

Biology

Science of Life

Basic unit of life process; Cell Theory; prokaryotic and eukaryotic cells- structure and differences

Ultra structure and functions of cellular components

Cell wall, plasma membrane, plastids, endoplasmic reticulum, Golgi bodies, mitochondria, ribosomes, lysosomes, nucleus, nucleolus, centrosome, microbodies (peroxisomes and glyoxysomes), cytoskeleton, vacuole, centriole, cilia, flagella

Chemical constituents of living cells

Classification, components and structural properties of carbohydrates, lipids, proteins and nucleic acids; enzymes, enzymatic action (lock and key, allosterism, regulation)

Chromosome

Morphology of chromosomes; brief idea of polytene chromosomes; euchromatin and heterochromatin; nucleic acids as genetic material (viral transduction and bacterial transformation)

Cell division

Cell cycle; mitosis- definition and significance (process not required); meiosis- process, types and significance; difference between mitosis and meiosis

Genetics and Evolution

Mendelian inheritance (laws only); deviations from Mendelism- (i) incomplete dominance, (ii) codominance, (iii) multiple alleles and inheritance of blood groups (ABO, Rh); phylogenetic inheritance (elementary); chromosome theory of inheritance; chromosomes and genes; sex determination in humans, birds and honey bees; linkage and crossing over; sex-linked inheritance- haemophilia, colour blindness; Mendelian disorders in humans- (i) autosomal (a) Thalassemia (b) Down syndrome; (ii) sex-linked (a) Turner's syndrome (b) Klinefelter's syndrome (cause and symptoms only)

Molecular basis of inheritance

DNA as the genetic material (Griffith, Avery-MacLeod-McCarty and Hershey-Chase experiments); structure of DNA and RNA; types of RNA- mRNA, rRNA and t-RNA; DNA packaging; central dogma (elementary); DNA replication; transcription; genetic code; translation; elementary knowledge of regulation of gene expression (lac operon); DNA finger printing (basic idea only)

Evolution

Origin of life- theories of origin of life; abiogenic origin/chemical origin of life- Oparin-Haldane hypothesis; biological evolution- evidences, theories of organic evolution, Darwin's contribution, synthetic theory; mechanism of evolution- variation and its sources of origin, mutation, recombination; gene flow and genetic drift; Hardy-Weinberg principle; human evolution- an outline

Morphological variations and structural organization

Plant tissue and tissue system- types, structure and functions; animal tissue- classification, structure and functions in brief

Physiology and Biochemistry

Plants

1. Movements of water, nutrients and gases: absorption of gases, water and nutrients; cell-to-cell transport, diffusion, active transport; plant-water relation- imbibitions, water potential, osmosis and plasmolysis; long distance transport- apoplastic, symplastic, root pressure, transpiration pull, uptake of minerals; transpiration and guttation; opening and closing of stomata; transport through xylem and phloem
2. Essential minerals: macro and micro nutrients and their functions; elementary idea of hydroponics; nitrogen metabolism; nitrogen cycle; biological nitrogen fixation
3. Respiration: cellular respiration- glycolysis, fermentation, TCA cycle and ETS (aerobic)- definition, process and significance; energy relation- number of ATP molecules generated in respiration; amphibolic pathways; respiratory quotients of nutrients
4. Photosynthesis: definition; site of photosynthesis; photosynthetic pigments (structure not required); photochemical and biosynthetic phases; photorespiration; C3 and C4 pathways; factors controlling photosynthesis
5. Growth and development: idea of growth, differentiation and development; various growth factors (light, temperature, water, nutrients, hormones only); growth rate; growth regulation- auxin, gibberellins, cytokinin, ethylene, ABA; seed germination, seed dormancy, vernalisation; photoperiodism- definition, types of plants on the basis of the length of photoperiod
6. Reproduction: mode of reproduction- sexual and asexual; asexual reproduction- definition, characteristics, modes (binary fission, sporulation, budding, gemmule formation, fragmentation, regeneration, vegetative propagation, cutting, grafting, layering and gootee); sexual reproduction- flower structure; pollination (autogamy and geitonogamy); cross pollination (allogamy and xenogamy); agents of pollination- brief description with examples; significance; development of male gametophyte and female gametophyte; out breeding devices; pollen-pistil interaction, double fertilization; post-fertilization events- development of endosperm and embryo (in brief); formation of fruit and development of seed (elementary); special modes- apomixis, parthenogenesis, parthenocarpy and polyembryony (brief account); significance of fruit and seed formation

Animals: Human

1. Digestion and absorption: Structure of human alimentary canal including dental arrangement and digestive glands (in brief); peristalsis; digestion, role of digestive enzymes and the Cr-I hormones in digestion; absorption, assimilation of carbohydrates, protein and fats; egestion; nutritional and digestive disorder- protein-energy malnutrition (PEM), indigestion, constipation, vomiting, jaundice, diarrhoea (brief idea)
2. Breathing and respiration: respiratory organs in animals (in brief); respiratory system in human (outline); mechanism of breathing and its regulation in human body; exchange of gases,

transport of gases; regulation of respiration; respiratory volume; disorders related to respiration- asthma, emphysema, occupational respiratory disorders (e.g. Silicosis, asbestosis); definition of hypoxia, anoxia, apnoea, dyspnoea

