
Department of Medical Biochemistry

Main research topics

- Research on candidate anticancer drugs and experimental oncology
- Development of new mass spectrometric methods for pharmacokinetic, toxicokinetic and metabolic studies.
- Screening for the antiproliferative effect of newly synthesized, isolated and modified compounds and subsequent study of the mechanism of antitumor effect in selected promising compounds
- Study of the mechanism of resistance to standard chemotherapy in selected tumour lines
- Metabolomic analysis of bile acids
- Biocompatibility testing of novel composite nanomaterials

Equipment

Cell laboratories for the cultivation of tumor lines, equipment for the determination of changes in protein expression (BioRad), a system for real-time monitoring of cell proliferation (Xcelligence), a high-throughput imaging system for monitoring various cellular functions (ImageXpress), a multimodal plate reader (Tecan Spark), a flow cytometer with four excitation lasers and fourteen fluorescence detectors (Beckman Coulter), a qPCR cyclor for quantification of nucleic acids in tissues and cell cultures (Quantstudio 6).

Acquity I-Class liquid chromatograph coupled to a Xevo TQ-XS triple quadrupole mass detector for the analysis of drugs, metabolites and endogenous compounds in biological matrices. The focus of use is on the determination of drug levels in pharmacokinetic or toxicokinetic studies, for therapeutic drug monitoring and in bile acid screening for basic and applied research mainly in the field of liver pathology and drug development.

Scientific research groups

Research on candidate anticancer drugs and experimental oncology

Head: [prof. MUDr. Martina Řezáčová, PhD.](#)

Key Personnel: [doc. RNDr. Radim Havelek, PhD.](#), [PharmDr. Darina Muthná, PhD.](#), [Mgr. Alena Mrkvicová, PhD.](#)

The main research topic of the group is experimental oncology, in which we focus on several key areas. The first one is the study of novel candidate structures for cancer pharmacotherapy. This area includes screening for antiproliferative effects of compounds of different origin. Among the synthetic agents, these include low molecular weight kinase inhibitors and metallocomplexes, and among substances of natural origin, plant alkaloids and their synthetic or semi-synthetic analogues.

Selected promising compounds are further tested in more detail to elucidate the possible mechanism of anticancer action. A second key area of research is the study of mechanisms leading to resistance of cancer cells to standard chemotherapy. And the last research topic is to investigate the cytotoxicity of composite magnetic nanosystems and their potential use for drug transport. All research topics use modern preclinical testing methods that rely on in vitro experiments with selected tumor lines.

Mass spectrometric analysis laboratory: PharmaMassSpec

Head: [doc. Ing. Miloš Hroch, Ph.D.](#)

The laboratory specializes in the development, optimization and validation of analytical methods for quantitative and qualitative analysis of substances from groups of drugs, metabolites and endogenous substances. Our long-term focus is on bile acid analysis and analysis of anticancer drugs.

Another branch of research is focused on the implementation of 3D printing and the use of multivariate statistical methods in the field of analytical chemistry. All these methodologies are applied in the research of new drugs, the search for new indications for established drugs, therapeutic monitoring of drug levels in cancer research and other areas.

Cooperations

LFHK UK: [prof. MUDr. Stanislav Mičuda, Ph.D.](#)

FaF UK: [PharmDr Petr Pávek, Ph.D.](#), [prof. PharmDr. Petr Nachtigal, Ph.D.](#)

FN HK: [PharmDr. Martin Mžik, Ph.D.](#), [MUDr. Martin Šimkovič, Ph.D.](#), [MUDr. Dominika Écsiová](#)

University Hospital Hradec Králové, Biomedical Research Centre
Institute of Physics of the CAS, Department of Magnetism and Superconductors
Charles University in Prague, Faculty of Pharmacy, Department of Pharmacognosy and Pharmaceutical Botany
Charles University in Prague, Faculty of Pharmacy, Department of Pharmacology and Toxicology
Palacký University in Olomouc, Faculty of Science, Department of Inorganic Chemistry
University of Pardubice, Faculty of Chemical Technology, Department of Biological and Biochemical Sciences
University of Pardubice, Faculty of Chemical Technology, Department of General and Inorganic Chemistry
University of Defence, Faculty of Military Medicine, Department of Radiobiology