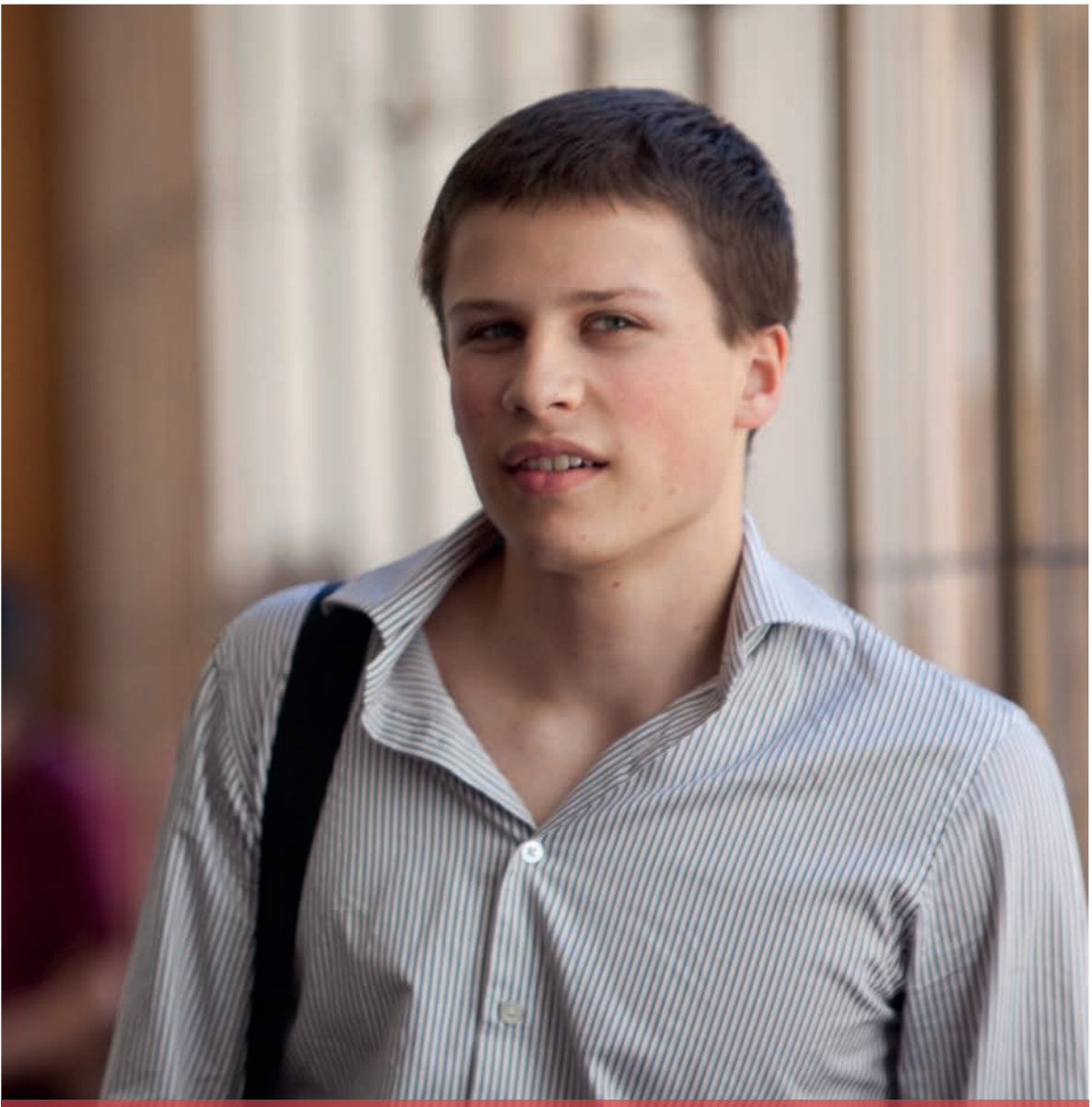
CHARLES UNIVERSITY – UNIVERSITY OF THE THIRD MILLENNIUM


UNIVERSITAS CAROLINA

CONTENTS



CHARLES UNIVERSITY – UNIVERSITY OF THE THIRD MILLENNIUM

INTRODUCTION

The Charles University management and academic community are always striving to fulfill the key principles of the university activities. The emphasis is placed on the protection and further development of the freedom of research and education; it's vital that the university keeps its integrity, autonomy and independence. We also understand the immense importance and necessity of the academic autonomous government, the emphasis on the ethic principles of research, education and academic freedom. These are the essential conditions of the free and creative environment at Charles University.

Charles University has seventeen faculties and four University Institutes (Institute of the History of Charles University and Archive of Charles University, Center for Theoretical Study, Center for Economic Research and Graduate Education, Environment Center).

For a long time, Charles University has offered a broad range of study programs and branches. The emphasis is placed on the quality improvement of study programs, and their interconnection with research. During the admission procedure for the academic year 2014–2015, Charles University received more than 65 000 applications; 88% of applicants applied for daily studies, 12% for combined courses. 9 735 applicants were admitted to bachelor courses, 5 060 to the follow-up master's programs, 4 221 to non-structured master's degree studies, and 1 332 to postgraduate courses; from applicants admitted to all types of courses and degrees, 62% were women; and foreigners made up 16%.

In 2014, the total number of 50 992 students studied at seventeen Charles University faculties. In the near future, the priority of development is not to continue to increase the number of students; instead, we have to focus on the quality of education provided. As for specific numbers, 61.5% of students were women. As for age structure, 16% students were older than thirty. In the academic year 2014–2015, 4657 academic staff members are working at Charles University, including 367 foreign employees.

The studies at Charles University are very popular among foreign applicants. In 2014, there were 7 794 foreign students at our Alma Mater, i.e. 15% of all students. This rate is increasing moderately yet steadily, which is in line with Charles University priorities. Apart from the support of various forms of student and academic staff mobility, as well as courses or whole programs in foreign languages, the international cooperation features international study programs (the Joint Degree Program), participated in by several European, as well as global, university institutions. These programs are most frequently realized as part of the European Commission program Erasmus Mundus, the Marie Sklodowska-Curie Program for funding inter-university postgraduate studies, or other international platforms.

Given the position and history of Charles University, lifetime education is an integral part of its educational concept. The importance of this type of education is growing steadily these days, with regards to the increasing demand for flexible strengthening and broadening of professional knowledge and skills.

In the long run, Charles University is working at creating conditions for fair access to university education. Specifically, this features support of

disadvantaged groups of applicants and students, aiming at removing barriers in the access to university education. These groups primarily include applicants and students with health disabilities, or students disadvantaged due to their socioeconomic situation. The members of these groups can use various forms of support during their studies.

Postgraduate studies are, in accordance with the profile of Charles University as a strong research institution, considered a priority within the university's educational activities. Currently, all 17 faculties run accredited postgraduate study programs and branches. The main priority is the increase of the number of foreign students in postgraduate programs, and accreditation of programs in foreign languages. The share of postgraduate students from the total number of students has been about 16% of all Charles University students for quite a time (the second highest in the Czech Republic). Meanwhile, the number of our postgraduate students is about one-third of all postgraduate students in the Czech Republic; this share has been almost constant for a long time.

The extent and quality of the research and creative activities of Charles University can be assessed from several different points of view. One of them is the number of "points" obtained upon the evaluation of papers, monographs and other outcomes, as part of the annual national performance evaluation of research organizations. The international bibliography and citation databases are also important, as well as the international comparison of universities and other research-focused institutions. Last but not least, we can assess the research performance by, for example, the amount of finances the university can collect via grants.

For both national and international methodology of evaluation, the international bibliography and citation databases are among the most important sources of information. As far as science and medicine is concerned, the most important information is published at the Web of Science. In 2014, the researchers and academic staff of Charles University published 3500 papers in journals and magazines indexed in this database. The quality of the research at Charles University is proven, primarily, by the citation rate in international expert papers; the H-index is generally accepted as the key indicator. The value of important indicators has improved recently.

In 2014, the International Advisory Board was created, to become the advisory institution of the Charles University Rector, mainly to identify the main trends in the research and educational activities of the university, its research centers and internal funding system. The mission of the Board is to improve the international reputation of Charles University, and help improve the quality of the research and educational activities to improve the results of the international comparison, so the university can confirm its role of an internationally renowned "research university".

In line with its long-term vision, Charles University focuses on the quality of its international cooperation, with major impact on the increase of the quality of research and education, and also on the openness of the university in the international college environment. In the academic year 2014–2015, Charles University entered the new phase of the European Union program Erasmus+, planned for 2014–2020, following on from the previous education programs Lifelong Learning Programme, Erasmus Mundus, Tempus, Alfa, Edulink, bilateral programs and the program Youth in Action. In the academic year 2014–2015, a total number of 1369 students joined the Erasmus program to study abroad; in the same period, 1545 students came to study at Charles University. According to the latest available statistics of the European Union, Charles University

was 12th in the ranking of outgoing students, and 7th for incoming ones.

The priorities for international cooperation include the support of student and academic mobility, based on inter-university agreements, joint degree or double degree programs, postgraduate courses in the cotutelles model as part of the Post-doc fund supporting the visits of young foreign researchers at Charles University, the CEEPUS program and AKTION Czech Republic – Austria.

