Palacký University
Olomouc

SCIENCE & RESEARCH

Palacký University
Olomouc

PALACKÝ UNIVERSITY OLOMOUC

Palacký University Olomouc is the second oldest university in the Czech Republic. It comprises eight faculties and one institute, offering more than 1000 study programme combinations attended by more than 23,000 students.

UP is a research university: in addition to providing quality education, it operates a number of modern scientific and academic research centres, employing respected international teams.

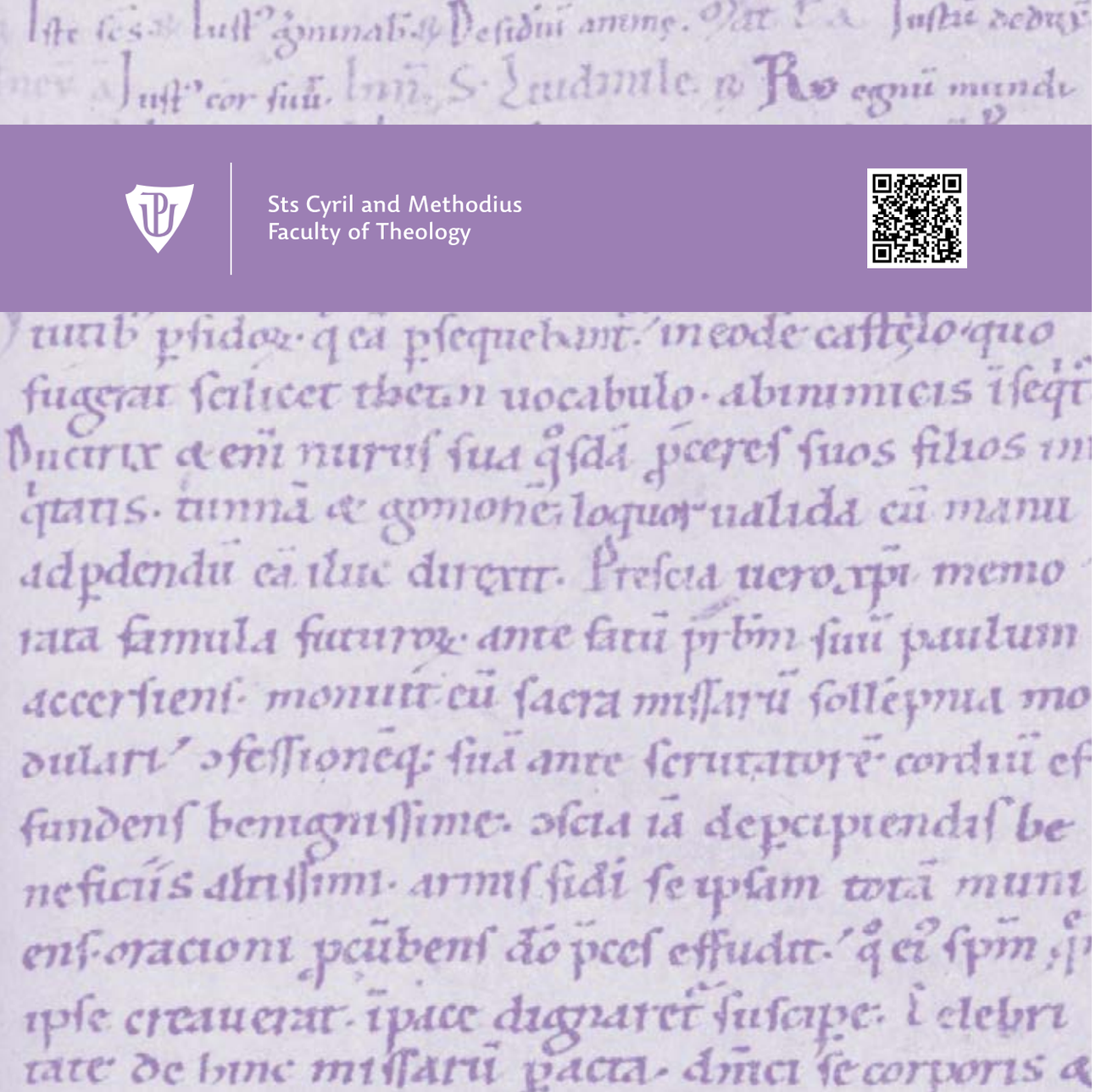
Key research activities take place in biomedicine, biotechnologies, optics, molecular and cell biology of plants, material chemistry, particle physics, nanotechnologies, new materials, and many other fields.

