Medicine

Medicine Research Teams
Here you can find collaboration opportunities with research teams from medicine. If you are interested in other parts of the Catalogue of Services, see the home page.

List of research teams

- Biomedical Laboratory
- Biophysical Laboratory
- Center for Advanced Preclinical Imaging (CAPI)
- Clinical Physiology Unit
- CLIP Cytometry Laboratory
- CLIP Genomics
- Department of Histology and Embryology
- Department of Immunology
- Department of Neuroscience
- Department of Probability and Mathematical Statistics
- Electrophysiology Laboratory for Assessment of Visual Processing
- Group of clinical physiology of nutrition and metabolism
- Human Movement Laboratory
- In Vivo Evaluation of Antituberculotic Activity of Agents with Efficacy Against Mycobacterium Tuberculosis
- Laboratory for Clinical Research of Vascular and Heart Diseases
- Laboratory for General Biochemistry and Haematology
- Laboratory of Antibiotic Resistance
- Laboratory of Bioanalytical Methods
- Laboratory of Biomechanics of Extreme Loads
- Laboratory of Cancer Treatment and Tissue Regeneration
- Laboratory of Cell-biomaterial Interactions
- Laboratory of Cellular Regenerative Medicine
- Laboratory of Drug Metabolism, Interactions and Resistance
- Laboratory of Electrophoretic Separation Methods
- Laboratory of Experimental Cardiology
- Laboratory of Experimental Intensive Care Medicine
- Laboratory of Experimental Neurophysiology
- Laboratory of Kidney Transplantation and Renal Replacement Therapy
- Laboratory of Laser Microdissection
- Laboratory of Molecular and Cellular Toxicology
- Laboratory of Neurodegenerative Disorders
- Laboratory of Pharmacogenomics
- Laboratory of Preclinical Studies
- Laboratory of Proteomics
- Laboratory of Quantitative Histology
- Laboratory of Reproductive Medicine
- Laboratory of Tumor Biology
- Material Physics Group
- Mathematical Modeling and Methods for high Performance Computing
- Mitochondrial Laboratory
- Workgroup of Biological and Medical Science

Biomedical Laboratory
Laboratory and field functional exercise diagnostics (aerobic and anaerobic exercise tests), reactivity testing, muscle strength and pulmonary function testing, biochemical analysis, body composition assessment, dietary consulting, and organization of educational courses (Nutritional consulting in practice, Nutrition and nutritional consulting).

For whole presentation including contact details, see this document.
• Consulting services in the development of instrumentation with a focus on medical and laboratory applications, especially in the area of temperature and pressure influencing.
• Consulting services in the field of measurement of temperature and pressure. In a limited range can be performed the measurement and calibration, including calibration of the thermo camera by black body simulator – without certification.
• The integrator for the development of a prototype design of selected instrumentation with a focus on medical and laboratory applications.
• Custom development and construction of prototypes of selected instrumentation with a focus on medical and laboratory applications – without certification.
• Testing, validation and instruments stress testing, testing of biological, food and other materials in a climatic chamber (a combination of changes in temperature, humidity and light – white and UV light) – without certification.
• Technical endoscopy within a distance of 3 meters and a diameter of 4 mm.
• Ultrasonic thickness gauge measurement.
• Measurement of material properties – tensile strength and pressure.
• Direct radiography – transillumination of small objects up to about 10 cm by RTG radiation in the range of 10–35 kV.

For whole presentation including contact details, see this document.

Center for Advanced Preclinical Imaging (CAPI)

For whole presentation including contact details see this document.

Clinical Physiology Unit
Clinical physiology unit offers scientific solutions in basic research as well as clinical trials involving human subjects. We aim to develop and provide protocols for advanced metabolic phenotyping mainly in the fields of experimental diabetology, endocrinology and nutrition. We offer e.g. these experimental methods: insulin sensitivity and secretion measures, functional endocrinology testing, tissue microdialysis, indirect calorimetry, ergometry, physical exercise testing and tissue biopsies. For whole presentation including contact details see this document.

CLIP Cytometry Laboratory

We offer:
• Development and innovation of cytometric assays
• Cell analysis by flow cytometry
• Monitoring of treatment response

For whole presentation including contact details see this document.