As part of the inter-university cooperation program, Charles University adopted a new cooperation form – strategic partnerships. We started with four important German universities (Humboldt-Universität Berlin, Universität zu Köln, Johann-Wolfgang-Goethe-Universität Frankfurt and Universität Hamburg), in accordance with the strategic objectives and visions of all participating institutions. The partnerships focus on multilateral and long-term cooperation in order to create common research projects, study programs involving the participation of students and young researchers, and further development of the selected key branches.

In 2015, the Charles University management met the representatives of the world's leading universities in Geneva to discuss the topic "UniversCities". Meetings with the representatives of the partner universities Leiden University and Heidelberg University were also very interesting. Without any doubt, these meetings improve the Charles University reputation, proving the university is a sound partner in science, research and studies alike. The University also prepared successful Charles University Days in Paris, including meetings with alumni, presenting its activities, successes and offer to its academic and research partners. There's also A Day in Brussels, in cooperation with the Czech, again very positively responded to by the Charles University alumni working at present in Brussels.

Charles University is home to many outstanding researchers, whose teams are among the best in the world. This is proven, among other things, by important awards received during the past year by our colleagues. A good example is Professor Roithová from the Faculty of Science, who became the first Czech laureate of Ignaz L. Lieben Prize for the development of a new method in physical organic chemistry, revealing ways to understand the key principles of chemical reactions. Another important award went to Professor Tomáš Halík from the Faculty of Arts; he is the first Czech to receive the prestigious Templeton Prize for his courageous attitude in Communist times, for overcoming barriers between atheists and believers, and also for encouraging the dialogue between confessions, which is a hot topic these days.

The international prestige of our Alma Mater is also proven by the fact that the university has been visited in the past year not only by numerous important researchers, representatives of many universities from all over the world, but also by a number of statesmen and diplomats. These meetings were always a big success. As for global leading researchers and scientists, I would like to point out – apart from the visit of the Oxford University Rector, Mr. Andrew Hamilton – the visit of the CEO of the European Organization for Nuclear Research (CERN), Professor Rolf-Dieter Heuer, who came to Prague to celebrate the 60th anniversary of this institution. His lecture had a positive response from our students, and not only from the Faculty of Mathematics and Physics, as a long-term CERN collaborator. As for statesmen and diplomats, I'd primarily like to point out the visit of the President of the Federal Republic of Germany, Mr. Joachim Gauck, a guest of Charles University several times. Also the Secretary General of the UN, Mr. Ban Ki-moon, was greatly interested in our work as were other foreign guests.

Building and development is carried out in line with the long-term plan of the Charles University

development. This plan involved further preparatory works aimed at solving the issue of insufficient existing facilities, especially at faculties focused on humanities and social sciences, and development of areas for top notch sites in scientific and medicinal branches. The priority in this area was the realization of new university campuses.

Valued feedback for Charles University, monitored every year, is the international comparison. Apart from the charts that have existed for more than a decade, several others have been created, such as the Best Global Universities chart, assessing the research and creative activities of colleges and universities using their reputation, bibliometric indicators, and the quality of postgraduate studies. In the first issue, Charles University finished in shared 179th place, together with Johann Wolfgang Goethe-Universität Frankfurt am Main and Korea Advanced Institute of Science and Technology (KAIST). In Europe, Charles University finished 67th, making it to the Top 100 in mathematics, physics, botany and zoology. In the three best--known charts, i.e. Academic Ranking of World Universities, Times Higher Education World University Rankings and QS World University Rankings, Charles University defended its position among the best universities in the world, and it scored high in several branches such as mathematics, physics, pharmacy, philosophy, linguistics, modern languages, geography etc..

Another inspiration for Charles University's further development is another type of international comparison, the outcome of which is not a chart with rankings but an overview of the schools' results in various indicators. In terms of research activities, such comparisons include, for example, SCImago Institutions Rankings, newly incorporating the evaluation of innovations and visibility of universities/colleges on the internet, or Leiden Ranking, with the most elaborate bibliometric indicators.

The founder of our university Bohemian King and Roman Emperor Charles IV wished the university to be equal to the best European universities of his time. I deeply believe that in recent years, we have together done everything to make this big task and historic legacy happen.

Quod bonum, faustum, felix, fortunatumque sit!

Tomáš Zima
Rector of Charles University

EDUCATION

The offer of study programs and courses has been always pretty rich at Charles University, as it's linked to the research activities of respective sites. At the moment, 163 accredited study programs are open in the undergraduate studies, with more than 600 courses, 60 bachelor's, 41 master's and 62 follow-up master's programs with 210 bachelor's, 130 master's and 268 follow--up master's courses. Of these accredited study programs and courses, the studies are realized in 58 bachelor's programs with 203 courses, 26 master's programs with 57 courses, and 59 follow-up master's programs with 244 courses.

While the number of accredited bachelor's programs has been constant for a long time, the number of follow-up master's programs is increasing steadily, which is in line with the long-term strategy of Charles University. The decrease in the number of the non-structured master's programs is caused by the transition to structured programs, already completed at Charles University. The biggest number of study programs (93) involves humanities and social sciences, followed by healthcare, medicine and pharmacy (79) and the science group (35).

In the area of postgraduate studies, the total number of 213 programs was accredited at Charles University, with 166 courses (some postgraduate programs, especially in medicine and science, don't break down into courses). Of these accredited study programs and courses, the studies are realized in 160 postgraduate programs and 146 courses. The number of realized programs is caused by the fact that numerous study programs, with the standard studying period of 3 years, were replaced by programs with 4-year standard studying period, and students gradually finish them. Most postgraduate study programs are also available in English.

In 2014, 50 992 students studied at 17 Charles University faculties. The vision and priorities of Charles University, in terms of development in the upcoming period, involve not increasing the number of students but putting more emphasis into the quality of education instead. The female/male student rate is 61.5% to 38.5%,

i.e. similar to 2013. As for the age structure, 16% of students are older than 30 years; almost half of these students study postgraduate programs, and almost one third study courses focused on social sciences. Given the demographic development, it's possible to expect the number of students over 30 to grow.

The bachelor's programs were attended by 18 560 students, the non-structured master's programs by 15 222, the follow-up master's programs by 9 559, and the postgraduate doctoral programs by 7 651 students. Overall, most of the students studied full-time (80%), with 20% of students using the combined form. This rate has been stable for a long time.

The highest numbers of students studied medicinal and pharmaceutical courses, and also courses focused on social sciences. The third largest group consisted of students of science--focused and educational courses. As for faculties, the largest are Faculty of Arts (7 304 students), Faculty of Education (5 408) and the First Faculty of Medicine (5 232). Studies at Charles University are continuously popular among foreign applicants. In 2014, there were 7 794 foreign students at the university, i.e. 15% of all students. This rate has been continuously increasing by small increments. A large part of study programs at Charles University are accredited in English.

According to permanent residence, the majority of foreign students come from Slovakia; other large groups are students from Russia, the United Kingdom, Portugal, Federal Republic of Germany, Norway and Ukraine.

In 2014, the courses were successfully completed by 8 600 in bachelor's, master's and postgraduate doctoral programs (of all successful graduates, 39% completed bachelor's programs, 53% graduated in master's programs, and 8% completed doctoral postgraduate studies).

Charles University has also signed a contract with the French Embassy, French Academy of Sciences, Centre national de la recherche scientique, and the Academy of Sciences of the Czech Republic, to create a platform for French-Czech cooperation in humanities and social sciences, as part of the French Institute for Research in Social Sciences (CEFRES). Upon the request of Prague-based Advance Health Management Institute (AI), an agreement was signed with the University of Minnesota, School of Public Health, USA, covering the research cooperation and study program Master of Healthcare Administration, aimed at management in healthcare business, in cooperation with our American partner and AI.

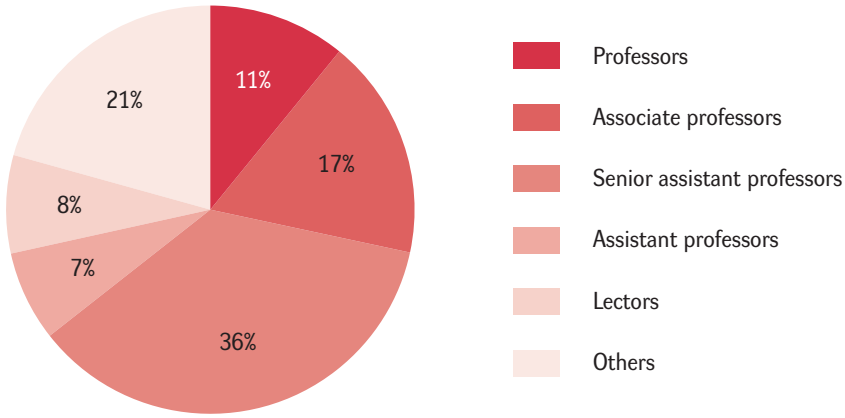
In the long run, Charles University aims to create conditions for fair access to university education.

