

## Master of Science program in Molecular Medicine

### Admission test

The admission test covers general, molecular, and medical aspects of anatomy, physiology, biochemistry, cell biology, genetics, pharmacology and pathology in humans. Please refer to the list of topics given below to prepare for the test.

#### Anatomy

- Functional organization of the human body
- cytology, microscopic organization of tissues and organs (epithelia, connective tissues, ossification, muscle, blood, blood vessels, nervous system)
- organogenesis and organ histology
- embryonic development: fertilization, early development, implantation, placentation, gastrulation, somite differentiation, development of skeleton and extremities, neurulation/neural tube, development of the circulatory system
- common ontogenetic malformations of the human organism

#### Physiology

- osmosis, membrane physiology, electrophysiology, blood physiology
- transport, electric signaling and signal cascades
- vegetative physiology and neurophysiology
- human pathophysiology
- methods: ECG, heart, blood, renal, circulatory and pulmonary parameters
- central and peripheral nervous systems and sensory organs

#### Biochemistry and cell biology

- cell structure, cell membrane, cytoskeleton, organelles, components and structure of the nucleus, cell movement, cell cycle and division, apoptosis
- structure and function of DNA and RNA, amino acids, nucleotides, gene structure, transcription, translation, DNA replication, DNA repair, gene regulation
- intracellular transport, endo- and exocytosis
- protein synthesis, posttranslational modifications, protein structure
- membrane proteins
- enzymes: classes, kinetics, regulation and allostery, coenzymes and vitamins
- lipids: structure, resorption, storing, mobilization, synthesis and degradation of fatty acids, cholesterol and LDL receptor
- signal transduction, ion channels, receptor classes, neurotransmitters
- hemostasis and fibrinolysis
- hormones and receptors
- structure of carbohydrates, glycogen synthesis and degradation, glycolysis, gluconeogenesis
- metabolism: TCA cycle, oxidative phosphorylation, pentose phosphate pathway, protein degradation, urea cycle, amino acids, citrate cycle, oxidative phosphorylation

- immune system, viruses and oncogenes, stem cells
- protein structure disorders, metabolic disorders, antibodies and autoimmunity, disorders of the blood system, channelopathies, mitochondriopathies, adrenoleukodystrophy, pancreatitis, gout, Xeroderma pigmentosum,  $\beta$ -thalassaemia, diphtheria
- principles of basic methods, e. g. cell culture, transfection, immunofluorescence, immunohistochemistry, PCR, cloning, transformation, plasmid preparation, immunoprecipitation, blotting, reporter assays, transgenic animal models

### **Human genetics**

- organisation of the human genome, genome evolution, chromosomes and mutations
- classical and molecular cytogenetics
- imprinting, instable mutations, epigenetics
- Mendelian inheritance, segregation analysis and Mendelian disorders
- microdeletion syndromes
- tumor genetics and tumor cytogenetics
- complex genetic disorders
- diagnostic and experimental techniques of mutation detection, functional analysis of mutations, high-throughput genotyping, microarrays, next generation sequencing, expression analysis, animal models in human genetics

### **Pharmacology**

- effects, indications and modes-of-action for important drugs
- drug therapy, principles of drug evaluation
- transport mechanism and metabolism of drugs
- strategies for drug development
- pharmacology of adrenergic and cholinergic systems
- animal models in pharmacological research, gene therapy, ion channels as drug targets
- neuropharmacology, treatment of M. Parkinson and epilepsy
- antiinfectives, analgesics, sedatives, antidepressants, antipsychotics, sex hormones, glucocorticoids, immunosuppressives, anticoagulants, thrombocyte aggregation inhibitors
- lipid metabolism and Diabetes mellitus
- calcium metabolism and therapy of osteoporosis
- cardiac hypertrophy and insufficiency, treatment of asthma bronchiale, heart, circulatory and renal disorders
- tumor chemotherapy, cytostatic agents, inhibition of tumorigenic signaling pathways

### **Pathology**

- cellular and molecular bases of pathology
- molecular mechanisms of tumorigenesis
- inflammation and immunopathology
- pathology of all organ systems (e. g. mammopathology, neuropathology, nephropathology)
- sarcoma
- predictive molecular pathology