CLIP Genomics

We offer:

• **NGS data analysis service:** We offer bioinformatic analysis of next generation sequencing data from all current NGS platforms. From your primary data we will create well-ordered and easily accessible results. Our working group has an adequate hardware for the analysis of large-scale NGS data. Our specialists have both mathematical and biological education which ensures a comprehensive approach to the results. **Amplicon/exome sequencing – variant analysis** - DNA sequencing of selected parts of the genome (amplicons) or all exons of protein-coding genes. **Transcriptome sequencing (mRNA-Seq)** - mRNA-sequencing for gene expression analysis. **Methylome sequencing (RRBS)** - sequencing of CpG-rich areas and their broader neighbourhood for the assessment of DNA methylation. **Chromatin immunoprecipitation sequencing (ChIP-Seq)** - sequencing of DNA after chromatin immunoprecipitation for the DNA-protein analysis.

• **NGS data analysis courses:** We organize regular NGS data analysis courses for both academy and industry participants covering all the process including data interpretation.

For whole presentation including contact details see this document.

Department of Histology and Embryology
We offer:

- Research on asthmatic airway wall remodeling, animal models.
- Research on pulmonary and placental vessel wall remodeling.
- Ultrastructure of respiratory cilia, high speed videomicroscopy.
- TEM research and diagnostics.
- Lectin histochemistry and immunohistochemistry in paraffin and frozen sections.

For whole presentation including contact details see this document.

Department of Immunology
We offer imaging flow cytometer Image Stream X Mark II that combines flow cytometry with microscopy imaging. This combination takes advantage of the flow cytometry in speed, robustness and sensitivity, and advantage of microscopy in morphology analysis and spatial distribution of the acquired signal from the analyzed cells. The instrument allows studies on, namely, cell signaling, internalization & phagocytosis, apoptosis, intracellular co-localization, morphology and cell-cell interactions; and all this with a statistical robustness. Due to the visualization it is possible to eliminate artifacts like non-cell objects or antibody aggregates.

For whole presentation including contact details, see this document.

Department of Neuroscience
We offer:

- Measurement of ion concentrations and the extracellular volume and tortuosity in situ and in vivo using ion-selective microelectrodes
- Measurements of biopotentials in the living tissue
- Fluorescence microscopy of cell cultures and tissue samples
- Image analysis including 3D morphometry

For whole presentation including contact details, see this document.

Department of Probability and Mathematical Statistics
The department develops, investigates and applies different kinds of complex stochastic models utilizing expertise in theoretical probability, statistics, and optimization. Stochastic models provide an invaluable tool for solving difficult problems in finance, insurance, biomedical sciences, and industry. The department offers experience and ability to develop creative solutions for tasks requiring analysis of high-dimensional data, modeling of complex data structures observed in time and space, optimization of processes or decisions, or design and analysis of complex scientific or industrial experiments.

For whole presentation including contact details, see this document.

Electrophysiology Laboratory for Assessment of Visual Processing
Our laboratory has a long tradition in research and development of diagnostic applications of visual evoked potentials (visual evoked potentials - VEPs) and cognitive potentials. Recently, we developed a mobile device for testing VEPs outside laboratory conditions, which will greatly enhance their use.

**Our expertise:**
- Assessment of visual information processing at several different brain levels (primary, association or cognitive visual area).
- Objective diagnostic of selected neuro-ophthalmologic and psychiatric diseases monitoring of their progression or effectiveness of treatment.
- Design and conduction of VEPs experiments for the theoretical research of brain functions as well as for clinical studies.
- Analysis and statistical evaluation of the experimental results in a bio-signal domain.

For whole presentation including contact details, [see this document](#).

**Group of Clinical Physiology of Nutrition and Metabolism**
Laboratory is in research focused on the study of clinical nutrition physiology, metabolism, and body composition, both in physiological conditions, and due to different pathological states. It is equipped with modern instruments for clinical measurement of energy expenditure and oxidation of nutritional substrates using indirect calorimetry eg. after administration of nutritional support, to determine body composition using anthropometric methods, bioimpedance spectroscopy to measure the amount of body fluids and body structure, dynamic and static dynamometry grip strength and performance of striated muscle, spirometry lung volumes, application methods "Comet assay" to evaluate the degree of oxidative DNA damage and repair.