Specifically, this includes support of disadvantaged groups of applicants and students, aiming at removing barriers in the access to university education. These groups primarily include applicants and students with health disabilities, or students disadvantaged due to their socioeconomic situation. The latter group includes mainly students from low-income families, or students with dependent children. The members of these groups can use various forms of support during the studies.

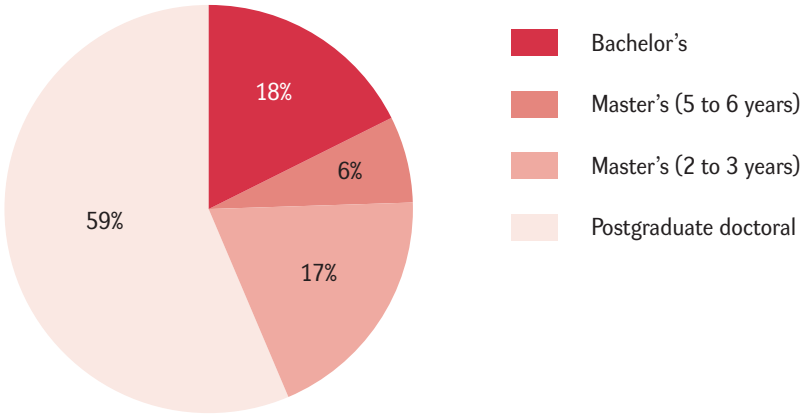
Charles University, as a modern university for the 21st century, offers education, in standard, and also electronic form – e-learning. As part of the central support, users can use the installations of Moodle UK, available for the whole university. Moodle is a software tool designed to support both full tuition and distance learning via online courses, available on the internet. With approximately 53 000 registered users and 5900 established courses, these two installations are among 100 world's biggest installations of this kind.

Another Moodle installation is Moodle MEFANET, used at all faculties of medicine in both the Czech Republic and Slovakia. A Wiki platform has also been developed. The most advanced Wiki application at Charles University is Wikiskripta at the First Faculty of Medicine. More Wiki applications are available at the Faculty of Education, Faculty of Arts, Faculty of Law, and Environment Center. The tools used at Charles University are supplemented by the tools provided by the CESNET Association (Czech Education and Scientific NETwork), such as ownCloud, Filesender, Foodle, data storages, etc. The importance of electronic sources of information steadily increases. At present, Charles University has 212 000 e-books and 101 000 e-magazine titles available.

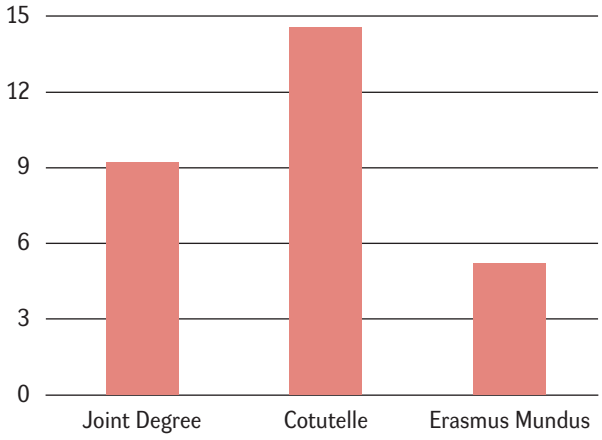
STRUCTURE OF THE ACADEMIC STAFF



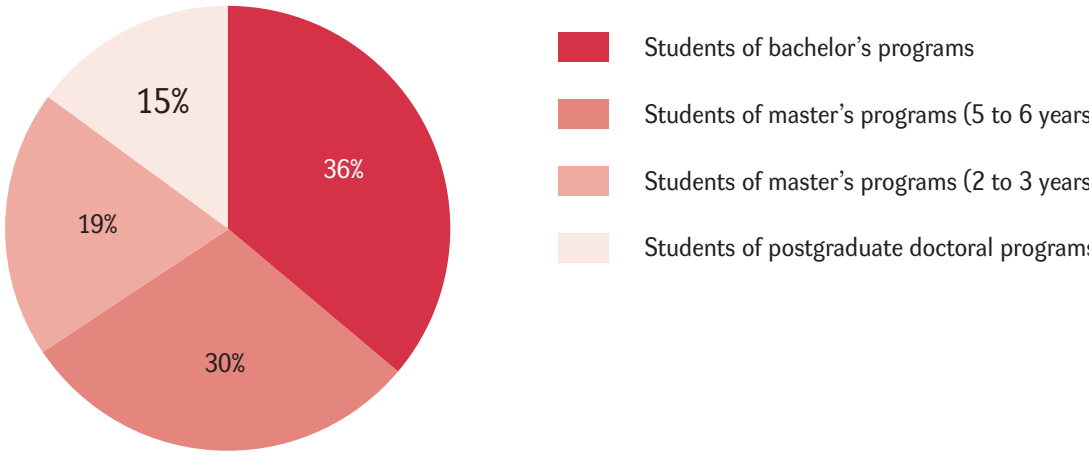
STRUCTURE OF STUDY PROGRAMS AT CHARLES UNIVERSITY