International Rankings

Palacký University Olomouc is listed in the most prestigious international rankings comparing universities across the world. UP is regularly ranked in the top 1000 in the Times Higher Education World University Rankings; even better scores have been achieved in the Academic Ranking of World Universities, QS World University Rankings, Best Global Universities, and The Center for World University Rankings, where it is customarily ranked among the top 700 and even higher.

As the theme of sustainability, social responsibility, and Sustainable Development Goals (SDGs) has become embedded in university strategies and plans, the rankings have also begun to look at how universities perform in these areas. Palacký University Olomouc is currently ranked in three such rankings (Times Higher Education Impact Ranking, QS World University Rankings: Sustainability, UI GreenMetric World University Rankings) and it is improving its positions year-on-year in all of them, despite that the number of participating universities in these rankings is growing.

RANKINGS



Sts Cyril and Methodius
Faculty of Theology

STS CYRIL AND METHODIUS FACULTY OF THEOLOGY

The **UP Sts Cyril and Methodius Faculty of Theology (UP CMFT)** is the largest and most productive theological faculty in the Czech Republic. It is involved in major projects such as SHAPES (Smart and Healthy Ageing through People Engaging in Supportive Systems), supported by Horizon 2020, and For Healing Souls, supported by Norway Grants. The faculty is also engaged in research on digital technologies and well-being (DigiWELL) and in the preservation and presentation of sacral monuments.

UP CMFT participates in the Fulbright programme and collaborates with dozens of European universities. Doctoral studies under dual supervision (cotutelle) are possible at the University of Groningen, Pontifical Lateran University in Rome, and Ukrainian Catholic University in Lviv. In cooperation with Czech and Slovak theological faculties, CMFT publishes the journal *Studia theologica* and popularises its research topics via podcasts.

Science and research institutes at UP CMFT

The Centre for Patristic, Medieval and Renaissance Texts is unique in the context of the Czech Republic. Important works of European Christian culture are studied and made available to the Czech public. Connections are made between classical and medieval philologists, philosophers, theologians, and historians of science on an interdisciplinary basis. It researches for example Alexandrian Christianity and the origins of Western monasticism.

The Olomouc University Social Health Institute (OUSHI) allows UP CMFT to focus on research and education with a special emphasis on psychological, social, and spiritual determinants of health, health inequalities, individuals with illnesses, and non-profit pharmaceuticals. Researchers also focus on topics such as access to and quality of health care, promoting mental health in adolescents, and improving the quality of life of the elderly.

Faculty of Medicine
and Dentistry

FACULTY OF MEDICINE AND DENTISTRY

The **UP Faculty of Medicine and Dentistry (UP FMD)** is one of the leading biomedical research institutes in the Czech Republic, with a long-standing tradition and the ambition to become a major centre of innovation and excellence – not only among medical faculties in the country, but also in the wider Central European space.

Science and research at UP FMD is currently based on three pillars. These are **basic and translational research**, **preclinical research**, and **clinical research**. These components are not isolated, but rather intertwine and work ensemble. One of the major advantages for research at UP FMD is the **interconnection of the faculty's departments and University Hospital Olomouc**, making possible joint projects and sharing technologies. A number of teams cooperate very closely with UP Faculty of Science (UP FS) institutes, and collaboration with leading biomedical research institutes in the country and important institutes abroad is developing promisingly. The faculty pays great attention to the scientific education of undergraduate and postgraduate students. Currently, 29 doctoral study programmes are accredited at UP FMD.

International recognition

UP FMD is currently the principal investigator of nearly **60 major national grants** and co-investigator of 20 others. The faculty has successfully concluded **2 long-time priority research projects** for the Czech Ministry of Education and participated in one such project with UP FS. Annually, UP FMD authors participate in at least **300 high-quality scientific articles** published in prestigious international journals listed in the Web of Science database, and another 200 articles are published in peer-reviewed periodicals.

Many scientists who earned international recognition for their efforts and research have been active at UP FMD. To name just a few: Prof František Šantavý, the pioneer of phytochemical research on alkaloids from *Colchicum* plants and on the structure of

cannabidiol; Prof Václav Vejdovský, who described a new method of reconstruction of the lower lacrimal duct through the mucous membrane of the oral cavity; Prof Pavel Lukl, the prominent Czech cardiologist and President of the European Society of Cardiology; Prof Boleslav Wiedermann, who achieved many international firsts in the research of blood diseases, particularly monoclonal gammopathies; and Prof Václav Rapant, the author of many key works on oesophageal and gastric surgery.