We have more than 10 years of experience gained through cooperation with the University Hospital, with studies in pregnant and lactating women, with polytrauma patients in the surgical ICU, with patients with non-small cell bronchogenic carcinoma. We are open to cooperation with academics, clinics and hospitals as well as private and public companies dealing with the development of new nutritional formulas or devices mentioned above.

For whole presentation including contact details see this document

Human Movement Laboratory
We offer services not only to athletes and coaches, but also to the general public, without regular movement training, who would like to find out and assess their training levels and movement preparedness. This includes specific population groups, such as seniors or selected groups of patients. Our specialisms include sport training leadership, selection criteria for sport talent identification, evaluation of the state of muscle apparatus and presuppositions of strength, and 2D and 3D analyses of movement activities with assessment of flexibility of selected joints.

- Analysis of body composition
- Evaluation of postural stability
- Evaluation explosive strength
- Evaluation of isokinetic strength
- Evaluation of load for movement activities
- Analysis of walking 3D
- Analysis of movement activities 2D and 3D

For whole presentation including contact details see this document

In Vivo Evaluation of Antituberculotic Activity of Agents with Efficacy Against Mycobacterium Tuberculosis
The method *in vivo* evaluation of antituberculotic activity of compounds with efficacy against *Mycobacterium Tuberculosis* was developed in cooperation of Faculty of Pharmacy of Charles University and the Central Military Health Institute, Centre of Biological Defence in Těchonín. *In vivo* evaluation of potential antituberculotics involving the use of this method and unique equipment may be used by scientists from other scientific institutions and by development departments of private companies working on development of new antibacterial drugs.

For whole presentation including contact details see this document.

*Laboratory for Clinical Research of Vascular and Heart Diseases*
We offer:

- Screening and longitudinal follow-up of subjects at risk of cardiovascular diseases (CVD) or patients with manifest CVD.
- Genetic studies of subjects at risk and patients with CVD.
- Phase II–IV pharmacologic studies in cardiovascular medicine.
- Research on blood pressure (BP) and hypertension, focused on BP measurement, genetics of hypertension, pharmacology of hypertension, arterial stiffness.
- Research on arterial properties with noninvasive methods: arterial stiffness, endothelial dysfunction, intima-media thickness of carotid artery.
- Research on biological markers of CVD in collaboration with different labs; e.g., markers of calcification, accelerated atherosclerosis, subclinical myocardial ischemia, nutrition parameters.

For whole presentation including contact details, see this document.

Laboratory for General Biochemistry and Haematology
We offer:

- Broad spectrum of both routine and special biochemical analyses (substrates, enzymes, minerals)
- Examination of blood cell including five-population differential count of leukocytes
- Basic and special haemocoagulation examinations
- Quantitative determination of biomarkers in very low concentrations (cytokines, adhesion molecules, organ damage biomarkers, oxidative stress markers, hormones etc.) by ELISA method in both human and animal samples of biological material
- Development of new methods and measurement of absorption spectra in visible and UV light in low volume samples

For whole presentation including contact details, see this document.

Laboratory of Antibiotic Resistance
We offer:

• DNA sequencing, including capillary and whole-genome sequencing, and metagenomic analysis.
• Molecular typing of Gram-negative bacteria.
• Detection of resistance mechanisms in Gram-negative bacteria (β-lactamases, mechanisms of resistance in fluoroquinolones, aminoglycosides, colistin, etc.).
• Applications of mass spectrometry in microbiology.

For whole presentation including contact details, see this document.

Laboratory of Bioanalytical Methods
The laboratory is engaged in applied research, particularly in the development of chromatographic methods for clinical research. Considerable emphasis is also placed on the preanalytical phase, primarily on the development of modern sample preparation techniques in bioanalysis. Researchers have extensive experience with different types of biological fluids. The laboratory is equipped with the HPLC and UHPLC system with mass spectrometry detection. The research team is cooperating with a number of important centers in the Czech Republic and abroad and is a successful investigator of many research projects. It also participates in education of undergraduate and doctoral students of Faculty of Pharmacy. We are looking for cooperation with academic institutions as well as with the private sector. We offer a complete service in chromatographic methods development in bioanalysis and the possibility of developing bachelor’s, master’s and doctoral thesis in our department.

For whole presentation including contact details, see this document.