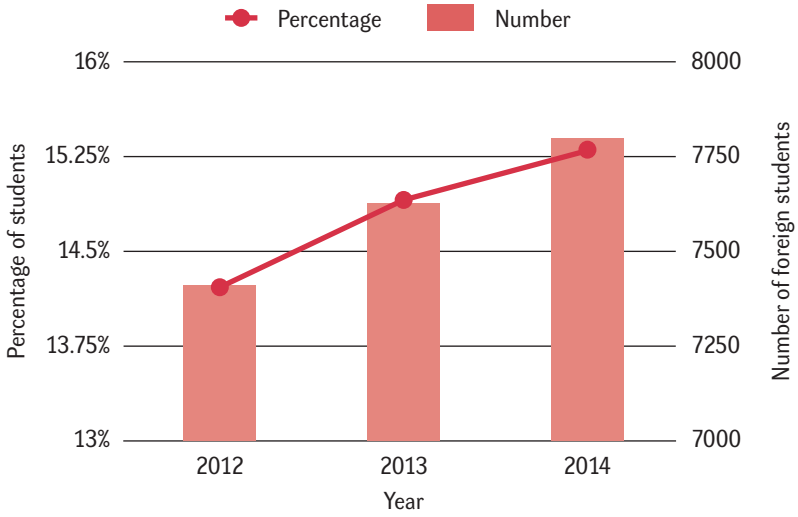
INTERNATIONAL STUDY PROGRAMS AT CHARLES UNIVERSITY



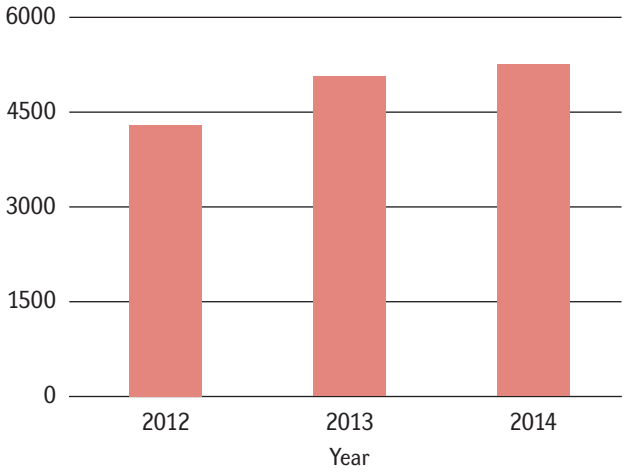
STRUCTURE OF STUDENTS



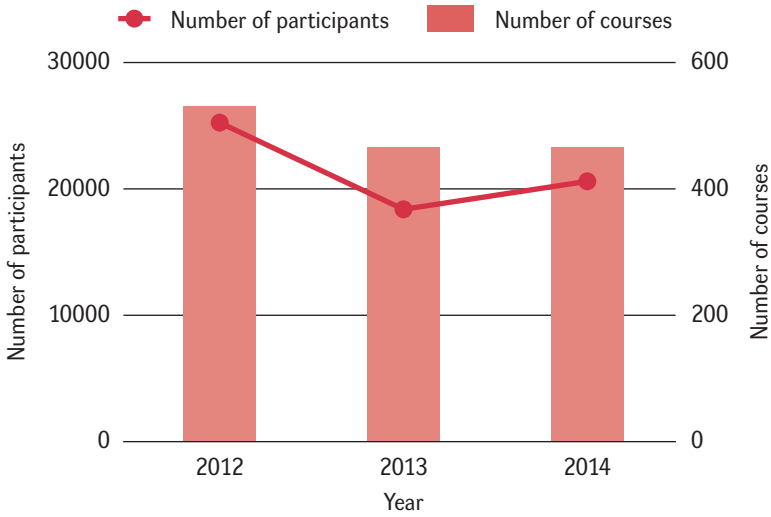
FOREIGN STUDENTS



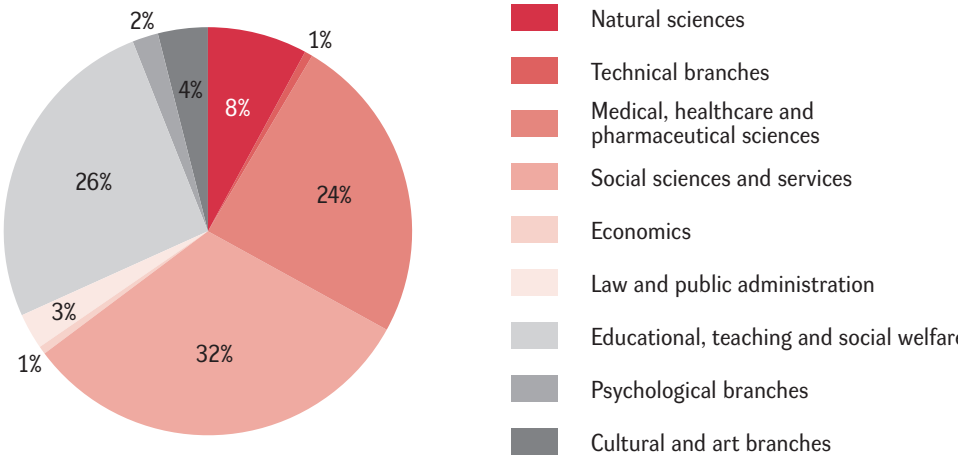
E-LEARNING COURSES



LIFELONG LEARNING PROGRAMMES



STRUCTURE OF LIFELONG LEARNING PROGRAMMES

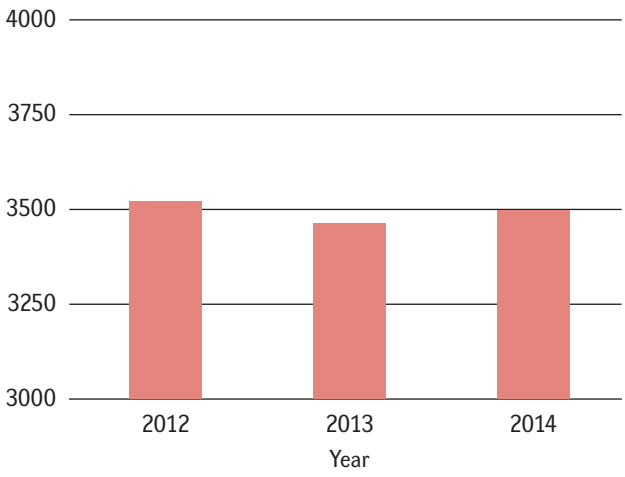


RESEARCH

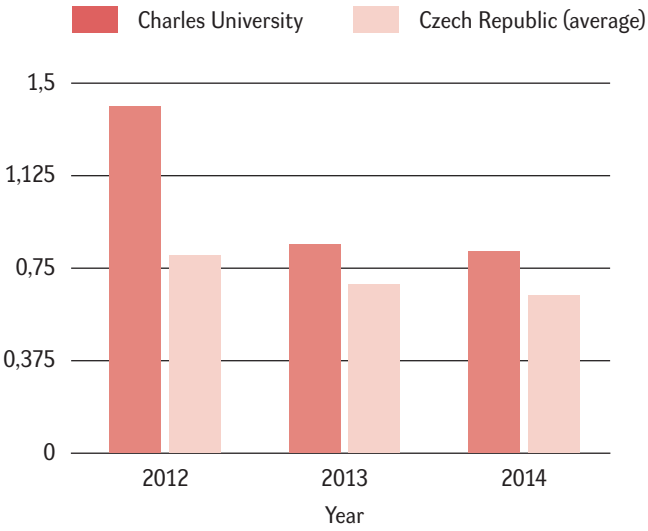
The long-term success of the most important universities in the world is based on the cultivation of intellect and talent of students in an environment where top-level research is encouraged. This concept is also observed by Charles University. Therefore, research is an essential component of the university's primary activities. The research-focused nature of Charles University has strengthened during recent years. According to various external assessments of research outcomes, Charles University is – together with the institutes of the Czech Academy of Sciences – consistently the most effective research institution in the Czech Republic. Based on the criteria used in the assessment, the university caters for 20 to 30% of the research performance of the whole country.

For both domestic and international assessment methodology, international bibliographic and citation databases are important sources of

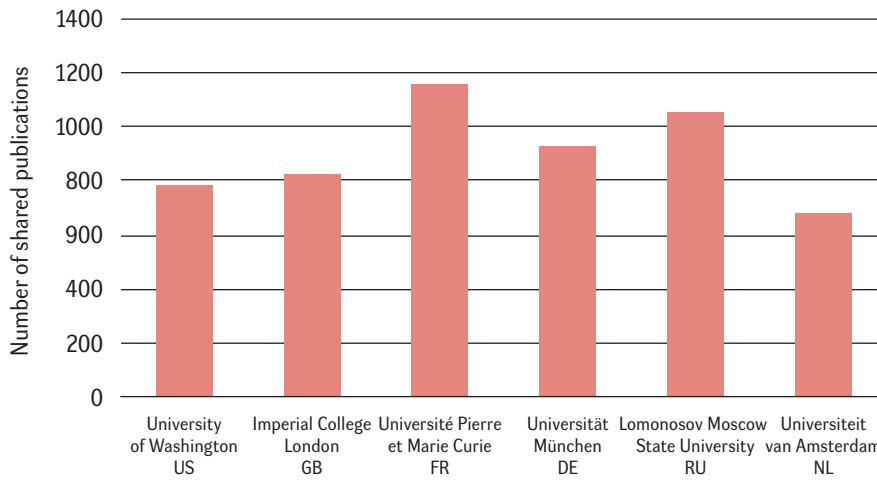
SCIENTIFIC PUBLICATIONS (WEB OF SCIENCE)



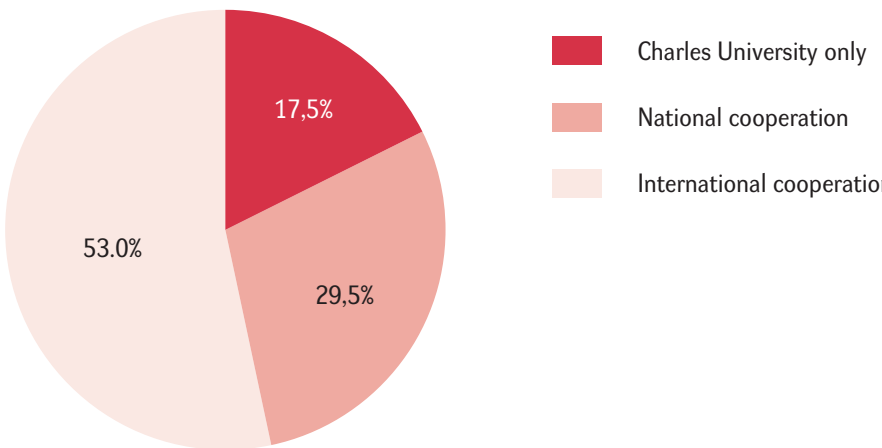
CITATION RATE OF SCIENTIFIC PUBLICATIONS (WEB OF SCIENCE)



SHARED PUBLICATIONS WITH SELECTED LEADING UNIVERSITIES (2004–2014)



PUBLICATIONS IN COOPERATION IN WOS IN 2012–2014



information. For science-based and medicinal courses, the most important are the data in the Web of Science. In 2014, Charles University academics and researchers published 3 500 papers in the journals indexed in this database, achieving the same results as the Academy of Sciences of the Czech Republic, and reaching almost 30% share in the country's results. Also the number of papers created due to the cooperation between Charles University and other domestic or international research institutions increased. The quality of the research is indicated, primarily, by the citation rate in the international journals; the H-index is generally accepted as the key indicator. For Charles University, this index reached the value 76 for outcomes published between 2012 and 2014. The value of important indicators has improved recently.

In 2014, just like in previous years, Charles University ranked among the world's best universities in international comparisons. For example, based on the traditional Leiden Ranking, 5% of Charles University publications from 2009 to 2012 are in the top 10% of the most cited papers in their respective branches.

In the three best-known rankings, i.e. Academic Ranking of World Universities, Times Higher

Education World University Rankings and QS World University Rankings, Charles University defended its position among the top 2% in the world, and it scored high in several disciplines (e.g. mathematics, physics, pharmacy, linguistics, modern languages, geography, etc.).

In the first issue of another ranking, Best Global Universities, assessing the research and creative activities of universities using their reputation, bibliometric indicators, and the quality of postgraduate studies, Charles University finished in joint 179th place, together with Johann Wolfgang Goethe-Universität Frankfurt am Main and Korea Advanced Institute of Science and Technology (KAIST). In Europe, Charles University finished 67th, making it to the Top 100 in mathematics, physics, botany and zoology.

With the increasing international prestige of our university, also is the international cooperation in research is strengthening. Given the multinational nature of scientific knowledge, international cooperation is an essential aspect of research.

The European Centre was established in 2014, with its mission to provide administrative support for researchers in participating in European research and mobility projects. The aim of the center is to increase the number of international grants and strengthen Charles University's position reputation as a "research university". The Centre collaborates with renowned scientific institutions in the Czech Republic and more broadly in Europe, involving it in decision-making on matters of science policy. Finally, the center works hard to create a university-wide strategy to increase the university's success in the competitive environment for European Research Council (ERC) grants. To this end, with the support of the European Centre, the university has managed to obtain more of the international projects and awards granted.

