SUMMER COURSE FOR MEDICAL STUDENTS

September 6 – 10, 2021
Program

The course is financed from the project no. CZ.02.2.69/0.0/0.0/16_015/0002362: Increasing the quality of education at Charles University and its relevance to the needs of the labor market

Monday, September 6: Introduction to Experimental Cardiovascular Research

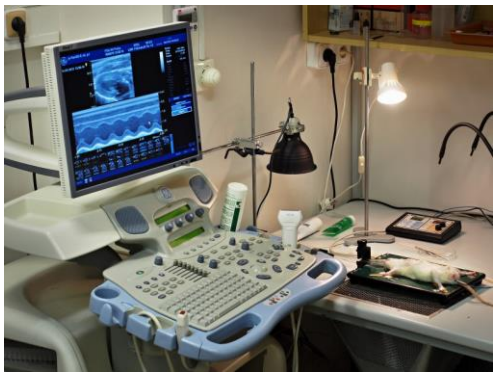
Organized by: Institute of Physiology CAS - Laboratories of Developmental Cardiology and Experimental Hypertension

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 (D. Sedmera)
- myocardial hypoxia and ischemia/reperfusion, cardioprotection (J. Neckář)
- myocardial hypertrophy and heart failure (J. Neckář)
- mechanisms of blood pressure regulation, patophysiology of hypertension, end-organ damage in hypertension and chronic kidney disease (I. Vaněčková)

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
- assessment of contractile properties of vascular smooth muscle



Tuesday, September 7: **Introduction to Neuroscience**

Organized by: Institute of Physiology CAS - Laboratories of Pain Research, Neurophysiology of the Memory, Developmental Epileptology, Neurochemistry, and Cellular Neurophysiology

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

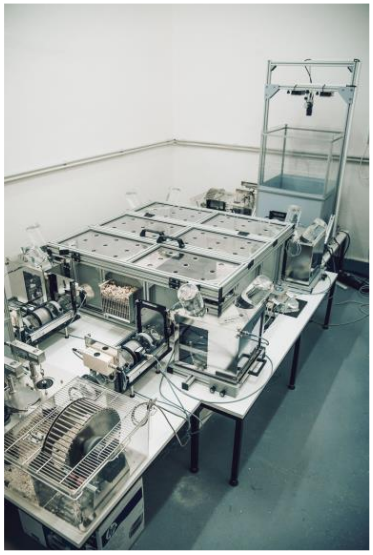
Lectures (9:00 – 12:00)

- molecular pharmacology of muscarinic receptors (J. Jakubík)
- glutamate receptors in health and disease (L. Vyklický)
- experimental neurobiology of learning and memory (J. Svoboda)
- pain pathophysiology and mechanisms (J. Paleček)
- pathophysiology of epilepsy and epilepsy-related comorbidities, epileptogenic insults and acquired epilepsies (H. Kubová)

Lunch (12:00 – 13:00)

Demonstrations (13:00 – 16:00)

- methods in molecular pharmacology of muscarinic receptors
- patch clamp technique to record ion channel activity
- learning and memory in rodents: Behavioral tests and optogenetic approach
- measurement of pain in rodents, spinal cord slice electrophysiology
- epileptic insult and postnatal development: behavioral tests in developing rodents



Wednesday, September 8: Introduction to Chemical Biology and Advanced imaging for biomedical research

Organized by: Institute of Molecular Genetics CAS

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

Lectures (9:00 – 12:00)

