
Laboratory of Molecular and Cellular Toxicology

"We are open to collaborations in areas of drug-induced cardiotoxicity, photodynamic therapy of cancer as well as other research topics that can make use of our expertise and/or instrumentation."

Offer

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
- molecular biology

NVCM cells are highly advantageous over the readily available immortalized cell lines which is particularly important in cardiotoxicity studies.

Furthermore, we are equipped with Lonza 4D Nucleofector device with the Y-unit for transfection of adherent primary cells.

Expertise

The research of our laboratory is focused on diverse aspects of molecular and cellular toxicology.

- Using cultured cells (both isolated primary cell cultures as well as permanent cell lines) we aim at advancing the mechanistic understanding of various types of cellular injuries and actions of xenobiotic substances
- We study differences in actions of various agents in different cell types and involvement or induction of specific cell death pathways, including apoptosis – the most important type of the programmed cell death
- We also focus on mitochondria – organelles crucial for cell death and survival and key mediators of the intrinsic apoptotic pathway

Content of Research

Most of our research projects aim at drug-induced cardiovascular toxicity, particularly the cardiotoxicity of anthracycline anticancer chemotherapeutics, but we also examine cardiotoxic properties of other anticancer drugs (and/or their combinations with anthracyclines).

Our next important topics are cardiac oxidative stress, catecholamine cardiotoxicity and the role of redox-active iron and other transition metals in oxidative stress and toxicity.

We are engaged in several collaborative projects aimed at development of potential cardioprotective agents but also study novel potential anticancer agents with iron-chelating and photodynamic properties.

Key Research Equipment

Study of Material Properties

- The Faculty of Pharmacy provides the laboratory with good technical background and core instruments, including deep freezers, cell line cryopreservation facility, spectrophotometers and fluorimeters including the versatile Tecan Infinite 200 M plate reader, various centrifuges and ultracentrifuges as well as radioactivity and GMO (class II)-accredited laboratories.
- Our cell culture laboratory enables experiments with both permanent cell lines and isolations of primary cell cultures, such as the cardiomyocytes.
- We have two biohazard class II laminar flow cabinets, CO₂ and CO₂/N₂ incubators, Newport research arc lamp source 450– 1000W Xe-ozone free lamp (for photodynamic experiments) and an inverted epifluorescence microscope (Nikon Eclipse TS100) with a digital cooled CCD camera and NIS Elements 3.10 software (Laboratory Imaging).
- We recently obtained new Lonza 4D Nucleofector device equipped with the Y-unit for transfection of adherent primary cells and have access to the Accuri C6 flow cytometer.

- For advanced microscopical methods we use Nikon A1+ confocal system (based on Nikon Eclipse Ti-E fully-integrated and motorized inverted microscope) with Perfect Focus System, highly sensitive cooled sCMOS digital camera Andor Zyla 5.5, NIS Elements 4.2 software (Laboratory Imaging), CoolLED fluorescence source and Top Stage CO2 Incubator.

Partnerships & Collaborations

Main Projects

This laboratory coordinates network of several groups joined in the Charles University Research Center for the Study of Toxic and Protective Effects of Drugs on Cardiovascular System.

This center integrates approaches of biochemistry, medicinal chemistry, pharmacology, toxicology and bioanalytical chemistry, in order to bring together complementary skills, knowledge, and resources to jointly address the research problems.

Main Ongoing Grant Projects

- Czech Science Foundation (13-15008S): New potential cardioprotective agents: study of structure-activity relationships in various types of myocardial injury

- Czech Science Foundation (13-27761S): Development of new photosensitizers for photodynamic therapy and investigation of their mechanism of action on cellular level

Achievements

- Highly cited publications in respected international peer-reviewed journals

- Presentations at international and domestic scientific conferences

Are you interested in this expertise?

Please contact CPPT UK

Web: www.cppt.cuni.cz/

Mail: transfer@cuni.cz

Phone: +420 224 491 255

Experts and their department

Prof. PharmDr. Tomáš Šimůnek, Ph.D.

Department of Biological and Medical Sciences

Web: <http://portal.faf.cuni.cz/Groups/Molecular-and-Cellular-Toxicology-Group>