The university staff joined primarily the 7th framework program of the European Union. Now Charles University gained 14 projects as part of the 8th EU framework program "Horizon 2020", starting in 2015. Also stronger is the involvement in programs supporting the international research cooperation (KONTAKT, COST, INGO, EUPRO), Erasmus+, Public Health program, and several Norwegian Fund calls.

The essential objective of Charles University is to create conditions for the development of various research areas, support good-quality teams from the faculties and young gifted researchers, encourage cooperation between courses and faculties, and therefore gain from the diversity of Charles University courses. For more information on research at Charles University, see the later chapter: "Major Research Areas".

RESEARCH CENTRES

The building and development is carried out in line with the long-term plan of the Charles University development. This plan involves further preparatory works aimed at facilities, humanities and social sciences, and development of centers for top notch sites in scientific and medicinal branches. The priority in this area, based on the current stage of development of each project, was the realization of new university campuses in Pilsen, Hradec Králové and Vestec near Prague (Biocev).

During 2014, the last construction works were finished in the 1st stage of the campus near the Faculty Hospital Pilsen (FNP) in Pilsen-Lochotín, and in October 2014, the opening ceremony of the new facilities took place. The new university medicinal centre features the theoretical institute building, designed primarily for the education of students (UniMeC), and the building of the Biomedical Centre – the institute aimed at research and development (BioMediC). The new educational facilities of UniMeC accommodate five

theoretical institutes of the Faculty of Medicine in Pilsen (biophysics, biology, pharmacology and toxicology, physiology and pathologic physiology). BioMediC features two buildings with labs and studies with the total area over 4 000 m^2. The work of the center will support the long-term cooperation of the faculty and the Pilsen Faculty Clinic. The center will focus on biomedical research and development, especially in organ replacement and regeneration.

Mephared I is a shared project of Faculty of Medicine in Hradec Králové and Faculty of Pharmacy in Hradec Králové, aimed at building of the first facility of the new campus. The development of the new campus will help the university improve the quality of education, and enable translation of the basic research into clinical application. The centre was opened in October 2015.

The aim of the project BIOCEV (Biotechnological and biomedical centre of the Academy of Sciences and Charles University in Vestec) is to build a centre of excellence of biotechnology and biomedicine. The project is realized together by Charles University (Faculty of Science, First Faculty of Medicine) and Academy of Sciences of the Czech Republic, represented by six institutes. The key funding source is the European Fund of Regional Development, via the operational program "Research and development for innovations".

In Prague-Albertov, the new Charles University campus will be built. New facilities of Biocentrum and Globcentrum will be built in this beautiful location in the heart of Prague, to be shared by the Faculty of Science, First Faculty of Medicine, and the Faculty of Mathematics and Physics. Biocentrum will explore new biotechnologies and analyze biodiversity, while Globcentrum will investigate the planetary climatic changes, plant species distribution, and natural risks. In 2015, the open international architecture competition will be called, and the campus should open in the beginning of 2022.

The centre for transfer of knowledge and technologies (CPPT UK) is currently going through changes in order to improve the services provided for the faculties, and to facilitate translation of knowledge and technologies to applications. Next, the main mission is to build the new university--based innovation network to interconnect the innovation potential of the faculties, university institutes and other parts of the university structure, together with representatives of industrial and financial sectors, government and NGOs.

INTERNATIONAL COOPERATION

The international cooperation is one of the main Charles University priorities. The international relations are focused on the quality of cooperation as it affects the level of research and education, and also the openness of the university in the international university environment. In this, we focus on using various programs and cooperation forms to support prioritized activities. One of these priorities is the support of the mobility of students and academic staff.

As part of the inter-university cooperation program, Charles University adopted a new cooperation form – strategic partnerships. We started this new form of cooperation with respectable universities (Humboldt-Universität zu Berlin, Universität zu Köln, Goethe-Universität Frankfurt am Main a Universität Hamburg), in accordance with the strategic objectives and visions of all participating institutions. The partnerships focus on the multilateral and long-term cooperation in order to create common research projects, study programs involving the participation of students and young researchers, and further development of the selected key branches.

The number of joint degree programs, realized in cooperation with partner universities, also increased, and more are now prepared. In the cotutelle model, Charles University PhD students recently visited Australia. Also the number of incoming PhD students is increasing. There's also new legal status of contracts on the dual leadership of dissertations, presented on the Charles University web portal.

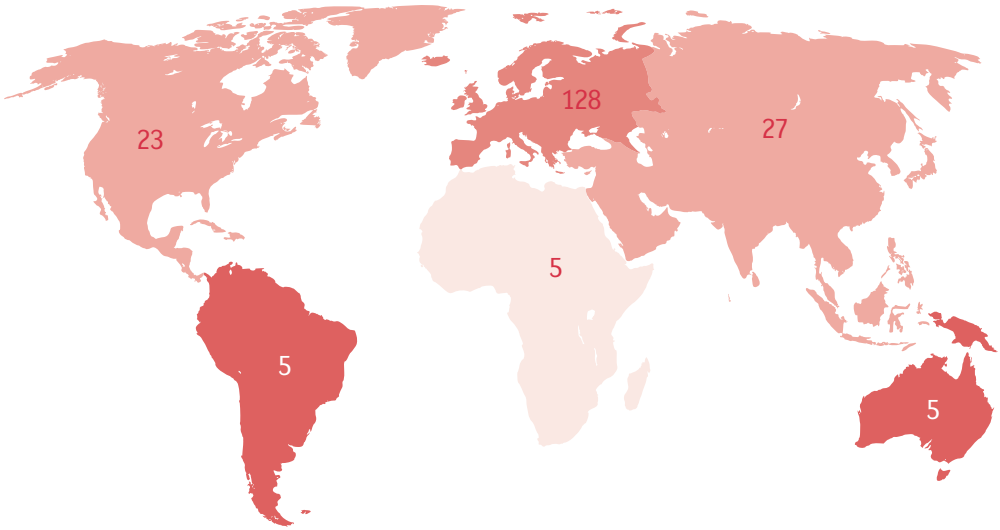
In 2012–2014, Charles University signed many inter-university agreements. These included framework agreements for cotutelle with Martin-Luther-Universität Halle-Wittenberg and Universität Potsdam, Universiteit Antwerpen, Université Pierre, Université de Strasbourg, The University of Tuscia, Universiteit Hasselt, Universiteit Gent. With the University of Toronto, Canada, we signed the Memorandum of Understanding, and negotiated the text of the agreement on the student exchange program. The following inter-university agreements were extended: National Taiwan University and Chiang-Ching-Kuo Foundation, China (Taiwan);

University of Washington, USA; University of Padova, Italy; University of Melbourne, Australia; Universidad de Lima, Peru; Kansas State University, USA; Universidad Autónoma de Nuevo León, Mexico; University of Massachusetts Lowell, USA; University of Macedonia, Greece, Josai University, Japan, and many others.

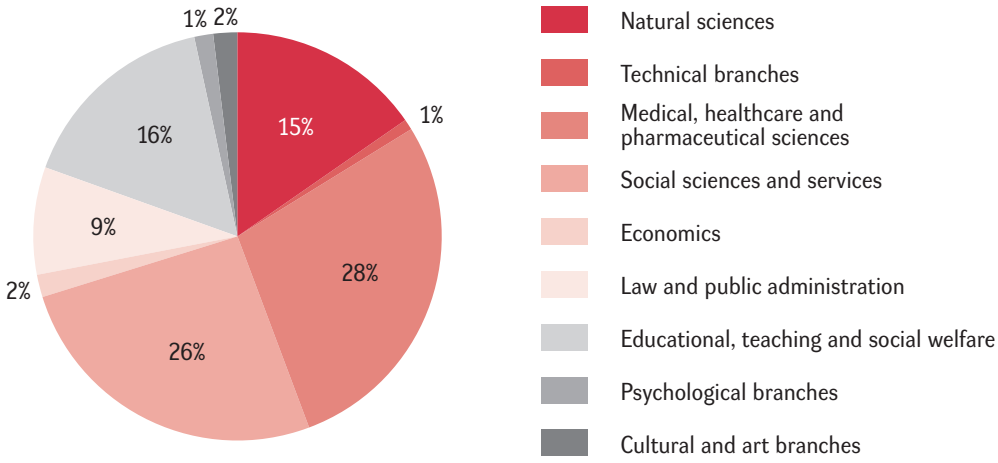
Charles University offered twenty Ukrainian students to complete their studies here, via Václav Havel Scholarship. It was established for students who were illegitimately forbidden to study in their home countries, and were systematically oppressed and persecuted by the government and authorities. Over 200 people applied for the scholarship, and 17 applications were accepted. Of those applicants, 15 started studying at Charles University.

The program LLP/Erasmus was finished in 2014, to launch a new stage Erasmus+ in the academic year 2014/2015, planned for 2014–20. Charles University presented the final report on the Erasmus program for the academic year 2013/2014 to the National Agency for European Educational Programs. In this academic year, Charles University realized the following mobility program: 1106 students left for study visits, 70 students left for internship, 168 teachers left for teaching visits, and 19 employees left for training. We are very glad that Charles University, based on the survey of the European Commission, finished 7th in the popularity ranking of European universities among foreign students using the Erasmus program.