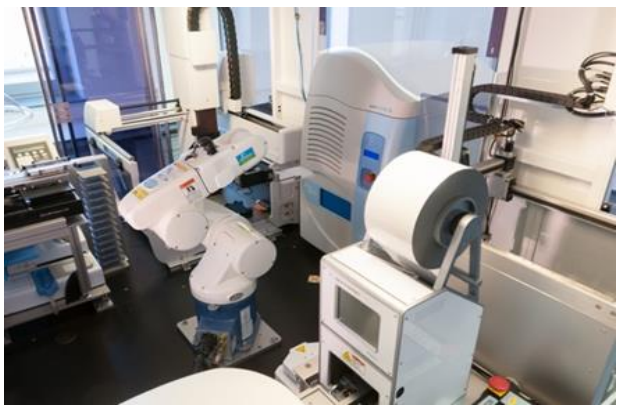
- **Chemical biology** in Academia what is probe and what is drug?
- drug repurposing, biochemical
- cell-based and model-organism-based assays
- signaling pathways, target ID
- big data and how to make sense out of it
- **Advanced bioimaging** - principles of fluorescence microscopy
- fluorochromes, confocal microscopy
- principles of super-resolution microscopy (STED, SIM, STORM/PALM)
- live cell imaging
- principles of electron microscopy
- TEM, STEM and SEM for biomedicine,
- cryoelectron microscopy and tomography
- immunodetection of molecules
- principle of analytical ultrastructural methods

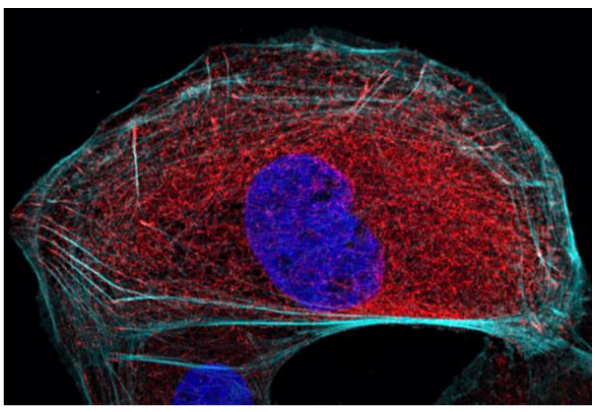
Lunch (12:00 – 13:00)

Demonstrations (13:00 – 16:00)

National Infrastructure for Chemical Biology (CZ-OPENSCREEN)
- high-throughput screening - demo of laboratory automation
- high-content screening (image-based, label-free)
- compound storage and logistics – demo of advanced microplate reformatting

National Infrastructure (Czech Bioimaging)
- comparison of various imaging methods, sample preparation for photon microscopy
- demonstration of ultrastructural tomography





Thursday, September 9: **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 6

Lectures (9:00 – 12:30)
- introduction (Z. Hostomský and M. Fusek)
- structure biology (P. Maloy Řezáčová)
- in silico chemistry (P. Hobza)
- medicinal chemistry I (Z. Janeba)

Lunch (12:30 – 13:30)

Lectures and demonstrations (13:30 – 16:00)
- HBV initiative (I. Píchová)
- medicinal chemistry II (R. Nencka)
- tour around the institute

Bruker Avance III HD, 600 MHz Cryo

Friday, September 10: Introduction to Experimental Research on Metabolism

Organized by: Institute of Physiology CAS - Laboratories of Adipose Tissue Biology, Bioenergetics, Biological Rhythms, Epithelial Physiology and Metabolism of Bioactive Lipids

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

Lectures (9:00 – 12:00)

- cellular energy provision, intermediary metabolism, mitochondria, and mitochondrial oxidative phosphorylation (T. Mráček)
- mitochondrial myopathies – rare inherited diseases of mitochondrial metabolism (P. Pecina)
- energy balance, adipose tissue, obesity and metabolic dysfunction (M. Rossmeisl)
- nutrition and metabolism (O. Kuda)
- Laser Captured Microdissection (LCMD) - general info, options, limits, and processing of LCMD samples (M. Vodička).
- basic mechanisms of circadian regulation (A. Sumová)

Lunch (12:00 – 13:00)

Demonstrations (13:00 – 16:00)

- metabolic screening using mass spectrometry
- metods for phenotyping metabolism at the whole body level
- preparing tissue for LCMD (staining, cutting, fixation), dissecting regions of interest
- recording of circadian rhythms - from human to Petri dish