Laboratory of Biomechanics of Extreme Loads
Biomechanics researches into questions of the functional and structural response of connective tissues, organs and systems to a dynamical stress field. The aim of the research is a mathematical expression of rheological parameters of thermo-visco-elastic tissue structures (ligaments, tendons, bones and muscles). The output is then a parametrical expression of artificial materials (nanomaterials – scaffolds, implants) as the inputs for their production; the recommendation of stress programs during restoration of the organism after an injury or an operation; and reconditioning procedures.

For whole presentation including contact details, see this document.

Laboratory of Cancer Treatment and Tissue Regeneration
We offer:

• Preparation of experimental large animals models including surgical and anesthesiological parts.
• Follow-up of animals by imaging, biochemical and immunological methods.

For whole presentation including contact details, see this document.

Laboratory of Cell-biomaterial Interactions

We offer:

• Evaluation of material biocompatibility.
• Cytotoxicity measurement.
• Evaluation of cell adhesion and migration on bio-materials.
• Cell viability measurement.
• Cultivation of commercial available cell lines.

For whole presentation including contact details, see this document.

Laboratory of Cellular Regenerative Medicine

• Isolation and cultivation of primary cells from various tissues.
• Cultivation of commercial available cell lines.
• Cell viability measurement.
• Cytotoxicity measurement.
• Immunogenicity measurement.
• Evaluation of material biocompatibility.
• Evaluation of cell adhesion and migration on bio-materials.
• Fluorescent and confocal microscopy, including real-time monitoring.

For whole presentation including contact details, see this document.

Laboratory of Drug Metabolism, Interactions and Resistance
Laboratory deals with basic and applied research in the field of drugs and other xenobiotics metabolism in vitro (subcellular fractions, cell lines and cultures, tissue slices) and in vivo in animals (rodents, livestock), in parasitic helminths (nematodes, cestodes and trematodes) and in plants. Another research field is study of dietary supplements and drugs interactions and study of drug resistance in parasitic helminths – both in vitro and in vivo. Our laboratory is equipped with all necessary instruments, for example qPCR, LC/MS, Western blot, laminar flow cabinet and many others. Group implemented various methods for qualitative and quantitative evaluation.

Laboratory has also access to the accredited animal facility for small rodents (rats, mice, guinea-pigs).

We are looking for cooperation with partners from area of academic research, industry and agronomy who are interested in pharmacology, biochemistry and parasitology research.

For whole presentation including contact details, see this document.

Laboratory of Electrophoretic Separation Methods
Laboratory of electrophoretic separation methods at the Third Faculty of Medicine is fully equipped with instrumentation to excellent research in following areas:

- Development of new electrophoretic strategies for rapid determination of amino acids, saccharides and other metabolites in various clinical samples that represents background for solution of different pharmacological and physiological studies.
- Construction and optimization of electrochemical detectors for microscale separation techniques.
- Development of new preconcentration techniques of biological samples that are based on electrophoretic principle.

For whole presentation including contact details, see this document.

Laboratory of Experimental Cardiology
We offer development of experimental models and analysis of cardiac function. Development of an appropriate animal model (broad experience with various experimental animal species and models, e.g. rat with chronic renal failure, rat with diabetes mellitus, rat with autonomic denervation, hypercholesterolemic rabbit, Carls- son’s model of rabbit, pig with sepsis) with a detailed description of cardiac function (ECG including variability analysis, measured both in vivo and in isolated heart, measurement of contraction and of membrane potential in multicellular preparation, measurement of membrane ionic currents in isolated cardiac myocytes).

For whole presentation including contact details, see this document.

Laboratory of Experimental Intensive Care Medicine
We offer:

- Independent testing of the efficacy and safety of novel candidate molecules.
- Independent evaluation of the efficacy and safety of novel extracorporeal methods of organ support and replacement.
- Rapid and comprehensive reporting of high quality proof-of-concept results, including statistical analyses and data interpretation.
- Advice prior to initiation of a study and experimental design helping.
- Consultation in the development of models.
- Confidential data that are the sole property of the client International reputation with more than 15 years of experience in experimental research.

For whole presentation including contact details, see this document.