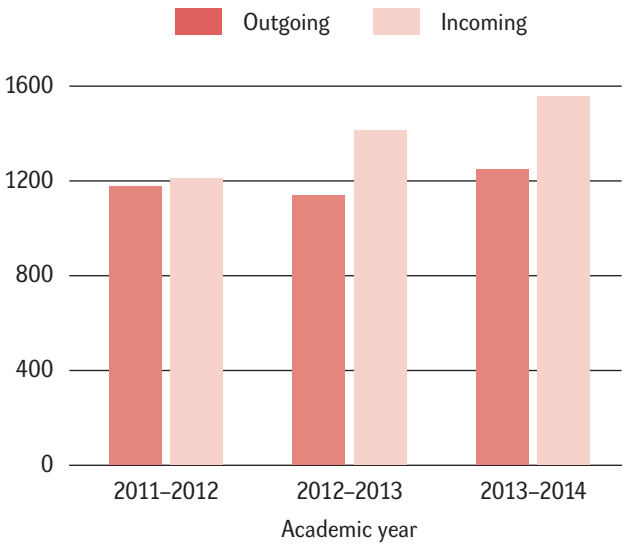
CONTRACTS ON COOPERATION WITH UNIVERSITIES



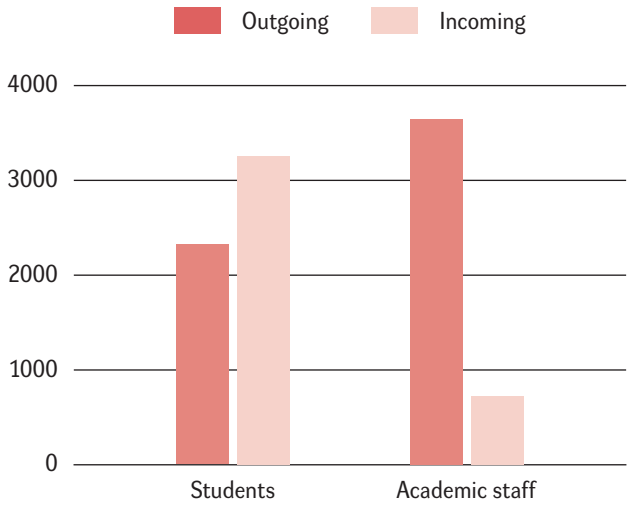
STRUCTURE OF STUDENTS BASED ON THE AREAS OF EDUCATION



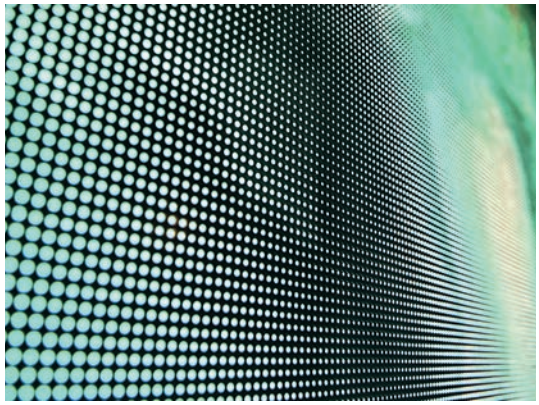
OUTGOING AND INCOMING STUDENTS IN THE ERASMUS PROGRAM



TOTAL MOBILITY OF STUDENTS AND ACADEMIC STAFF



STRATEGIC AND OTHER PARTNERSHIPS OF CHARLES UNIVERSITY



STRATEGIC PARTNERSHIPS OF CHARLES UNIVERSITY

Australia: University of Melbourne
Austria: Universität Wien
Belgium: Katholieke Universiteit Leuven
Brazil: Universidade de São Paulo
Canada: McGill University
Federal Republic of Germany: Humboldt-Universität Berlin; Universität zu Köln; Universität Heidelberg
Israel: Hebrew University of Jerusalem
Netherlands: Leiden University
People's Republic of China: Peking University, Beijing
Poland: Uniwersytet Jagielloński, Krakow
Sweden: Karolinska Institutet
United Kingdom: University of Oxford

OTHER PARTNERSHIPS WITH FACULTIES OF CHARLES UNIVERSITY

Austria: Medizinische Universität Wien; Medizinische Universität Graz; Universität Salzburg; Universität Wien
Belgium: Katholieke Universiteit Leuven
Canada: Université de Montréal; University of Toronto
Federal Republic of Germany: Technische Universität Berlin; Charité – Universitätsmedizin Berlin; Technische Universität Dresden; Friedrich-Schiller-Universität Jena; Goethe--UniversitätFrankfurt am Main; Universität Heidelberg; Heinrich-Heine-Universität Düsseldorf ; Humboldt-Universität zu Berlin; Johannes Gutenberg-Universität Mainz; Universität Würzburg; Ludwig-Maximilians--Universität; Ruhr-Universität Bochum; Technische Universität München; University of Cologne, Köln am Rhein; Friedrich-Alexander--Universität Erlangen-Nürnberg; Albert-Ludwigs--Universität Freiburg; Universität Hamburg; Universität Leipzig; Christian-Albrechts--Universität zu Kiel; Universität Regensburg
France: EHESS Paris; Hopital Cochin, Paris; Institut Laue-Langevin; SciencesPo, Paris
Hungary: Eötvös Loránd Tudományegyetem, Budapest; Semmelweis Egyetem, Budapest

Ireland: University College Dublin
Israel: The Hebrew University of Jerusalem; Tel Aviv University
Italy: ELETTRA Synchrotron Light Laboratory; Sapienza – Universitá di Roma; Università degli Studi di Milano
Japan: Japan Advanced Institute of Science and Technology; National Institute for Materials Science
Netherlands: Erasmus MC: University Medical Center Rotterdam
Poland: Uniwersytet Jagielloński w Krakowie; Uniwesytet Pedagogiczny; Uniwesytet Warszawski
Sweden: Karolinska Universitetssjukhuset, Stockholm; Göteborgs Universitet
Switzerland: CERN; Eidgenossische Technische Hochschule Zürich; Universität Zürich
United Kingdom: Birmingham City University; London School of Hygiene & Tropical Medicine; Newcastle University; University College London; University of Bristol; University of Cambridge; University of Hull; University of Nottingham; University of Oxford
United States of America: Dartmouth College; Temple University

THIRD ROLE OF THE UNIVERSITY

The “third role” of the university, is, today, more important than at any point in the past. It is in the interests of every university to elucidate and explain what is happening on its grounds and its purpose for the given country and its inhabitants. Every university should therefore take a professional point of view with regard to a wide variety of processes occurring within society, be they economic development, social and scientific issues or social aspects of the development of society, not to mention the presentation of the latest results of work performed by members of the academic community from the fields of science, mathematics, biology, medicine and chemistry; the self-presentation of every university should also include the sporting achievements of its students and graduates. Today’s universities have to play the key role as major public corporations that contribute to important societal processes and as places for a free plurality of opinions and discussions resulting in the enrichment of society as a whole.

One of the key activities to successfully fulfill the "third role" is the public relations area. For a long time, Charles University has been involved in the standard production and PR of events supporting the presentation of the university (such as Bolzano Prize, Day of the Open Doors, the Gaudeamus Fair in Prague and Brno, Information Day, Rector's Cup Run, Science Day at the universities in Prague, the Hockey Battle, etc.). Services are also provided for the faculties and other Charles University departments in preparing press conferences, issuing press releases, and organizing PR-based and presentation events.

The public perceives Charles University as an important partner that provides, via numerous experts, statements, comments and opinions in the discussions on current topics and issues. That's why the Advisory Committee for the Charles University Rector Focused on the Current Issues was founded. The members are renowned people with long cooperation with Charles University.

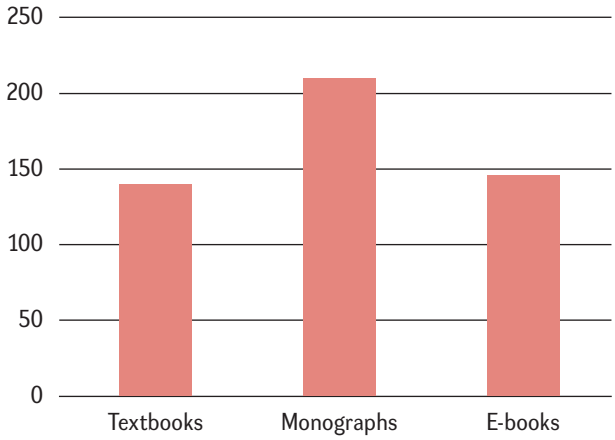
In 2014, Charles University launched the new cycle of lectures for academic area and general public, The Round Table Meetings. Leading experts of Charles University discussed important anniversaries of 2014.

Since autumn 2003, the university internet magazine iForum addresses current topics and events at Charles University, responds to various issues, and attempts to cover all areas related to the university activities – education and research, general college/university issues, legislation, etc. Its success is proven by the steadily growing number of readers. There's also the English section: http://iforumeng.cuni.cz/. In 2014, the first issue of the Forum magazine was published with a new design and editorial concept. The magazine focuses on academia and the public alike.

