



Major studies and research projects

The Jagiellonian Centre for Experimental Therapeutics (JCET) is an extra-faculty unit of the Jagiellonian University. Its main objective is to develop experimental pharmacotherapy for civilisation diseases as well as to develop collaboration with industry in this area. The idea of establishing JCET involves collaboration between the Jagiellonian University, Łódź University of Technology, and the Niewodniczański Institute of Nuclear Physics of the Polish Academy of Sciences in Kraków.

The main goal of JCET is to develop interdisciplinary research on the role of endothelium in civilisation diseases and to seek new pharmacotherapeutic mechanisms in the endothelium and vascular wall on the basis of interdisciplinary pharmacological, pharmacokinetic, analytical, and biochemical studies, as well as with use of a wide panel of imaging methods (Raman spectroscopy, EPR, and MRI). Of particular significance for the concept of establishing JCET is the specialisation of this unit in the research on original chemical compounds and drugs endowed with endothelial activity of potential therapeutic application.

Key research areas explored at JECT are:

- **Endothelium in Civilisation Diseases.** Research in the following areas is being conducted as part of the project coordinated by JCET: pharmacological effect of compounds in the models of endothelial inflammation in isolated endothelial cells and *in vitro* in the isolated aortic rings; therapeutic efficiency of compounds with endothelial activity in the unique models of animal endothelial dysfunction and hepatitis. This group of analyses includes studies on optical activity and intermolecular interactions of new chemical compounds as well as the development of a methodology for the phenotype assessment of endothelial inflammation using the Raman mapping method and infrared absorption spectroscopy. Additionally, JCET conducts pharmacokinetic (PK) studies on the selected compounds with vasoprotective actions as well as analytical research on biomarkers of endothelial dysfunction using the LC/MS/MS technique.
- **Endothelium and Cancer.** Research on the pharmacotherapy of endothelium, as well as prostacyclin-dependent platelet activation, nitrogen monoxide, and carbon monoxide is conducted at JCET laboratories. The objective of this research is to develop a new strategy for endothelium-dependent cancer metastasis prevention.
- **Pharmacology of Carbon Monoxide-Releasing Compounds.** Studies on antiplatelet and anticoagulant effect of carbonmonoxide-releasing compounds are conducted at the JCET Laboratory of Experimental Pharmacology of Endothelium in collaboration with France's Université Paris-Est, INSERM.



Collaboration

JCET's activity is based on extensive domestic and international cooperation, particularly in the field of medical chemistry and the development of original chemical structures acting on endothelium. The list of JCET's significant foreign partners includes the Institute of Organic Synthesis (Latvia), National Institute of Health (United States), University of Zurich (Switzerland), University of Exeter (United Kingdom), and Université Paris-Est (France). Domestic partners include the Łódź University of Technology, Poznań University of Technology and the Institute of Biotechnology and Antibiotics in Warsaw.

Scientists from JCET collaborate within the framework of research on endothelium and cancers with four institutions in Poland: the Institute of Immunology and Experimental Therapy of the Polish Academy of Sciences in Wrocław, the Medical University of Gdańsk, the Medical University of Białystok, and the Medical University of Łódź, as well as with foreign partners such as the aforementioned Institute of Organic Synthesis in Riga. In the scope of the research project "Endothelium in Civilisation Diseases..." JCET collaborates with a total of seventeen research teams from nine scientific centres in Poland.

Scholars

Prof. Stefan Chłopicki – a pharmacologist and a professor of medical sciences. His main interests focus on pathophysiology, biochemistry, and pharmacology of endothelium, the role of lipid mediators in infection, and the pharmacology of platelets. He is the academic supervisor of the JCET Laboratory of Pharmacology of Endothelium and the Head of the Department of Experimental Pharmacology at the Chair of Pharmacology of the Jagiellonian University Medical College. Prof. Chłopicki has written more than 180 papers, numerous abstracts presented at international Conferences, and several patent applications. He has received numerous awards for academic achievement including the prestigious Professor's Subsidy from Foundation for Polish Science (FPS). One of Prof. Chłopicki's most important achievements is the discovery of COX-2 and PGI2-dependent endothelial effect of 1-methylnicotinamide (MNA): nicotinamide metabolite and nicotinic acid. This discovery allows for a new understanding of the pharmacology of nicotinic acid and opens up new therapeutic perspectives.

Prof. Małgorzata Barańska – a professor of chemistry. Her research focuses on the analysis of biological compounds using spectroscopic methods, particularly Raman spectroscopy. She also focuses on imaging of animal tissue and endothelial cells in search for the markers of pathology and drug therapy with use of the atomic force microscope (AFM) and the near-field scanning optical microscope (SNOM). She is the scientific supervisor of the JCET Laboratory of Raman Spectroscopy, and the Head of the Raman Imaging Team at the Faculty of Chemistry of the Jagiellonian University. She is the winner of numerous prizes for academic achievement. Prof. Barańska's most important achievement is the development of a methodology for spectroscopic testing of bioactive compounds and complementary spectroscopic imaging of animal tissues and cells, that allows for the tracking of processes occurring in live cells: changes caused by dysfunction and drug treatment, as well as analysing the mechanisms of these processes.

Assoc. Prof. Maria Walczak – holds the degree of habilitated doctor in pharmaceutical sciences and is a specialist in clinical pharmacy. Her main scientific interests include the assessment of pharmacokinetic profiles of new biologically active compounds, the profiling of metabolic pathways of bioactive structures, the assessment of the extent of drug protein binding, the assessment of physicochemical properties of new substances, and the use of LC/MS/MS and capillary electrophoresis in the bioanalysis of new compounds and biomarkers. She is the Head of the JCET Laboratory of Analytics and Pharmacokinetics and works in the Department of Pharmacokinetics and Physical Pharmacy of the Jagiellonian University Medical College. One of her most significant achievements was the implementation of a new LC/MS/MS technique designed to assess the pharmacokinetic profile of compounds with beta-antagonistic effects, in particular enantioselective analysis of chiral compounds, determining the extent of their binding to blood protein, predicting metabolism pathways, and determining their physicochemical properties.

Achievements

One of JCET's significant achievements was establishing a unique scientific framework in Poland that conducts interdisciplinary research on endothelium.

JCET conducts advanced studies with several original groups of particles with potential therapeutic effect.

In 2013, JCET – as one of the few academic laboratories in Poland – implemented a Good Laboratory Practice (GLP) system, thus obtaining the related accreditation issued by the Polish Accreditation Centre.

JCET prepares a unique offer of an overall assessment of endothelial dysfunction and the effect of chemical compounds on the endothelium and the vessel wall. This proposal is addressed to the industry and other scientific centres.

As a result of research conducted in JCET, numerous patent applications for technologies have been filed, and these new technologies will be commercialised in the coming years. Patent applications resulting from projects coordinated by JCET include original chemical structures, markers for magnetic resonance imaging (MRI), and new technical solutions used in microscopy.

- Interdisciplinary Experimental Pharmacology of Civilisation Diseases
- Studies on Endothelium

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