Laboratory of Experimental Neurophysiology
We offer:

- Extracellular single neuron activity, chronically implanted microelectrodes.
- EEG recorded through superficial or deep electrode.
- Behavior in cognitive tasks under parallel registration of single neuron activity.
- Memory tests in animal models (rat, mouse).
- Relation between EEG, single unit activity and behavior (sleep, locomotion, cognitive tasks).
- EEG analysis.

For whole presentation including contact details, see this document.

**Laboratory of Kidney Transplantation and Renal Replacement Therapy**
We offer:

- Suggestion of designing methods of clinical studies in the field of viral infections after kidney transplantation, biocompatibility of dialysis membranes and peritoneal dialysis solutions, anticoagulation therapy during hemodialysis, and infectious complications in hemodialysis population.
- Evaluation of biocompatibility of dialysis membranes.
- Cytomegalovirus and polyomavirus detection in blood or other tissues based on molecular biology methods.
- Assessment of cytomegalovirus antiviral drug resistance

For whole presentation including contact details, see this document.

Laboratory of Laser Microdissection
We offer:

- Staining of tissue sections by common histological dyes.
- Dissection of selected cells from tissue section and its transfer to microcaps followed by nucleic acids isolation.
- Sterile dissection of alive cells from cell cultures for subsequent cultivation.
- Creating of photo documentation of complete microdissection process for each sample.

For whole presentation including contact details, see this document.

Laboratory of Molecular and Cellular Toxicology
The research of our laboratory is focused on diverse aspects of molecular and cellular toxicology. Most of our research projects aim at drug-induced cardiovascular toxicity, particularly the cardiotoxicity of anthracycline anticancer chemotherapeutics. We are engaged in several collaborative projects aimed at development of potential cardioprotective agents but also study novel potential anticancer agents. Apart from wide array of standard instrumentation and experimental protocols, we can offer several rare or unique instruments and techniques, particularly isolated rat neonatal ventricular cardiomyocytes (NVCM) which are highly useful for mechanistic studies in cardiovascular physiology, pharmacology, toxicology or molecular biology.

For whole presentation including contact details, see this document.

Laboratory of Neurodegenerative Disorders
We offer:

- Tests of effects of chemical substances including pharmaceuticals on neural function.
- Design of the experimental protocol.
- Motor and behavioural tests in laboratory mice.
- Analysis and statistical processing of the data.
- Application of stem cells and chemical substances directly into mouse brain.

For whole presentation including contact details, see this document.

Laboratory of Pharmacogenomics
We offer:

- Research in pharmacogenetics and genomics from the clinical and academic point of view.
- Isolation of nucleic acids from different types of tissues and cells, especially from clinical specimens.
- Detection of single nucleotide polymorphisms and mutations by allelic discrimination, HRM, and sequencing.
- Quantitative PCR in real-time (qPCR) design and gene expression analysis.
- Help with interpretation of results of studies on metabolism and transport of anticancer drugs.

For whole presentation including contact details, see this document.

**Laboratory of Preclinical Studies**
We offer:

- Model of healing of cutaneous wounds in non-diabetic and diabetic rats (both DMI and DMII).
- Porcine model of healing of normal cutaneous wounds.
- Porcine model of healing of full-thickness cutaneous wounds experimentally infected with bacterial biofilm.
- Porcine model of osteochondral defect in knee joint.
- Porcine models of fractures of femur.
- In vivo testing of materials for stomatology and maxillofacial surgery.
- In vivo testing of materials for soft tissue augmentations.
- In vivo testing of wide spectrum of implants and prostheses.
- Murine models of experimental infection of Cryptosporidium (both for basic research and evaluation of anti-protozoal drugs.)

For whole presentation including contact details, see this document.

Laboratory of Proteomics
We offer:

- Preparation of biological samples prior to proteomic analysis, i.e. homogenisation, isolation, purification and fractionation.
- One-dimensional polyacrylamide gel electrophoresis.
- Two-dimensional polyacrylamide gel electrophoresis.
- Differential polyacrylamide gel electrophoresis (DIGE).
- Gel imaging in visible and UV spectrum.
- Gel image analysis including statistical evaluation.
- Protein identification by tandem mass spectrometry.
- Biofilm analysis of implantable devices and extracorporeal circuits.

For whole presentation including contact details, see this document.

