

Università degli studi dell'Insubria – Insubria University
BMS – Master Sc. in Biomedical Sciences
Basic background in Biological Sciences required for access

CELL BIOLOGY AND PHYSIOLOGY

- Cell compartments and organelles: structure and function
- Cell membranes: composition and functions
- Intracellular and extracellular matrix: cytoskeleton, transport, cell adhesion and motility
- Principles of bioelectricity and cell excitability
- Regulation of cell functions, the principles and mechanisms of homeostasis
- Cellular programs: growth, proliferation, differentiation, apoptosis
- Mendelian heredity. Concepts of gene, alleles, genotype and phenotype

Recommended textbook: Bruce Alberts et al. “Molecular Biology of the Cell” – 6th Ed. Garland Science, 2014

GENETICS

The keywords for the background knowledge are the following:

- Mendelian heredity. Concepts of gene, alleles, genotype and phenotype
- Sex-linked traits. Genetic linkage and recombination
- Basis of population genetics: concepts of gene pool, genotype and allele frequencies, genetic diversity, Hardy-Weinberg equilibrium
- Chromosomal, genomic and gene mutations and their genetic and phenotypic consequences
- DNA structure. Molecular mechanisms of transcription and translation
- The genetic code
- Gene structure in eukaryotes and splicing
- Bases of gene regulation in eukaryotes
- Molecular cloning and cloning vectors of widespread use
- Theoretical and practical aspects of PCR and hybridization assays
- Genomic and cDNA libraries
- Gene transfer assays in eukaryotic cells. Basic notions on transgenic models and gene knock-out or knock down approaches.

Recommended textbook: Peter Russel "GENETICS: A MOLECULAR APPROACH". Pearson Education Inc.

BIOCHEMISTRY

Keywords of background knowledge

- Biomolecules: Carbohydrates, lipids, amino acids, proteins, nucleic acids.
- From structure to function: structural organization of proteins, enzymes, enzyme kinetics, cooperativity and allostery.
- Bioenergetic and redox balance.
- Metabolism: Catabolism of sugars, fatty acids, amido acids, nucleosides. Basics of biosynthesis.
- Signal, receptors and signal transduction.
- Protein homeostasis.

Recommended textbook: Nelson and Cox, Lehninger's principles of biochemistry. 7th edition. Freeman, 2017. ISBN-10: 1464126119.

MOLECULAR BIOLOGY

- DNA, RNA and proteins: the main structures.
- Stability/dynamics of the DNA double helix – denaturation and renaturation (important for understanding some of techniques of molecular biology).
- Replication: overview of DNA synthesis at the replication fork and the enzymes/proteins involved.
- Transcription: overview of transcription in prokaryotes and its regulation. Organisation of transcription units in operons. Lac-operon as paradigm of transcriptional regulation in prokaryotes.
- RNA processing: how is the eukaryotic mRNA matured? Capping, splicing, poly-adenylation.
- Translation: overview of the process of protein synthesis.
- DNA repair: Mismatch repair, nucleotide/base excision repair.
- Techniques: Northern, southern, western, microarray, DNA sequencing, PCR, real-time PCR. Use of antibodies for immunoprecipitations.

Recommended textbook: Watson et al., Molecular Biology of the Gene (Pearson Inc)

PHARMACOLOGY

- Basic principles of pharmacokinetics (routes of administration, absorption, distribution, metabolism, excretions, drug interactions)
- Drug-receptor interactions and relationship with biological response (drug affinity, efficacy, dose/response curves; agonists/antagonists)
- Classes of molecular drug targets: receptors, enzymes, transporters, ion channels.
- Receptor-coupled intracellular signal transduction pathways

Recommended textbooks:

F. Clementi G. Fumagalli: General and Molecular Pharmacology: Principles of Drug Action. 1st English edition, 2015, Wiley

D.E. Golan, E.J. Armstrong, A.W. Armstrong: Principles of Pharmacology - The Pathophysiologic Basis of Drug Therapy. 4th Edition, 2016, Wolters Kluwer.

BIOINFORMATICS

Basic knowledge of common databases of biological sequences, such as:

www.uniprot.org www.ncbi.nlm.nih.gov
www.ebi.ac.uk