

REGISTRATION FORM FOR CZECH SCIENTIFIC INSTITUTION

1. Research institution data (name and address):

Faculty of Pharmacy
Charles University
Akademika Heyrovského 1203
500 05 Hradec Králové, Czech Republic

2. Type of research institution: Public university (veřejná vysoká škola)

3. Head of the institution: prof. MUDr. Milena Králíčková, Ph.D. - Rector

4. Contact information of designated person(s) for applicants:

Ing. Mgr. Anna Opitz - Administrative officer the Department of Grant Support and Strategic Development

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Charles University, Faculty of Pharmacy
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5. Research discipline in which the strong international position of the institution ensures establishing a Dioscuri Centre:

Natural Sciences and Technology: *Physical and analytical chemical sciences* - physical chemistry/chemical physics, theoretical chemistry, analytical chemistry, inorganic chemistry, organic chemistry, method development

6. Description of important research achievements from the selected discipline from the last 5 years including a list of the most important publications, patents, or other results:

Faculty of Pharmacy at Charles University (FoP) is among the top institutions in the Czech Republic in terms of scientific activity, especially in the field of analytical chemistry. Every year more than 30 publications in the field of analytical science are published in prestigious scientific journals. **The selected publications** (five from them in top D1 journals) correspond to the area of analytical chemistry and cooperating research groups; from the Department of pharmacology and toxicology at FoP (4), from Technical University Liberec (1-3) and also from well-known research groups working on separation sciences abroad (5-7).

- Háková, M.; Chochouloušová Havlíková, L.; Solich, P.; Švec, F.; Šatínský, D., Electrospun nanofiber polymers as extraction phases in analytical chemistry - The advances of the last decade, *TrAC Trends in Analytical Chemistry*, 110 (2019) 81-96.
- Raabová, H.; Háková, M.; Havlíková, L. Ch.; Erben, J.; Chvojka, J.; Solich, P.; Švec, F.; Šatínský, D., Poly-ε-caprolactone Nanofibrous Polymers: A Simple Alternative to Restricted Access Media for Extraction of Small Molecules From Biological Matrixes, *Analytical Chemistry*, 92 (2020) 6801-6805.
- Šrámková, I.H.; Horstkotte, B.; Erben, J.; Chvojka, J.; Švec, F.; Solich, P.; Šatínský, D., 3D-Printed Magnetic Stirring Cages for Semidispersive Extraction of Bisphenols from Water Using Polymer Micro- and Nanofibers, *Analytical Chemistry*, 92 (2020) 3964-3971.
- Sklenářová, H.; Rosecká, M.; Horstkotte, B.; Pávek, P.; Miro, M.; Solich, P., 3D printed permeation module to monitor interaction of cell membrane transporters with exogenic compounds in real-time, *Analytica Chimica Acta*, 1153 (2021) 338296.
- Zajíčková, Z.; Nováková, L.; Švec, F., Monolithic Poly(styrene-co-divinylbenzene) Columns for Supercritical Fluid Chromatography–Mass Spectrometry Analysis of Polypeptide. *Analytical Chemistry* 92 (17) (2020) 11525-11529.
- Pilařová, V.; Plachká, K.; Khalikova, M.A.; Švec, F.; Nováková, L. Recent developments in supercritical fluid chromatography – mass spectrometry: Is it a viable option for analysis of complex samples?, *TrAC Trends in Analytical Chemistry*, 112 (2019) 212-225.
- Pilařová, V.; Al Hamimi, S.; Cunico, L.P.; Nováková, L.; Turner, C., Extending the design space in solvent extraction – from supercritical fluids to pressurized liquids using carbon dioxide, ethanol, ethyl lactate, and water in a wide range of proportions, *Green Chemistry*, 21 (2019) 5427-5436.

FoP owned 10 valid national patents, 1 industrial / utility design and 4 international PCT patent applications. Listed below there are the most important patents in the relevant field of Chemistry.

1. Module for on-line monitoring of permeation tests, WO/2021/185394, 23.9.2021, International Application No. PCT/CZ2021/050031.

