

## SUMMER COURSE FOR MEDICAL STUDENTS, July 9 – 14, 2018 Program

### Monday, July 9: Introduction to Experimental Cardiovascular Research

**Organized by:** Institute of Physiology CAS - Departments of Developmental Cardiology and Experimental Hypertension

**Venue:** Institute of Physiology CAS, Vídeňská 1083, Prague 4

#### Lectures (9:00 – 12:00)

- molecular background of pacemaker potential, spreading of action potential in the heart, conduction system, regulation of heart rate, mechanism of arrhythmias
- molecular mechanism of excitation-contraction coupling, regulation of contractility
- myocardial hypoxia and ischemia/reperfusion, cardioprotective mechanisms
- pathophysiology of systemic and pulmonary hypertension, myocardial hypertrophy and heart failure
- mechanisms of blood pressure regulation, calcium influx, calcium sensitization
- sympathetic component of blood pressure regulation, kidney and regulation of blood pressure, end-organ damage in hypertension and chronic kidney disease

#### Lunch (12:00 – 13:00)

#### Demonstrations (13:00 – 16:00)

- non-invasive assessment of structural and functional properties of the heart with ultrasound (echocardiography)
- isolated perfused heart and its use in experimental cardiology and pharmacology
- preparation of isolated ventricular myocytes for physiological experiments
- use of telemetry for continuous monitoring of hemodynamic parameters (blood pressure, activity, ...)
- acute blood pressure monitoring in conscious animals
- functional assessment of embryonic cardiovascular system by videomicroscopy
- assessment of contractile properties of vascular smooth muscle



## Tuesday, July 10: Introduction to Experimental Research on Metabolism

**Organized by:** Institute of Physiology CAS - Departments of Adipose Tissue Biology, Epithelial Physiology, Bioenergetics, and Neurohumoral Regulations

**Venue:** Institute of Physiology CAS, Vídeňská 1083, Prague 4

### Lectures (9:00 – 12:00)

- cellular energy provision, intermediary metabolism, mitochondria, and mitochondrial oxidative phosphorylation
- mitochondrial myopathies – rare inherited diseases of mitochondrial metabolism
- energy balance, adipose tissue, obesity and associated metabolic diseases
- nutrition, types of dietary lipids, dietary interventions using n-3 fatty acids
- laser Captured Microdissection (LCMD) - general info, options and limits, and processing of LCMD samples
- basic mechanisms of circadian regulation

### Lunch (12:00 – 13:00)

### Demonstrations (13:00 – 16:00)

- metabolic screening using mass spectrometry
- measuring mitochondrial respiration using Oxygraph or Seahorse bioanalyzer
- preparing tissue for LCMD (staining, cutting, fixation), dissecting regions of interest
- recording of circadian rhythms - from human to Petri dish



**Wednesday, July 11: Introduction to .....**

**Organized by:** Institute of Molecular Genetics CAS

**Venue:** Institute of Molecular Genetics CAS, Vídeňská 1083, Prague 4

**Lectures (9:00 – 12:00)**

## Thursday, July 12: Introduction to Drug Development Process

**Organized by:** Institute of Organic Chemistry and Biochemistry CAS

**Venue:** Institute of Organic Chemistry and Biochemistry CAS, Flemingovo nám. 2, Prague 4

### Lectures (9:00 – 12:00)

- basic principles of target discovery
- evaluation of the market for given indication
- medicinal chemistry and lead structure discovery
- High throughput screening of libraries
- phenotypic screening and hit deconvolution
- *in silico* methods
- methods for protein – small molecule interactions NMR and X-ray
- *in vitro* methods of the compounds testing
- ADME methods
- preclinical testing
- clinical testing
- biodrugs
- general information on pharmaceutical industries
- tech transfer process

### Lunch (12:00 – 13:00)

### Demonstrations (13:00 – 16:00)

- *in silico* modelling
- molecular biology, cloning and protein expression
- kinetic measurements



## Friday, July 12: Introduction to Neuroscience

**Organized by:** Institute of Physiology CAS - Departments of Functional Morphology, Neurophysiology of Memory, Developmental Epileptology, Cellular and Molecular Neuroendocrinology, and Cellular Neurophysiology

**Venue:** Institute of Physiology CAS, Vídeňská 1083, Prague 4

### Lectures (9:00 – 12:00)

- pain pathophysiology and mechanisms
- electrical activity of hypophyseal cells
- molecular pharmacology of muscarinic receptors
- excitatory synaptic transmission
- pathophysiology of epilepsy and epilepsy-related comorbidities, epileptogenic insults and acquired epilepsies

### Lunch (12:00 – 13:00)

### Demonstrations (13:00 – 16:00)

- behavioral tests in pain research – spinal cord slice preparation for electrophysiological recording and immunohistochemical analysis
- intracellular  $\text{Ca}^{2+}$  signaling and measurement of  $\text{Ca}^{2+}$  concentration in neuroendocrine cells
- registration of spontaneous and evoked electrical activity of the brain