Science and research priorities

In the area of **disease onset and development**, UP FMD focuses mainly on cancer, circulatory system diseases, infectious diseases, metabolic and endocrine diseases, neurological and mental disorders, musculoskeletal disorders, inflammatory and immunological diseases, and addiction. The faculty is also developing **new diagnostic and therapeutic methods**; among them, innovative surgical procedures including transplantation, gene and cell therapy, tissue replacement, and biologicals including vaccines. It also focuses on in vitro diagnostics, low molecular weight therapeutics, drug delivery systems, and the development of new medical devices and equipment. The third priority area is **epidemiology and prevention** of major diseases such as cancer, circulatory system diseases, infectious diseases, and metabolic and endocrine disorders.

Faculty
of Arts

FACULTY OF ARTS

The **UP Faculty of Arts (UP FA)** is the largest and most diverse arts and humanities faculty in the Czech Republic – its academic and scientific work covers practically all Fields of Research and Development in FORD categories 5 (Social Sciences) and 6 (Humanities and the Arts). International cooperation takes place in these fields and beyond their borders (for example, also into the natural sciences and medicine).

UP FA publishes 11 academic journals, including *Transactions on Transport Sciences* and the *Czech and Slovak Journal of Humanities*.

UP FA is where the **Academia Film Olomouc International Festival of Science Documentary Films** was founded in 1966, today one of the largest educational events in Europe. The festival has hosted such famous scientists as evolutionary biologist Richard Dawkins, robotics visionary Hiroshi Ishiguro, and AI philosopher Susan Schneider.

UP FA was home to the prestigious international project **Sinophone Borderlands**, exploring the influence of China on its geographical and cultural neighbours. The interdisciplinary team covers themes from research on languages and ethnographic anthropology through media and cultural artifacts to the political and economic results of development in China.

UP FA experts are contributing to current trends in general linguistics and natural language processing, encompassing the latest developments in AI. Their research, which led to a patent from the World Intellectual Property Organization, is now finding uses via their spin-off company, Deepeffects.ai. They have produced one-of-a-kind technology which allows automatically profiling of individuals on the basis of their specific means of expression. It can be used in aiding automatic profiling of psychiatric disorders and in criminalistics. Security organisations such as the **Czech Army** and the **Czech Republic's National Counter-Terrorism, Extremism and Cybercrime Agency** have already expressed interest.

Olomouc psychologists at UP FA are cooperating with other workplaces on methodologies to choose the best candidates for space travel. The project leaders are researching tools for exploring the influence of personal characteristics and external factors on team dynamics for long-term living in isolation in confined and extreme conditions and have unique simulator facilities at their disposal.

International cooperation

UP FA has established partnerships throughout the world in terms of mobility programmes, also on the individual research level. UP FA is actively engaged in the programmes **Erasmus+**, **AIA** (Academic Information Agency), **DAAD** (Deutscher Akademischer Austauschdienst), **CEEPUS** (Central European Exchange Program for University Studies), **EEA** (European Economic Area study stays and project cooperation with Norway, Iceland, and Liechtenstein), **Czech Ministry of Education, Youth, and Sports** bilateral international agreements, the **Visegrad Fund**, and direct cooperation between universities, colleges, and faculties abroad.

Academic and scientific workplaces

UP FA is comprised of 19 departments and the UP Language Centre. Among its research centres and laboratories are the Laboratory for Virtual Reality and Cyberpsychology, the Centre for Comics Studies, the Material Culture Lab, the Centre for the Research of Travelogues and the History of Written Representation of Intercultural Contacts, and the Performativity Research Centre.

Faculty
of Science

FACULTY OF SCIENCE

The **UP Faculty of Science (UP FS)** contributes significantly to the scientific performance of Palacký University. It has succeeded in the Horizon 2020, Horizon Europe, ERA-NET, and other European and international projects, which make it possible to support high quality and successful research on the international scale. Faculty departments actively cooperate in the form of contract research with dozens of regional and foreign companies and multinational partners. Academics are successful in registering national, European, and US patents and utility models. From 2019 to 2023, researchers from UP FS published over 3,700 publications in impact journals and registered 60 patents and utility models.

Key areas of research

Research in **mathematics** focuses on theoretical and computational analysis of mathematical models, applied statistics, data optimization and approximation, differential geometry, and many-valued and quantum logic.

In **computer science**, research is focused on algorithms for challenging problems, computational complexity problems, logic, artificial intelligence, and new methods for analysis and processing of relational data.

In **physics**, researchers are focused on the study of new properties of light from the theoretical and practical point of view. Further, the faculty participates in the **ATLAS-CERN** project for the study of elementary particle interactions. Investigation is also focused on optical quantum information processing and quantum interaction of light with ensembles of neutral atoms and trapped ions. Biophysicists investigate the role of reactive oxygen species in living systems and the structure-function relationship of protein complexes. Research in physics has long been devoted to nuclear spectroscopic methods, including Mössbauer spectroscopy.