2. Substituted 1,2,4-Oxadiazole OXADIAZOLE, its application and a pharmaceutical preparation comprising it, WO/2020/128675, 25.6.2020, International Application No. PCT/IB2019/059934.

7. List of no more than 3 important research projects in the selected discipline awarded in national and international calls to the institution in the last 5 years:

Title: Efficiency and safety improvement of current drugs and nutraceuticals: advanced methods - new challenges (acronym EFSA-CDN), Reg. no: CZ.02.1.01/0.0/0.0/16_019/0000841

Amount of funding: 212 766 530 CZK (8 510 661 EUR), Source of funding: Ministry of Education, Youth and Sports (MEYS), Operational Program Research, Development and Education (OP RDE).

The EFSA-CDN project (2018- 2023) has supported problem-oriented research of interdisciplinary character in the field of improving the efficiency and safety of drugs and nutraceuticals through developing selected excellent research teams comprised of the best FoP CU workers, especially in the field of synthesising and developing new anti-infective and anticancer drugs and antidotes, in overcoming drug resistance, enzyme xenobiochemistry and drug transporters, in the biopharmacy of the skin and the placental barriers, and in new analytical methods for the development of pharmaceuticals and nutraceuticals. This project improved the internationally competitive quality of research and developed international partnerships with 9 leading scientific and research institutions abroad. Project also contributed significantly to the modernisation of instrumentation infrastructure.

Title: Establishment of Specialized Team for Advanced Research on Separation Science (acronym STARSS), Reg. no: CZ.02.1.01/0.0/0.0/15_003/0000465

Amount of funding: 150 193 320 CZK (6 007 732 EUR), Source of funding: MEYS, OP RDE.

The aim of the project (2017 – 2022) was based on development of advanced separation techniques belonging to the group of chromatographic and electrophoretic methods and methods for sample preparation prior to analysis. This project improved the international quality of research in terms of cooperation with many top research groups from abroad. Contacts were also supported by organisation of international STARSS conference every year where main experts from these groups present and discuss their research in the field of separation science. The modernisation of infrastructure and the material and technical equipment of the new research team facilitated the creation of knowledge that is producing excellent and innovative results. The project emphasised the principles of internationalisation, excellence, and support for the target group and – by extension – it also supported the foundation of a specialised Centre of Separation Science.

Both EFSA-CDN and STARSS projects helped to increase quality and visibility of research in the field of analytical chemistry, which was proven during the International evaluation of research at Charles University in 2021, as the subject Chemistry at FoP received the highest possible mark - **evaluation A** – as the best of all research areas evaluated in FoP.

Title: Metabolic effects of Endocrine Disrupting Chemicals: novel testing METHods and adverse outcome pathways (acronym EDCMET), Reg. no: 825762

Amount of funding: 5 980 408 EUR, Source of funding: Horizon 2020, The Framework Programme for Research and Innovation (2014-2020).

Project EDCMET is running from 2019 until 2023 and is coordinated by Prof. Dr. Anna-Liisa Levenon from the University of Eastern Finland. Project partners from eight European countries will contribute to achieving the scientific goals of EDCMET. Within EDCMET, Faculty of Pharmacy at Charles University participates in development of cellular screening method for interaction testing of potential endocrine disruptors with nuclear receptors (WP2). In addition, FoP works on animal models for analysis of hormonal and metabolic interference of endocrine disruptors (WP3).

8. Description of the available laboratory and office space for a Dioscuri Centre:

The Faculty of Pharmacy, Charles University, is currently situated in **three buildings** - the south building (since 1969), the north building (since 1980) and the first new building of the **Charles University Campus in Hradec Králové** (since 2015). In the last ten years, the research groups at FoP have been very well equipped by instrumentation, thanks to financial support from large institutional projects. The strategic instruments that form the "axis" of Faculty of Pharmacy's research activities are listed in the section no. 9.

Currently, the construction of second building of the future Charles University Campus in Hradec Králové, which will accommodate both Faculty of Pharmacy and Faculty of Medicine, is scheduled to start in the immediate future. The Campus will offer a total of 18,550 m² of net teaching and research space in one location for more than 3,500 students from both faculties. This will create a unique educational and research centre, the first of this kind in the Czech Republic.