3. Body fluids and circulation: composition of blood (in tabular form); blood grouping; coagulation of blood; lymph and its function; outline idea of human circulatory system; structure of human heart and blood vessels; cardiac cycle, cardiac output, stroke volume, minute volume, determination of cardiac output- Fick's principle; double circulation; regulation of cardiac activity (neural and hormonal) including factors regulating blood pressure; disorders of circulatory system- hypertension, coronary artery disease, angina pectoris, heart failure (brief idea only)
4. Excretory products and their elimination: modes of excretion- ammonotelism, ureotelism, uricotelism (definition and examples); human excretory system- structure and function (histology of nephron); urine formation and osmoregulation; regulation of kidney functions, rennin, angiotensin, antidiuretic factor (ADH) and diabetes insipidus; role of other organs in excretion- liver, skin, lung and salivary glands; disorders- uremia, renal failure, renal calculi, nephritis; dialysis and artificial kidney (brief idea only)
5. Locomotion and movement: types of movement-ciliary, flagellar and muscular; skeletal muscle contractile proteins and its function; joints; disorders of muscular and skeletal system- myasthenia gravis, tetany, muscular dystrophy, arthritis, osteoporosis, and gout (brief idea only)
6. Neural control and coordination: brief idea of neurons and nerves, neural control and coordination; nervous system of human- central, peripheral and visceral; brain and its major parts- cerebral cortex, thalamus, hypothalamus and limbic system; midbrain, pons, medulla, cerebellum and spinal cord (outline idea); distribution and function of peripheral nervous system and autonomic nervous system; generation and conduction of nerve impulse; reflex action and reflex arc; sense organs- sensory perception; outline structure and function of eye and ear
7. Chemical coordination and regulation: endocrine glands and hormones; human endocrine system- hypothalamus, pituitary, pineal, thyroid, parathyroid, adrenal, pancreas, gonads- location and function only; elementary idea of hormone action, role of hormones as messengers and regulators; hypo- and hyperactivity of endocrine glands and related diseases- dwarfism, acromegaly, cretinism, goitre, exophthalmic goitre, diabetes, Addison's disease (brief idea of cause and symptoms only)
8. Reproduction: male and female reproductive system (outline idea with diagram); microscopic anatomy of testis and ovary; gametogenesis (brief account); menstrual cycle; fertilization and development of embryo up to blastocyst formation; implantation, pregnancy and placenta formation; elementary idea of parturition and lactation

Taxonomy, Systematics and Biodiversity

Definition; binomial nomenclature; Law of priority; need for classification; genetic diversity; species diversity, ecosystem diversity, biodiversity; five kingdom classification; salient features and classification of plants and animals

Ecology and Environment

Concept of ecology, ecosystem, environment, habitat and niche; biome concept and distribution; major abiotic factors; response to abiotic factors and adaptation; population interaction- mutualism, competition, predation, parasitism; population attributes- growth, birth rate and death rate; trophic relationship, pyramids of number, biomass and energy; ecological succession

Biodiversity and Conservation

Pattern of biodiversity; importance and loss of biodiversity; need of biodiversity conservation; hotspot; endangered species; extinction; Red Data Book and Green Data Book; biodiversity conservation biosphere reserve, national parks and sanctuaries (general idea)

Environmental issues

Sound, air, water pollution and their control; agrochemical and their effects; green house effect and global warming; ozone depletion; deforestation; idea of success stories addressing environmental issues- 1) Chipko Movement, 2) Dasholi Gram Swarajya Mandal Movement (DGSM), Silent Valley or Amrita Devi Bishnoi Movement (Jaipur); concept of biomagnification and bioaccumulation; cause of dyslexia, Minamata and itai-itai diseases; idea of BOD, COD, acid rain, ozone hole

Microbes and human welfare

Morphological characteristics of bacteriophage (T2), plant virus (TMV), animal virus (influenza) and bacteria (E. coli), gram negative and gram positive bacteria (characteristics and examples)

Health and diseases

Concept of immune system, antibody, antigen and its reactions; types of immunity, vaccine and vaccination (brief idea); pathogens and parasites causing human diseases (only causative agents, symptoms of diseases, modes of transmission and preventive measures)- malaria, kala azar, amoebiasis, filariasis, ascariasis, typhoid, pneumonia, common cold, ring worm, HIV, AIDS, cancer

Biotechnology and its applications

Principle and process of genetic engineering (recombinant DNA technology); cloning of microbial genes (brief idea only); application of biotechnology in health and agriculture- in household food processing; industrial production, energy generation, sewage treatment; Rhizobium and other nitrogen fixing bacteria, biofertilizers and biopesticides, industrial production of curd; tanning and brewery, synthesis of antibiotics, vitamins, human insulin and vaccine production; gene therapy, transgenesis, transgenic animals and plants with examples (including BT cotton)