One area of research in **chemistry** is the development of advanced chemical compounds and materials, with emphasis on potential applications as various drugs. Attention is also paid to computational chemistry, where drug interactions with DNA and cell membranes are studied. Significant research is carried out on living organisms at the molecular level, where laws of metabolism, defence mechanisms, and stress factors are revealed. Development of analytical methods results in various applications, e.g. measurement of pharmaceutical samples, disease markers, drug detection, and analysis of archaeological samples and works of art.

Research in **biology and ecology** covers biotechnological applications, plant genetics, etc. Zoologists have shown impressive results in the field of speciation and hybridization, and diversity and phylogeny of beetles and Hymenoptera. In the field of ecology and the environment, research is focused on the population dynamics of mammals, landscape ecology, and more. Cell biologists and geneticists study the mechanism of xenobiotic activity on the human body and other interactions with antitumor and anti-inflammatory effects. Important work on plant hormones and their functioning at the molecular and cellular levels is ongoing. Many compounds with high potency in medical application have been patented and subsequently licensed to industrial companies.

The main research directions in **earth sciences** include the study of the spatial distribution of ecosystems and landscapes and the interaction between them. Researchers deal with regional delineation and spatial interactions, urban climates and green infrastructure in cities. In geology, research on sedimentary rocks as an archive of information on climate, surface geological processes, and pollutant transport is a key topic. Research is also focused on sustainable development within the Czech Republic and abroad.

Faculty
of Education

FACULTY OF EDUCATION

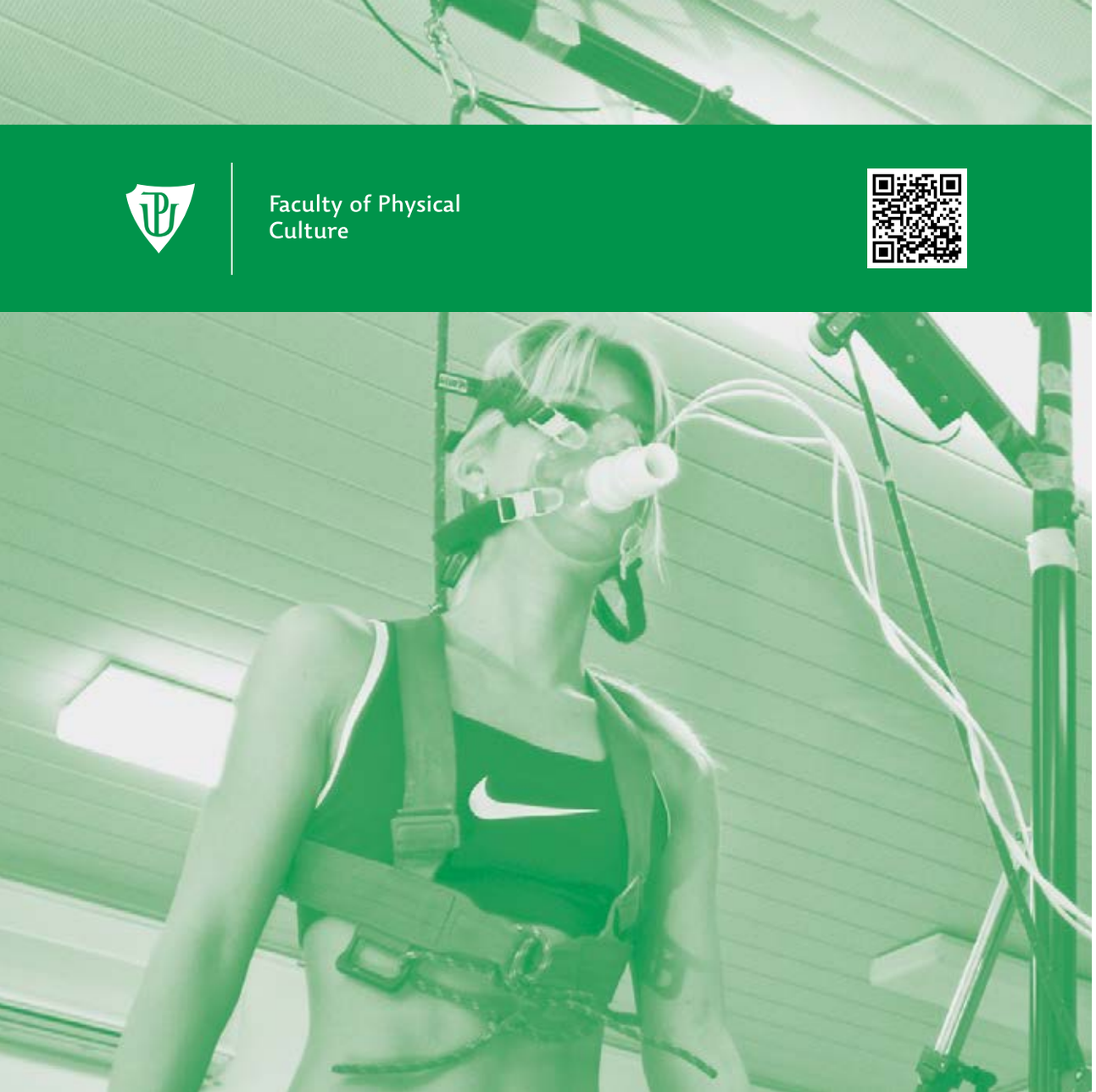
In addition to educational activities, the **UP Faculty of Education (UP FE)** is dedicated to the realisation of academic research and artistic creation across various areas related to education, teacher training, special education, and didactics of special fields. Central to its mission is collaboration with partner schools and educational institutions, the primary places for applying research findings.

