Biology 131-General Biology

Description of Course Topics

- **Course Introduction, Characteristics of Life**
  Characteristics of life, viruses as "gray" area, levels of biological organization

- **Chemistry of Life**
  Chemical composition of living things, atomic structure, types of chemical bonding, the properties of water as they are crucial to life, acids and bases, pH

- **Organic Compounds**
  Categories and functions of organic macromolecules, chemical subunits, and biologically important examples of each category, dehydration and hydrolysis reactions, levels of protein structure

- **Cell Types and Plasma Membranes**
  Cell theory vs. spontaneous generation, five kingdom characteristics, prokaryotic vs. eukaryotic cells, structure and function of phospholipids, carbohydrates and proteins in plasma membranes

- **Eucaryote Organelles**
  Structure and function of eucaryote organelles in animal and plant cells

- **Cell Structure and Function**
  Cell size as limited by surface to volume ratio, complementarity of cell structure and function, endosymbiotic theory for the origin of eucaryotic cells

- **Movement of Materials In and Out of Cells**
  Mechanisms of diffusion, osmosis, facilitated diffusion, dialysis, active transport, endocytosis and exocytosis, and the factors affecting molecular transport

- **Enzymes and ATP**
  Structure and function of enzymes, induced fit model of enzyme action, factors influencing enzyme activity, the structure of the ATP molecule, hydrolysis and phosphorylation of ATP

- **Cellular Respiration**
  Oxidation and reduction reactions, role of temporary electron carriers, aerobic/anaerobic stages and their respective cellular locations

  Glycolysis – starting and ending products, ATP investment and yield
  Citric Acid Cycle – starting and ending products, production of NADH and FADH, pathways for alternative fuels (lipids and proteins)
  Electron Transport – oxidation and reduction reactions of et chain molecules, role of oxygen, chemiosmotic formation of ATP, energy yield of glucose metabolism

- **Fermentation**
  Production of ethyl alcohol and lactic acid, energy yield, regeneration of NAD+

- **Photosynthesis**
  Autotrophs vs. heterotrophs, electron energy changes within the chlorophyll molecule, structure of the chloroplast, localization and end products of the light independent and light dependent reactions, plant structure in acquiring materials for photosynthesis – leaf adaptations, stomata, xylem and phloem.

- **DNA Structure and Replication**
  Evidence that DNA is the genetic material, Watson and Crick model for the model for the structure of DNA semi-conservative model of DNA replication, procaryote vs. eucaryote replication.

- **Protein Synthesis**
  Structure and types of RNA, transcription, translation, DNA processing.

- **Mutations**
  Spontaneous vs. induced, point mutations – examples of substitutions, additions, deletions and frame shifts, examples of chromosomal mutations, chromosome structure, description of homologous chromosomes.

- **Cellular Reproduction – Mitosis and Meiosis**
  Similarities and differences between mitosis and meiosis, mechanism of crossing over, independent assortment, similarities and differences between spermatogenesis and oogenesis, mechanism and consequences of nondisjunction of autosomes and sex chromosomes, karyotypes, Barr bodies, role of telomeres in cell aging and cancer.

- **Genetic Engineering/Recombinant DNA**
  Plasmids as vectors, restriction enzymes as molecular scissors, products of recombinant DNA and their commercial value, procedures of DNA fingerprinting, description of PCR, uses and current difficulties of gene therapy.

- **Mendelian Genetics**
  Punnett squares – monohybrid and dihybrid crosses, solving genetics problems, alternate patterns of inheritance – incomplete dominance, multifactorial inheritance, pleiotropy, codominance, and sex-linked traits.

- **Genetic Regulation**
  Control of transcription – Lac operon of E.coli, promoters and role of RNA polymerase, operator sites and repressor proteins.

- **Evolutionary Theory / Evidences For Evolution**
  Intellectual climate of Victorian England, influence of Lyell and Malthus on Darwin; evidences for evolution as seen in the fossil record and transitional forms, homologous structures, comparative embryology, comparative biochemistry and artificial selection, divergent vs. convergent evolution, gradualism vs. punctuated equilibrium models of evolutionary change.

- **Natural Selection and Other Sources of Evolutionary Change**
  Description of change in gene frequencies, reproduction as critical in natural selection, kin selection, requirements of genetic variation and heritability, natural selection vs. Lamarckism as explanations for adaptations, modern examples – peppered moths, antibiotic and DDT resistance, modes of selection directional, stabilizing, disruptive, genetic drift, parental investment by males and females as an example of using evolution to understand behavior. (proximate vs. ultimate explanations)

- **Energy Transfer In Ecosystems**
  Food webs and trophic levels, ecological pyramids, biological magnification of chemical residues, the water cycle and carbon cycle, causes and consequences of the greenhouse effect, the nitrogen cycle, acid rain.

- **Population Ecology**
  Patterns of population growth, density dependent and density independent limiting factors, patterns of human population growth, life history strategies.

- **Interactions Between Organisms**
  Competition, defenses against predation, commensalism, mutualism and parasitism.