



PhD Entrance Examination 2025

LIFE SCIENCES SYLLABUS

Biochemistry

Bioenergetics: ΔG , ΔG° , ATP hydrolysis, redox, NAD^+/NADH , FAD/FADH_2

Carbohydrates: monosaccharides, stereochemistry, glycosidic linkages, cellulose, amylose/amylopectin, glycogen

Glycolysis & Gluconeogenesis: Key enzymes, irreversible steps, ATP yield, hormonal regulation (glucagon, cortisol)

TCA & OxPhos: CAC intermediates, ETC complexes, proton gradient, cyanide inhibition

Lipids: Simple, compound, derived, β -oxidation, triacylglycerol synthesis, cholesterol/steroid hormones.

Amino Acids & Proteins: Classification, essential/nonessential, α -helix, β -sheet, primary quaternary, denaturation, chaperones, urea cycle, transamination, metabolic disorders

Bioinformatics

Structural Biology: X-ray, NMR, PDB, RASMOL, β -sheet, disulfide bonds

Databases & Tools: FASTA, BLAST, local/global alignment, NCBI, EBI, accession numbers, PubMed.

Genomics: HGP, gene count, EST, cDNA, pseudogenes, conserved regions, orthologs, phylogenetic tree, comparative genomics

Molecular Biology: DNA to RNA to Protein, gene structure, PCR (Denaturation, annealing, MgCl_2 , GC %), NGS, sequence alignment, homology, evolutionary analysis

Biotechnology

Mutations & Cancer: Spontaneous mutations, oncogenes, proto-oncogenes, p53, antioxidants.

Enzymes: Allosteric regulation, feedback inhibition, inactive forms, glucose-6-phosphatase.

Hormones: Insulin, glucagon, placental hormones (hCG, hPL), menstrual cycle, ductless glands.

Analytical Techniques: Chromatography, electrophoresis, blotting, mass spectrometry, Bragg's law.

Clinical Embryology

Gametogenesis: Spermatogenesis (Sertoli/Leydig), oogenesis, FSH/LH, estrogen/progesterone.

Fertilization: Capacitation, acrosomal reaction, zona pellucida, zygote formation.

Embryonic Development: Cleavage, morula, blastocyst, implantation, gastrulation (ectoderm, mesoderm, endoderm), organogenesis.

Fetal Membranes: Amnion, chorion, yolk sac, amniotic fluid, placenta.

ART & IVF: Ovarian stimulation, egg retrieval, embryo transfer, ICSI, GIFT/ZIFT, PGT.

Cryopreservation: Vitrification, DMSO, sperm/oocytes/embryos.

Food Science & Nutrition

Macronutrients: Carbohydrates (~50%), proteins (animal/plant), fats, fiber, calories, BMR.

Micronutrients: Vitamin C (scurvy), D (rickets), A (vision), B-complex (beriberi), Ca/Na/K/Mg, hypercalcemia.

Functional Foods: omega-3 (anti-inflammatory), antioxidants, flavonoids, carotenoids, probiotics, prebiotics.

Assessment: Anthropometry, biochemical, clinical, dietary, foodomics.

Genetics

Cell Cycle & Mendel: G1/S/G2/M, diploid/haploid, alleles, locus, genotype/phenotype.

Laws: Segregation, independent assortment, monohybrid/dihybrid, incomplete dominance, codominance, pleiotropy.

Gene Interactions: Epistasis (dominant/recessive), complementary, duplicate, masking, ABO/Rh blood group.

Sex Determination: Barr bodies, dosage compensation, atypical karyotypes.

Probability: Punnett squares, chi-square, test cross, ratio calculations.

Microbiology

Bacteria: Diplococci, E. coli, abscess formation, nosocomial infections, Syphilis, plague, Clostridium, teichoic acid, mycobacteria

Viruses: EBV, Nipah, H1N1, Dengue, Chikungunya, smallpox, Togaviruses, COVID-19

Physiology: autotrophs, extremophiles, thermophiles, hyperthermophiles, ion pumps, mutualism, mycorrhizae, conjugation.

Industrial: Yogurt, kefir, Aspergillus, spawn, mycotoxins.

Environmental: eutrophication, lake zones, bioremediation, air quality, acid rain

Microscopy & Sterilization: Fluorescence, electron, 3D imaging, autoclaving, chemical disinfectants, turbidimetry.

Research Methodology

Principles: Definition, characteristics, originality, ethics, reproducibility, GLP, field research.

Design & Methods: Blueprint, exploratory/experimental, data collection (surveys, interviews, observation, experiments), PhD thesis.

Statistics: Chi-square, null/alternate hypothesis, graphs/charts

Researcher Qualities: Curiosity, objectivity, integrity, reproducibility, sampling (representative/unbiased)

Educational Research: Knowledge generation, teaching, learning improvement, policy guidance, evidence-based practice.