Multidisciplinary approach

What sets the faculty apart is its wide range of research within its constituent areas. The inherently multidisciplinary nature of education research means that the faculty's investigations are remarkably varied. The faculty collaborates with external partners on diverse themes, extending to areas such as internet safety and risky behaviour, where they work alongside the **National Cyber and Information Security Agency**, the **Police of the Czech Republic**, and **O2**. UP FE is engaged in applied research, such as software to evaluate children's literacy (TETRECOM) and an online diagnostic tool aimed at assessing children's readiness. Faculty experts are innovating education at primary and secondary schools, and conduct studies on media literacy in partnership with **CEDMO** and **Google**, incl. the use of AI in education. Especially important is disciplinary didactics: research in the approaches to teaching individual school subjects. A key focus is integrating research findings with art therapies. The faculty established a specialised evidence-based centre affiliated with the **Joanna Briggs Institute (JBI)**. Examples in special education and speech therapy include research on reducing the information deficit and fostering the imagination of visually-impaired individuals through 3D models, such as the development of tactile-auditory aids.

Specialised centres

The faculty is home to several specialised centres, including the Centre for Research into Healthy Lifestyles, the Centre for the Prevention of Risky Virtual Communication, and the Centre of Evidence-based Education & Arts Therapies (EduArt).



Faculty of Physical Culture

FACULTY OF PHYSICAL CULTURE

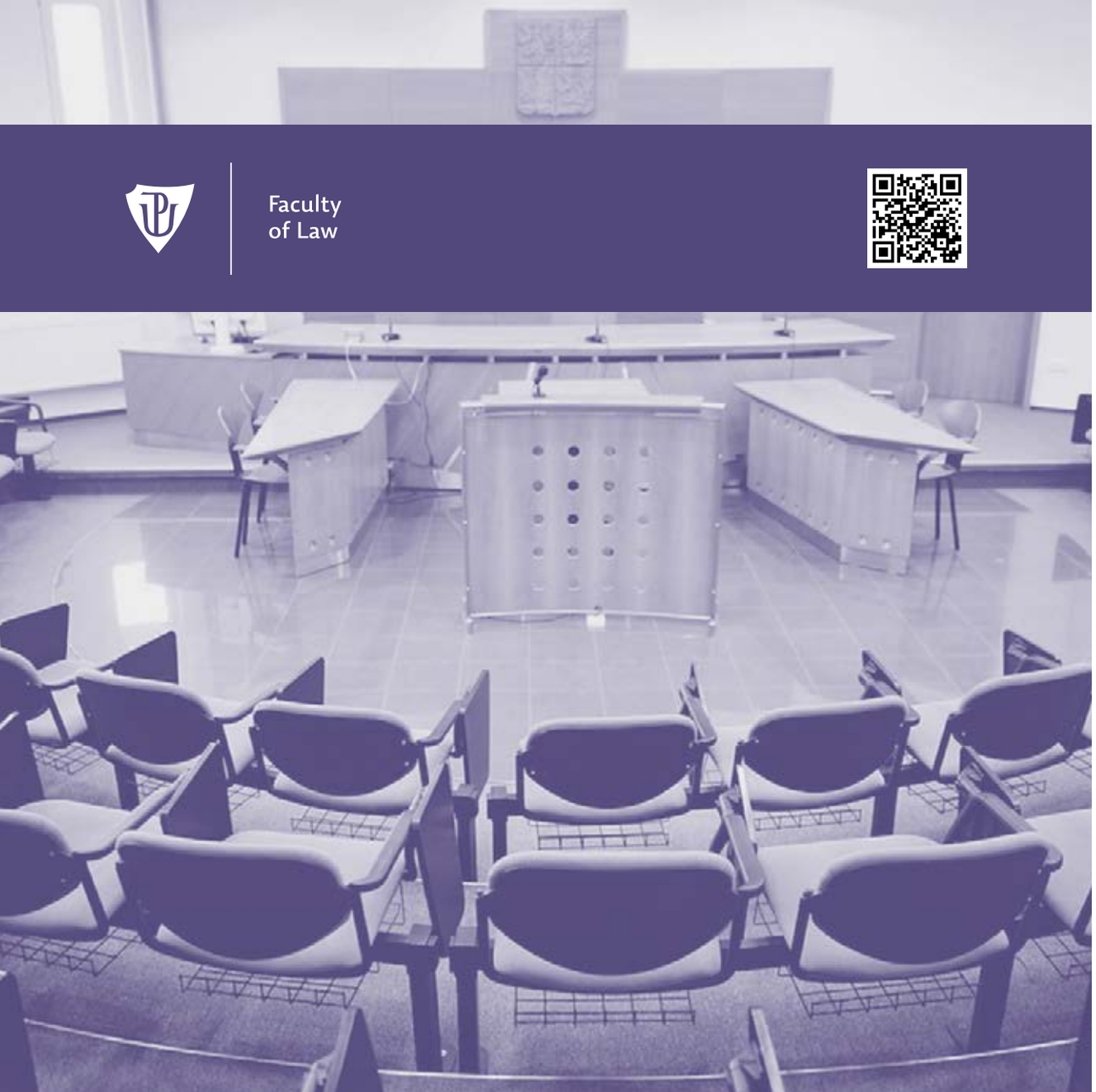
The **UP Faculty of Physical Culture (UP FPC)**, which secured a prestigious spot within the 151–200 range in the Shanghai Ranking's Global Ranking of Sport Science Schools and Departments for 2023, stands as the premier research institution in sport sciences in the Czech Republic. This accolade reflects its standing among over 300 sport-related institutions worldwide, evaluated on publication volume, citation impact, and international collaborations.