Centre of Separation Science at the Department of Analytical Chemistry

The research activities of Centre of Separation Science are located at the Department of Analytical Chemistry, FOP, where instrumentally well-equipped laboratories and office space would be available also for the DIOSCURI centre. The focus is on (1) separation science, namely chromatographic, electrophoretic, and low-pressure separation techniques, (2) mass spectrometry, and (3) sample preparation in both fundamental and application research including automation using flow techniques. Fundamental research in the field of sample preparation, flow techniques, and supercritical fluid chromatography is already well established. The FoP workplace belongs among world-recognized laboratories in these domains. Another research part involves development, optimization, and validation of analytical methods for selective quantitation of low concentrations of biologically important compounds in complex matrices. These projects are carried out in collaboration with biological and botanical sciences and include thus working with samples from laboratory animal models, cell models as well as plant materials. Handling these materials requires a variety of sample preparation techniques, often focused on miniaturization due to limited amounts of samples available from the biological experiments. Green chemistry principles and method automation are important goals to achieve in this research tasks as well. Finally, advanced approaches combining liquid chromatography and supercritical fluid chromatography coupled to mass spectrometry are also used in complex metabolomics profiling approaches. Targeted analytical methods using MS/MS detection and non-targeted approaches using HRMS may be combined. To complete the need for top-class research, many data processing and statistical software platforms are available in the research centre and may be used by DIOSCURI centre as well.

9. List of the available research equipment for a Dioscuri Centre:

Charles University, Faculty of Pharmacy in Hradec Králové, is in possession of modern core facilities, that provide resources and services for the faculty research teams, and also for the education of master and doctoral students. Due to subsidies obtained and projects co-financed by European sources, it was possible to obtain funding for high-quality modern research equipment.

The key instruments available for use in DIOSCURI centre involve a large variety of separation platforms and detection approaches. For **separation**, a broad spectrum of platforms are available for **liquid chromatography**, including several UPLC Waters Acquity (UV and FLR detectors and variety of MS); HPLC Shimadzu 10A (UV detector), HPLC Shimadzu LC-2010 C (DAD UV detector, FLR detector), scouting system Shimadzu Nexera accredited by State Institute for Drug Control, Shimadzu Nexera designed for on-lien SPE, and HPLC Shimadzu Prominence LC-20AD (DAD UV detector); HPLC Waters Breeze (UV detector); **supercritical fluid chromatography** including three Acquity UPC2 systems with UV and MS detection, and **electrophoresis** including Electrophoretic analyser EA 100 and EA 202 (conductometric detector, UV - VIS detector) ; CE Beckman – P/ACE MDQ (DAD UV detector); CE Prince and Prince CEC 750 (DAD UV detector, conductometric detector). To achieve advanced multidimensional separation, 2D-LC system from Agilent can be used. Supercritical fluids are used also in extraction system and preparative SFC scale.

For **mass spectrometry**, different types of analysers are available including four triple quadrupoles (two Xevo-TQS-XS and Quattro Micro from Waters and two from Agilent - 6495B) and two high resolution mass spectrometry instruments of Q-TOF type (Synapt G2-Si) and orbitrap type (Orbitrap HF-X). Ionization techniques of ESI, APCI, and MALDI are used in coupling with these instruments.

Available **flow injection systems** involve: FIA – automated system developed at DAC (DAD UV-VIS detector); SIA 1 – automated analyzer developed at DAC (fluorescence, chemiluminescence and electrochemical detector); SIA 2 – FIALab 3000 (DAD UV-VIS detector, fluorescence detector); SIA 3 – FIALab 3500 (DAD UV-VIS detector, fluorescence detector); SIA 4 – FIALab micro- SIA analyzer with Lab-On-Valve platform and Ocean Optics USB2000 detector.

Besides purely analytically focused instruments, **collaboration with other departments** and use of other advanced instruments is possible, such as NMR spectrometer 600 MHz, Fluorimeter, chromatography instrument for protein, peptides and nucleic acids purification, Preparative chromatograph with ELSD and UV detection, TLC plate reader with single quad mass spectrometer, cytometer with sorter for aseptic cell sorting with flow cabinet, Digital PCR cycler, Liquid scintillation counter (beta spectrometer) for alpha, beta and gamma detection, Microsizer analyzer, Nanoscale thermophoresis instrument, Syro I Parallel Peptide Synthesis System, and many many others.