Laboratory of Quantitative Histology
We offer:

- Histological sectioning for routine stains as well as for immunohistochemistry (coated slides).
- Identifying and testing continuous variables for quantification and morphometry of tissue samples according to the biological questions of our research partners (pilot studies with small sample size as well as full studies).
- Analyzing the sources of biological variability between groups of histological samples as well as within large tissue samples or even whole organs by comparing tissue samples representing the same organ and by comparing series of spatially correlated histological sections.

For whole presentation including contact details, see this document.

Laboratory of Reproductive Medicine
We offer:

- In vitro oocyte maturation (IVM), in vitro fertilization (IVF) and embryo culture (IVC).
- Flow cytometry and sorting of sperm (FACSAria, FACSVerse, BD Bioscience).
- Intracytoplasmic sperm injection (ICSI).
- Immunocytochemistry of oocytes and embryos.
- Epi-fluorescent and confocal laser-scanning microscopy, live cell imaging (Olympus, IX83, Tokai Hit).
- Western Blotting (Biorad).

For whole presentation including contact details, see this document.

Laboratory of Tumor Biology
We offer:

- Nucleic acid isolation from various cell types, frozen tissues and FFPE tissue samples.
- Quality control of nucleic acids.
- Analysis of relative gene expression and comparison of expression profiles of your samples.
- Preparation of gene expression microarray experiments.
- Detection of single-nucleotide polymorphisms and mutations.
- Fluorescence microscopy of cell cultures and tissue samples.

For whole presentation including contact details, see this document.

Material Physics Group
Development of advanced structure and functional materials has a wide range of applications not only in power engineering, transport industry, mechanical engineering but also in advanced application areas as medicine or space program. Many applications are expected also in nanotechnology and fusion engineering. Department of Physics of Materials (DPM) possesses a wide variety of equipment for the investigation of microstructure, mechanical and other physical properties of advanced materials. Experimental equipment is complemented by a deep expertise and knowledge of concepts and models of physics of materials and physics of solids. The main areas of the investigation include the mechanisms of plastic deformation, phase transformations, hardening and softening mechanisms in light metals and alloys, nanocrystalline and composite materials, intermetallic compounds and ceramics. Due to the co-operation with industrial partners the technology of production of aluminium sheets or new biocompatible materials for orthopedic applications, etc. have been developed in the DPM.

For whole presentation including contact details, see this document.

Mathematical Modeling and Methods for high Performance Computing
Mathematical modeling aims to describe and study various phenomena using the language of mathematics. It represents an indispensable tool in natural sciences, engineering, life and also social sciences. The uniqueness of the research consists in the fact that it is able to cover – at a very high scientific level – all aspects of the mathematical modelling workflow, in particular development of mathematical models, mathematical analysis of their properties, development of suitable numerical methods and their implementations optimally exploiting the available computational power of current and near future high performance computing systems. Particular attention is given to tutoring young scientific generation.

For whole presentation including contact details, see this document.

Mitochondrial Laboratory
We offer:

- Isolation of mitochondria from fresh tissues and cells, optimization of isolation protocols, evaluation of the quality of isolated organelles.
- Preparation of protocols for optimum tissue permeabilization and homogenization.
- Analysis of mitochondrial respiratory activity in biological samples using high-resolution respirometry.
- Determination of activity of selected mitochondrial enzymes.
- Evaluation of the effect/s of experimentally induced pathological states and pharmacological agents on mitochondrial respiratory parameters in animal studies.

For whole presentation including contact details, see this document.

Workgroup of biological and medical sciences
Research group of pathology and pharmacology of cardiovascular system is focusing on the atherogenesis and endothelial dysfunction study in experimental animal models. The main methodological approaches are histology, immunohistochemistry (light and fluorescence microscopy), Western blot analysis, RT-PCR and functional analysis of blood vessels by means of DMT myograph.

The main object of research of the group of microbiology and immunology is testing of antimicrobial activity in vitro and implementation of new, valid and reproducible methods for the study of antimicrobial compound-microbe interaction. Another object of research is focused on extracellular vesicles secretion of the yeast Candida albicans and relationship of these vesicles to mechanisms of pathogenesis. For studies, these methodological approaches are used: light microscopy (fluorescent, confocal laser scanning microscopy), cultivation (aerobic, anaerobic, microaerophilic), spectrophotometric evaluation of microbial count and metabolic activity, isolation, concentration and purification of microbial proteins.

For whole presentation including contact details, see this document.