Charles University increasingly uses social networks to support the building of an active community of followers. The profiles at Facebook, Twitter, YouTube and LinkedIn were harmonized visually, and the content strategy was prepared, with regards not only to the nature of the respective network but also to the various target groups that Charles University wants to address this way.

Karolinum – Karolinum Press is a publishing house of Charles University, supporting research and education in all of the disciplines taught at 17 faculties. The books published reflect this wide scope spanning from humanities to natural sciences and medicine. Karolinum publishes scholarly monographs, journals and textbooks, ranging from specialized exercise books to general textbooks used around the country. As a publisher of international scope, it strives to make individual titles permanently available in both Czech and

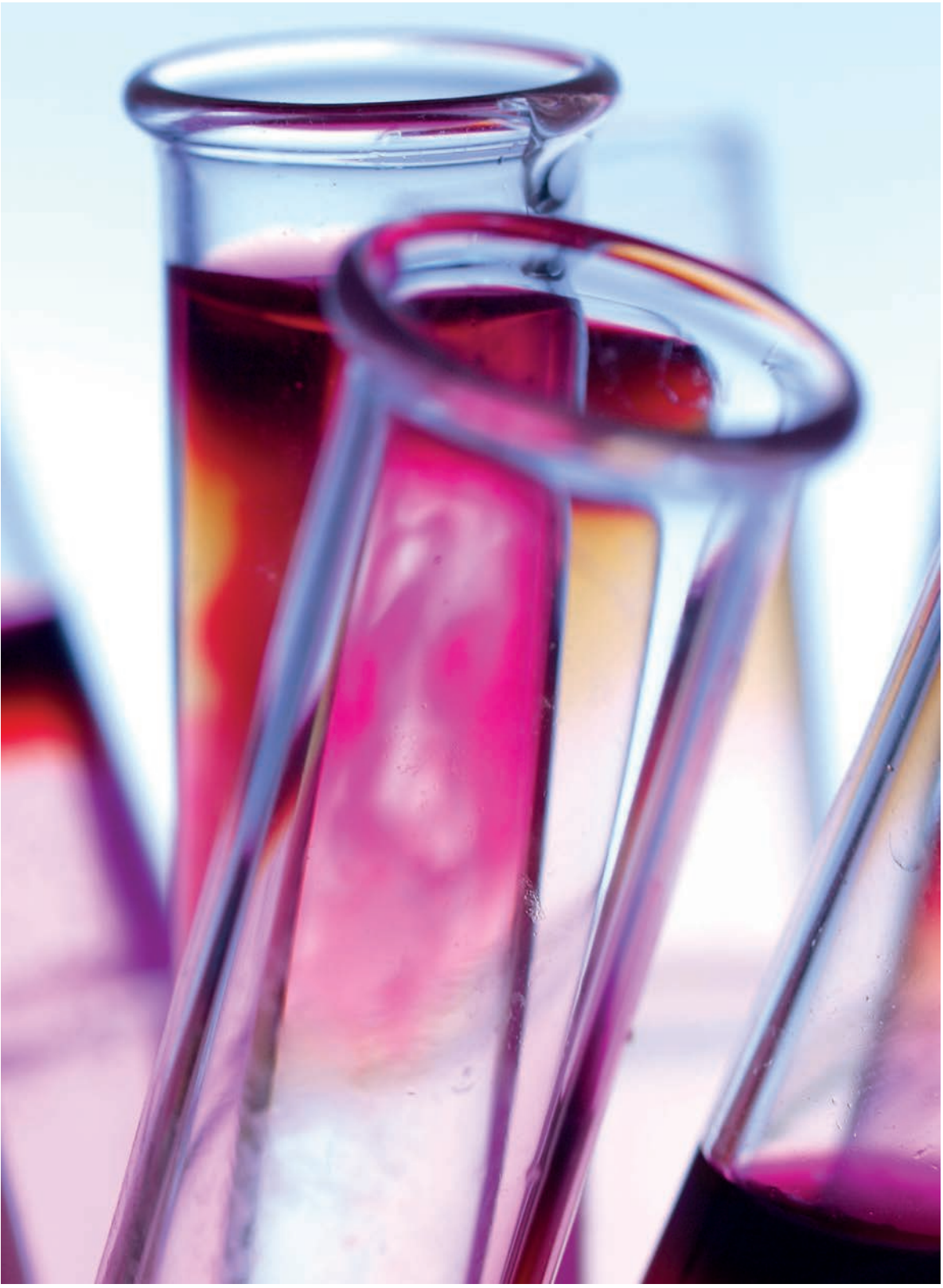
PRODUCTION OF UNIVERSITY PUBLISHING HOUSES



foreign markets, in the formats that readers demand.

In recent years, the following important and acclaimed publications can be mentioned: Macek, Petr – Biegel, Richard – Bachtík, Jakub (Eds.), Barokní architektura v Čechách (Baroque Architecture in the Czech Lands); Horyna, Mojmír, J. B. Santini – Aichel, Wittlich, Petr, Sochařství české secese (Sculpture of the Czech Art Nouveau); Buchvaldek, Miroslav – Lippert, Andreas and Košnar, Lubomír (Eds.) – Archeologický atlas pravěké Evropy (Archaeological Atlas of Prehistoric Europe); Fučíková, Eliška – Praha rudolfínská (Prague in the Reign of Rudolph II); Chomsky, Noam – Disident Západu (Selected Texts); Le Goff, Jacques – O hranicích dějinných období (Faut-il vraiment découper l'histoire en tranches?) and many monographs in medicine, science and humanities.

MAJOR RESEARCH AREAS



CATHOLIC THEOLOGICAL FACULTY

Theology, Philosophy, and Reflection of Art as Ways of Interpreting the Reality

Principal Investigators:
Dr. Mireia Ryšková
Prof. Vojtěch Novotný

The Catholic Theological Faculty focuses on the important task of interpreting the reality while using instruments of various disciplines in order to receive a unified image. Theological research aims at interpreting history and the present in respect to transcendence, i.e. the mystery of being, which is not fully accessible through mere rationality; it needs to be complemented by the hermeneutics of faith. Philosophical questioning reveals what is not self-evident in being, and is related to the essential appeal of man on the level of his freedom and his responsibility. Reflection of art offers the scope of aesthetic grasp of reality and its mediation through a new creative act. Unifying these three disciplines enables more complex interpreting of the reality as related to the truth, the beauty, and the good.

Charles IV – Spiritual World, Foundations, Buildings and Their Art Fixtures

Principal Investigators:
Prof. Jiří Kuthan
Prof. Jan Royt

The research team of professors Kuthan and Royt at the Catholic Theological Faculty of Charles University is engaged with one of the greatest personalities of the European Middle Ages – Charles IV (1316–1378).

The mapping and complex working of the extensive activities of the sovereign who was outstanding in his political abilities, who contributed to the peace stability of a large part of the European continent, who founded Prague University and as Emperor he supported and confirmed the origin of other universities on the territory of Holy Roman Empire, is at the heart of the research activities of the centre. He was among those few medieval sovereigns who were men of letters. From his great visions some founding deeds originated and became permanent in the appearance of Prague and the whole of our country. Equally important is also the context of his political and founding works in the whole of Europe. Attention is paid to his sources of inspiration and spirituality as well as the response of his operations that followed.

PROTESTANT THEOLOGICAL FACULTY

Biblical studies

Principal Investigators:
Prof. Martin Prudký
Prof. Petr Pokorný

Biblical studies have for a long time been among the disciplines at the Protestant Theological Faculty with the highest profile, and a correspondingly large number of staff. Since 1999 the Departments of Old Testament Studies and New Testament Studies have been strengthened by institutional cooperation with other academic institutions, together with which they established the Centre for Biblical Studies of the Academy of Sciences of the Czech Republic and Charles University in Prague.

The research is focused in particular on the study of biblical texts from the literary point of view and that of literary history. For a long time the attention was devoted to the literary heritage of antiquity that is part of the context of biblical studies (such as Aramaic epigraphy, New Testament Apocrypha, and Gnostic literature), and to the history of the relevant regions, their culture, and their religions (including institutional cooperation with the Institute of Archaeology of Tel Aviv University on the Lautenschläger Azeka Expedition). A specific feature of the research is an interest in methodological and hermeneutic questions, and in the later impact and reception of the biblical texts.

For the period 2012–2018 the Centre for Biblical Studies has received significant grant support from the Czech Science Foundation for the major interdisciplinary project "The History and Interpretation of the Bible".

