ADANCED BIOLOGY TOPICS

Class duration – **1.5-2 hrs**
Recommended number of classes – **2-3**

Enzyme Kinetics
During the class, different types of enzyme inhibition (competitive, noncompetitive, uncompetitive, mixed), Michaelis-Menten kinetics, allosteric enzyme kinetics, and Linweaver-Burk plots all will be discussed. You will also learn about different enzyme classes and factors that regulate enzyme activity.

Statistics
Chi square, t-tests, key statistical parameters will be explained. Probability and probability distributions. Application of mean, median, percentage, variance, standard deviation, standard error, Bayes' theorem, binomial expansion formula. Logarithms.

Biochemistry
Serial dilutions, Concentrations, Molar solutions, pH and Buffers, Henderson Hasselbach equation.

Cell metabolism
Glycolysis, Ketogenesis, Pentose Phosphate Cycle, Gluconeogenesis, TCA cycle, electron transport chain, fermentation, Cori cycle, Alanine cycle, Glycogen synthesis and catabolism, Urea cycle.

Chemistry of Biomolecules
Key biomolecule structure (including carbohydrates, lipids, amino acids, and nucleic acids) and recognition reactions to detect molecules in various solutions. Net charges of amino acids and peptides.

Molecular Biology
Analysis of blots, gel electrophoresis results, dideoxy chain termination reaction, PCR, RFLP, DNA fingerprinting.

Animal anatomy
Make dissections of an invertebrate (Ph. Annelida, Arthropoda, or Mollusca) and identify the main macroscopic organs

UPGMA and Cladistics
Unweighted Pair Group Method with Arithmetic Mean (UPGMA) is a standard method to build phylogenetic trees. Using examples from past IBO papers we will learn how to use UPGMA and how to draw and analyse phylogenetic trees.

Histology
During the class, the emphasis will be put on analysis of the human tissue slides and will cover the most important human body systems. In depth discussion on the functions of tissues and cells will also be included.

Advanced Topics in Botany
Main focus of this class is to look at cross sections of the stems, roots, and leaves, learn to compare CAM, C3 and C4 plants, explain the differences between xerophytes, hydrophytes, halophytes, and mesophytes. Also, floral diagrams and formulas are discussed.

Advanced Topics in Genetics
Complementation, Epistasis, Transfection, Pedigree analysis.

Linkage, Recombination & Gene Mapping
Chi square analysis, recombination frequency analysis, trihybrid and monohybrid crosses and linkages, gene mapping will be analysed.

Bacterial & Viral Genetics
Prokaryotic gene regulation, operon mutations, Recombinant DNA/Cloning, restriction map analysis, Beer's Law, Bacterial growth

Ecology
Topics include coevolution of the biosphere, geosphere, atmosphere and oceans; photosynthesis and respiration; the hydrologic, carbon and nitrogen cycles. We will examine the flow of energy and materials through ecosystems; regulation of the distribution and abundance of organisms; structure and function of ecosystems, including evolution and natural selection; metabolic diversity; productivity; trophic dynamics; models of population growth, competition, mutualism and predation.

Animal Behaviour (Ethology)
Habitat selection. Territoriality; dispersal; migration. Feeding. Foraging or stalking; prey capture; storage / hoarding; consummation. Antipredator behavior. Detection; tricking the predator; defenses-individual, social; other adaptations. Dimorphisms in body and behavior; social organization, dominance structures; evolution of sexual signals, emancipation from original uses. Mating and reproduction. Pair bonding varieties and advantages; brood tending and its evolution; similarities of emancipated actions across widely different species. Cooperation among conspecifics. Tool use.