two types of life cycle of bacteriophages |
| **49** | **Retroviruses**; Life cycle and molecular biology; Examples |
| **50** | **Cell and tissue cultures of human cells**, basic types, relevance; Laboratory work with them; Stem cells |