Innovative research

UP FPC leads sport science research, focusing on a nuanced understanding of 24-hour movement behaviours among diverse groups and how these behaviours impact health results and chronic disease prevention across various demographics. This involves a detailed examination of physical activity, sedentary behaviour, and sleep patterns through the use of objective monitoring techniques such as accelerometry, enabling the collection and analysis of behavioural data.

UP FPC research includes in-depth investigation into gait variability, stability, and complexity in the elderly, aiming to understand how these aspects influence fall risk and mobility issues. It conducts comprehensive analyses of the activity of selected intrinsic foot muscles during walking and balance tasks. Furthermore, its research extends to motor learning in children with developmental coordination disorders.

UP FPC's studies on the impact of molecular hydrogen on exercise performance and health have unveiled its potential to improve recovery and mitigate oxidative stress. It is also examining the advantages of simulated altitude training for enhancing athletes' endurance and performance. Moreover, its research into heart rate variability in sports and exercise offers valuable insights into athletes' cardiovascular health and their training adaptability.



Faculty
of Law

FACULTY OF LAW

The **UP Faculty of Law (UP FL)** is a leading research institution with significant achievements particularly in EU and international law, digital constitutionalism, legal clinics, and private law. The faculty publishes two internationally recognised journals focusing on international and EU law, both indexed by Elsevier Scopus. UP FL has also been successful in securing grant funding from the **Czech Science Foundation**, supporting research on legal aspects of digital transformation, gig work, competition law development, and class actions.

The most important research activities

The **Digital Sovereignty Lab (DiSoLab)** which conducts state-of-the-art research in key areas of digital law development, focusing on digital constitutionalism and individual rights protection in the digital space.

The **Jean Monnet Centre of Excellence in EU Law** was established with support from the European Commission's Erasmus+ programme to serve as a hub for research, discourse, and innovation in EU law.

The **UP Centre for International Humanitarian and Operational Law (CIHOL)** is a unique research facility established jointly by the faculty and the **Czech Armed Forces**, providing a fruitful connection between academic expertise and practical application.

UP FL is a pioneer in developing and innovating clinical legal programmes in the broader European perspective. It established the first legal clinic in Central Europe, and played a key role in creating the **European Network for Clinical Legal Education (ENCLE)**.

Expertise in private law

UP FL is home to a renowned group of private law scholars who have demonstrably innovated the legal landscape of the Czech Republic. They drafted the new Civil Code, and created the most authoritative expert commentaries on it.

Faculty of Health Sciences

FACULTY OF HEALTH SCIENCES

The **UP Faculty of Health Sciences (UP FHS)** conducts its science and research activities at the Science and Research Centre and at individual institutes according to their specialisation. Scientific research activity is primarily concentrated on non-medical health areas; UP FHS is firmly established among Czech research facilities with the same focus.