For more information, please check: [Core Facilities | Faculty of Pharmacy - Research Portal \(cuni.cz\)](#)

10. List of the additional benefits (other than listed in the conditions for hosting a DC, see invitation) that the Institution declares to provide for a Dioscuri Centre (i.e.: additional funds, personal benefits, dual career options, relocation support or other):

In the field of Pharmacy and Pharmacology, **Charles University** ranks among the top 250 global workplaces by international comparison of QS World University Rankings by Subject 2021. Charles University is a member of 4EU+ Alliance creating together with Heidelberg University, Sorbonne University, University of Copenhagen, University of Milan, and University of Warsaw a new quality of cooperation in research, education and teaching. The 4EU+ Alliance's main goal is to strengthen research excellence within the member institutions.

In 2019, the **HR Excellence in Research Award** was granted to the Charles University. This recognition reflects the commitment of the Charles University to continuously improving its human resources policies in line with the European Charter for Researchers and the Code of Conduct for the Recruitment of Researchers. The award confirms the efforts of the Charles University and Faculty of Pharmacy to ensure fair and transparent recruitment and appraisal procedures. There is an opportunity to take advantage of the services of the children's group FAFÍK for the children of faculty employees. Furthermore, the employees can profit from discounts and benefits for Charles University employees, such as discounted admission to sport centres, theatres and museums or accommodation in some of the university recreation centres. The benefit of flexible working hours is a standard at various outlets outside Charles University. Flexible working hours are a standard benefit, FoP provides its employees with five weeks paid vacation and personal development days amounting to five days per calendar year. FoP supports its employees in further education, professional and personal development.

The Dioscuri centre will be fully supported by Faculty of Pharmacy's authorities and Englishspeaking administrative staff which provides among others the administrative support in recognition of national and international research programmes and grant schemes (Department of Grant Support and Strategic development), support in all issues relating to knowledge transfer and intellectual property rights (Centre for Knowledge and Technology Transfer) and last but not least the assistance with visa procedures, relocation support, mobility grants and travels in Czech republic and abroad (International Relations Office). Charles University Staff Welcome Centre cooperates closely with the Faculty of Pharmacy and gives a support to complete all the necessary formalities and make the arrangements for the employees from abroad to ensure that all incoming academics and researchers as well as their families have the easiest possible start in a foreign country.

11. Other information about the internationalization of the research institution, international researchers employed at the institution, the availability of English language seminars etc.:

For long time, increasing attention at FoP is dedicated to **internationalization**. It will continue with established international cooperation both at the level of pedagogical exchanges, as well as in the field of science cooperation.

Internationalization in research and scientific activities plays an important role in the strategic development of the FoP and FoP continues in its gradual development. With internationalization in research and scientific activities we mainly refer to relationships with foreign research institutions, i.e., closing new and developing existing scientific ones and research partnerships, international scientific cooperation, obtaining grants for research activities with international participation and last but not least employment of foreign experts at FoP. The most important tools of internationalization are continued foreign research stays of young people scientists and staff placements abroad, further support of invited foreign experts at FoP. A large number of publications (about one-third) are created at FoP every year with foreign co-authorship.

Centre of Separation Science at the Department of Analytical Chemistry is closely collaborating with many prestigious universities, eg. Université de Genève (Switzerland), University of Las Palmas de Gran Canaria (Spain), University of Oslo (Norway), University of Jena (Germany), University of Balearic Islands (Spain), University of Melbourne (Australia), University of Porto (Portugal), etc.

Considering the wide range of the research subjects and the effort to substantially increase the internationalization of the research, more strategic partners are involved as part of the "Analytical sciences for safer drugs and nutraceuticals" research programme. The implementation of the project results in a significant broadening of the collaboration with research institutions from abroad. The mutual collaboration results especially in the transfer of scientific knowledge, joint publications with foreign research workers and the participation of foreign institutions in international projects at the R&D centre.