Priority themes

Priority themes are grounded on the evidence-based concept in non-medical fields, multidisciplinary teams in healthcare, the influence of lifestyle on health, and the area of prevention, protection, and support. The faculty also concentrates on the One Health concept, reproductive health, international classification in Nursing and Midwifery, medical rehabilitation, and kinesiotherapy. Research focuses on management in non-medical health professions, the system of health and social care for seniors, imaging methods, nuclear medicine, and radiotherapy.

Educational and research activities

UP FHS takes part in organising professional conferences and running educational professional workshops for interested members of the professional public. Its academic staff lecture at professional scientific conferences in the Czech Republic and abroad.

In 2022, faculty leadership announced an internal grant competition pilot project to continually support improving the quality of science and research activities at UP FHS and make possible development of its employees' research potential. UP FHS takes part in projects under the auspices of the **Technology Agency of the Czech Republic, the Johannes Amos Comenius Programme** (P JAC), and more.

CATRIN
Czech Advanced Technology and Research Institute

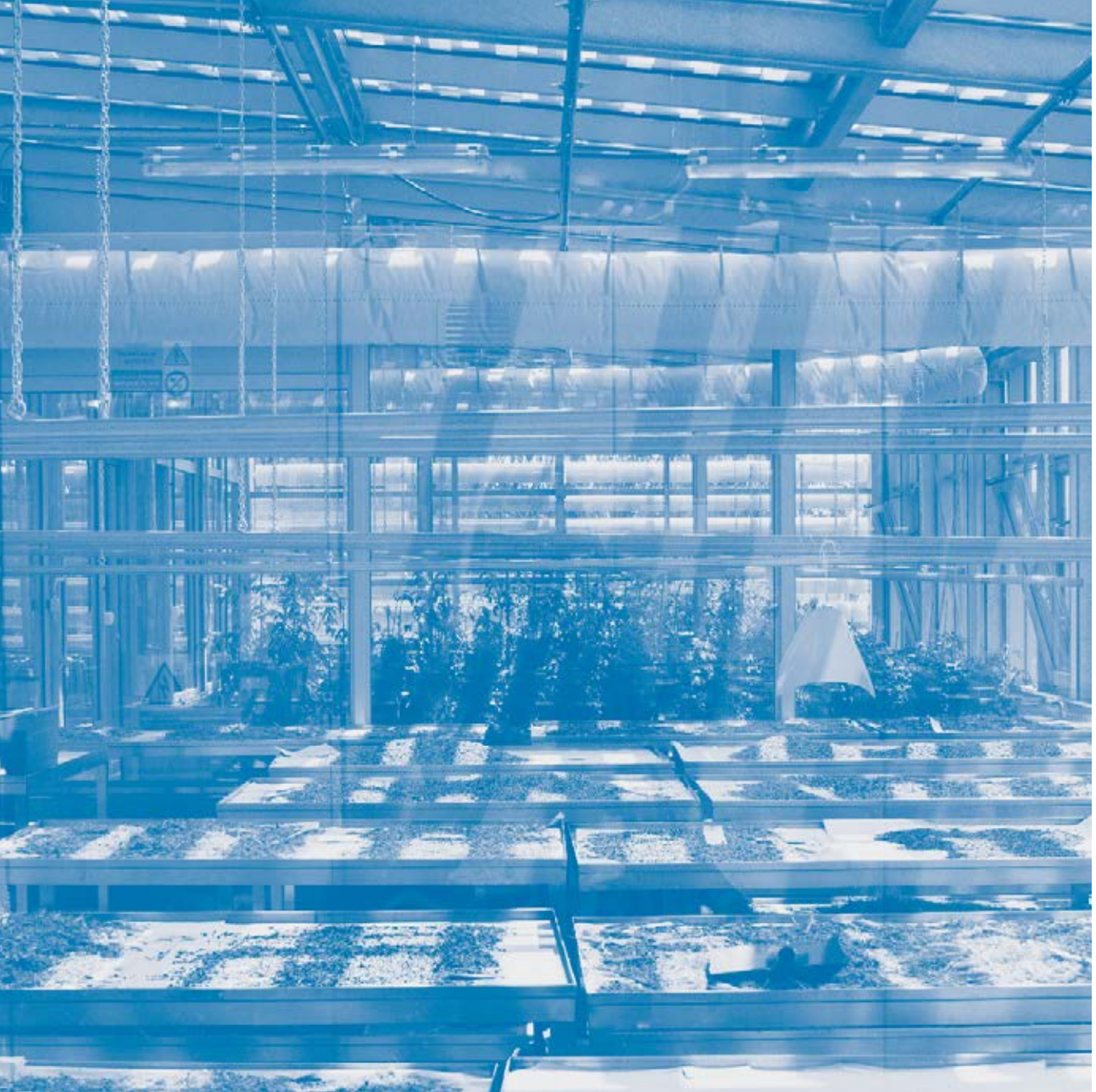
CZECH ADVANCED TECHNOLOGY AND RESEARCH INSTITUTE

The **Czech Advanced Technology and Research Institute (CATRIN)** at UP is dedicated to research in nanotechnology, biotechnology, and biomedicine. Its basic building blocks are high-quality scientific teams with a significant representation of international scientists, interdisciplinarity, transnational collaboration, and intensive efforts to transfer research results into practice.

Thanks to an unparalleled network of experts from a wide range of disciplines in material, plant, and biomedical research, and in collaboration with international centres of excellence, CATRIN researchers are introducing solutions to many a global challenge today. The materials and technologies developed at CATRIN aim to better the quality of life and health of society, to ensure food security through sustainable agriculture, and to contribute to the efficient use of energy resources including green energy, thus improving the environment.

Successful projects

CATRIN was founded in 2020 as a higher-education institute of Palacký University Olomouc. Since then, it has produced scores of significant results, with articles in journals in the *Science* and *Nature* family, and has been quite successful in **obtaining research grants**, including the most prestigious ones, awarded by the European Research Council and the **European Innovation Council**. Michal Otyepka, physical chemist and expert in 2D graphene chemistry, has been awarded four ERC grants, unprecedented in the Czech Republic. Another ERC grant winner is world-renowned chemist Alexander Dömling, who is building a research group at CATRIN thanks to the ERA Chair ACCELERATOR project from the **Horizon Europe** programme. As part of another Horizon Europe funded project "Boosting photosynthESis To deliver novel CROPs for the circular bioeconomy" (BEST CROP), CATRIN researchers are producing new barley breeding lines with improved photosynthetic properties using



groundbreaking technologies. The project “Nano-Monitoring of Cancer Immunotherapy Efficiency: The Graphene Lateral Electrophoretic Bioassay Platform” aims to develop a sensor system monitoring the effectiveness of treatment for neuroblastoma in children. The Horizon Europe RIA project PATAFEST aims to protect European potato production from certain diseases.

Important discoveries

Scientists from CATRIN have been involved in many important discoveries. They have made a major contribution to the development of a method that enabled them to be **the first in the world** to observe the non-uniform distribution of the electron charge around a halogen atom; thus the existence of a phenomenon that had been predicted theoretically but not directly observed has been confirmed. Their discovery was published in *Science*. They had a part in the **development of fluorographene**, and have long been involved in the fight against bacterial resistance to antibiotics.

CATRIN researchers are also refining the approach to **nanomaterial research**. They are using revolutionary atomic engineering methods to develop new materials. This is one of the goals of the **Technology Beyond the Nanoworld** (TECHSCALE) project, in which they are collaborating with domestic partners from Charles University and CEITEC-BUT. The five-year research project has been supported by €20 mil.

Strategic partnerships

CATRIN is the Regional Branch Office of the European Federation of Biotechnology (EFB). In cooperation with EFB, the biennial international conference Green for Good is held in Olomouc. CATRIN has strategic partnerships (Memoranda of Understanding) with the Bar-Ilan Institute of Nanotechnology & Advanced Materials (BINA), the Catalan Institute of Nanoscience and Nanotechnology (ICN2), and the Leibniz Institute for Catalysis (LIKAT).

Palacký University
International Cooperation

INTERNATIONAL COOPERATION

Palacký University cooperates with dozens of partner universities abroad. Internationalisation in education and scientific research as well as mobilities are intensively supported, and considerable time and effort are devoted to the development of strategic partnerships in these areas. UP cooperates with the Czech National Agency for International Education and Research in strengthening internationalisation in the globalised world and in partnership-building. UP currently has **more 1000 signed agreements for cooperation** with partner universities throughout the world, within the Erasmus+ programme and via direct bilateral or multilateral academic and exchange programmes.

The university is regularly represented at **international conferences and university fairs abroad**, for example by the NAFSA: Association of International Educators (USA), the APAIE (The Asia-Pacific Association for International Education), the European Association for International Education (EAIE), the EduExpo university fairs in Latin America, and university fairs in Ukraine, Italy, China, Kazakhstan, Indonesia, and other countries.

UP is a full member of the **Aurora Network**. Originally formed in 2016, Aurora is a consortium of research-intensive universities that are deeply committed to the social impact of their activities and have a history of engagement with their communities. The overall vision is to use academic excellence in education and research to affect social change. In doing so, they also place an emphasis on sustainable development and local community development. The Aurora European University programme has secured funding under the 2023 European Universities Initiative Call by the European Commission.

AURORA

Palacký University
Olomouc

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