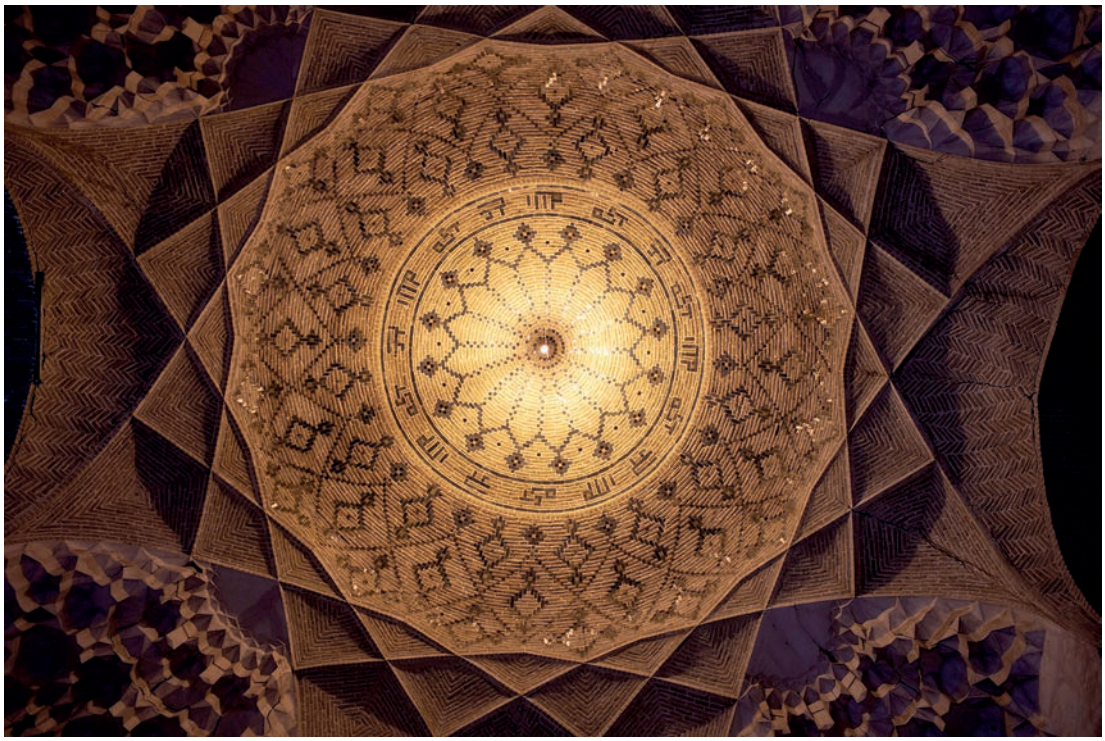
Ecumenical studies

Principal Investigator:
Prof. Ivana Noble

For the past five years the research conducted by Professor Noble and her team has concentrated on three main areas:

(i) Orthodox theology in the West – its relationship to Western thought and the Western Christian traditions (a study of the ways in which Orthodoxy came to the West, of the main theological themes, the personalities, confrontations and dialogues with Western theology and philosophy);
(ii) the relationship between theology and culture in post-communist countries (the concept of the world as a threatened place, the concepts of memory and reconciliation; the understanding of what human life most depends on and of what in the final instance most fulfils that life);
(iii) ecumenical hermeneutics emerging from a synchronic work with the basic themes of

fundamental theology in various Christian traditions (the revelation of God and human experience of God; the interpretation of Scripture in the tradition; the relationship between theology and spiritual, social and political life). These themes have come together under the research project "Symbolic Mediation of Wholeness in Western Orthodoxy". At the moment Professor Noble and her team are preparing a continuation project centred on the theme of theological anthropology in the Orthodox and Western traditions that aims to investigate especially the concepts of personhood, human relationships and hospitality towards the other.



HUSSITE THEOLOGICAL FACULTY

Confessionalism and Nationalism

Principal Investigator:
Prof. Jan B. Lášek

The Hussite Theological Faculty of Charles University focuses on the following research topics: Catholic modernism at the end of the nineteenth and at the beginning of the twentieth century, confessionalism and nationalism, and secularization. Two major research schemes were concerned with these topics. In the broader theme of "Theology as a method of interpreting history and culture", the research group led by Professor Jan B. Lášek explores the relationship between confessionalism and nationalism in the Czech Lands. The results so far indicate that when relationships between the adherents of the respective confessions are harmonious, no problems with extreme nationalism emerge. The results are published in the edition "Pontes Pragenses", up to 2012 also in the edition "Deus et Gentes", and also in the quarterly Theological Review HTF UK.

FACULTY OF LAW

Legal systems of the Far East and European Law

Principal Investigator:
Prof. Michal Tomášek

Research is focused on interpretation of law in Far Eastern countries like China, Japan, Korea and Vietnam. Beginning in the 19th century, these countries have been adopting foreign legal systems. Nevertheless numerous legal concepts have been interpreted in a different way. Legal transplants in the Far Eastern context thus shifted from their original meaning. Thus the research concentrates on the differences between "law in books" and "law in action". Furthermore in Far Eastern countries, there is a strengthening tendency to promote interpretation under the so called "New Confucianism". New Confucianism is considered particularly in China to be a basis of the economic success of the country. Traditional methods of interpretation of law under Confucianism or Buddhism can be currently observed also in Japan, Korea or Vietnam. The principal research method is comparative interpretation with regard to the European continental legal system, common law system as well as to EU law, which has a considerable influence particularly in South Korea. The research team has already integrated colleagues from foreign Universities in Switzerland, Japan, USA and South Korea.

The effectiveness of consumer protection in private law

Principal Investigators:
Prof. Jan Dvořák
Prof. Monika Pauknerová

Consumer protection from the perspective of substantive law, conflict of laws (private international law) and procedural law is a topic that currently belongs among priority issues of the Directorate-General for Justice, Consumers and Equality in the EU. The research focuses on both general trends (reinforcement of legal certainty – substantive law, governing law, jurisdiction) and specific features of consumer protection in Czech law in terms of the implementation of directives (substantive law, dispute resolution – litigation, arbitration, etc.).

The project aspires to analyse the current concept of consumers and their position in law of obligations. From the point of view of civil law a consumer is undoubtedly just one of possible weaker parties to an obligation; however, it is necessary that the term be redefined and its contours newly outlined with regard to both the recent recodification of private law and further development of the Union legislation. The proposal for a Common European Sales Law (CESL) has been withdrawn, however, at the same time the creation of a new concept of a Digital Contract is being contemplated, which raises questions regarding further impact

on domestic regulation of consumer affairs, its stratification and overlapping. It is necessary to open a debate regarding the extent of desirable consumer protection anew. Ambivalence of the term 'consumer' is also reflected in relevant professional literature (in this regard differentiation between an active consumer and a passive consumer is made). A negative – and undesirable – consequence of exaggerated consumer protection is that it might happen that protection is given to consumer's recklessness or irresponsibility. This observation is based on knowledge that when creating regulations concerning consumer protection, and more so when applying and interpreting them, it is necessary to have in view not only the protective purpose of relevant legal regulations, but at the same time seek that rights and obligations in a particular case are just (fair), i.e. reasonable, balanced and in particular proportionate, not one-sidedly favouring, pro-consumer approach. What is problematic is the assessment in cases when acts of a particular entity have mixed characteristics, i.e. they have the features of both consumer and entrepreneurial acts. Another disputable issue is whether a professional entering into a contract with another professional may be, under certain circumstances, protected

as a consumer. The aim of this project is to analyse the indicated issues, as well as other issues connected therewith.

Compensation in international law

Principal Investigator:
Prof. Pavel Šturma

Reparation (indemnification) belongs to the topics of international law that are both classical and very modern. The classical aspect relates to restitution and compensation as two major forms of the reparation obligation which forms the content of the responsibility of States for internationally wrongful acts. The modern dimension of the topic relates to the right of individuals and various non-state actors to reparations. The internationalist doctrine has only started to analyse this aspect. However, the dynamic nature of international law needs to be taken into consideration. The recent developments in this law seem to open a direct access of individuals to reparation. While individual claims increase in number, inter-state disputes based on the diplomatic protection are less frequent. The individualization and depolitization of international disputes is generally considered as a positive trend, taking place mostly in the international law of human rights and international investment law. Even the recent development in international criminal law has contributed to this trend, in particular since the establishment of the International Criminal Court. It aims not only at punishing perpetrators of crimes but also at indemnifying victims of such crimes, in the forms of restitution, compensation and rehabilitation. The developments in the area of international humanitarian law are less definite, as most States show reluctance to grant reparation to individuals harmed by the actions of their armed forces within armed conflicts. The research aims at verifying whether the practice of international courts, criminal tribunals and other institutions acting in the field just results in the creation of special regimes, thus contributing to the fragmentation of international law, or whether it could actually bring about deeper structural changes of general international law.

Analysis of the constitutional system of the Czech Republic and proposals for changes

Principal Investigator:
Prof. Aleš Gerloch

Constitutional Law and Theory of State is one of the key branches of jurisprudence. The importance of the branch reflects not only in the scientific work but also in the benefit to the society addressing current issues of constitutional and political system of the Czech Republic in the European and global context.

The branch of Constitutional Law and Theory of State develops international cooperation within the framework of mobility programmes of the Charles University. It has a long-lasting extensive cooperation with professional practice (one department member is a Justice of the Constitutional Court, two are members of the Government Legislative Council, one is a deputy minister and one serves as a director of the Parliamentary Institute).

Currently several bills (both government and private member's bills) are submitted to change the Constitution of the Czech Republic. These bills are not internally interlinked and coordinated.

Simultaneously in the recent years (since 2013 in relation to the 20th anniversary of the adoption of the Constitution) a theoretical analysis of the operation of the constitutional system of the Czech Republic is being carried out. This analysis is

based not only on the valid Constitution but also on the judgments of the Constitutional Court, the Supreme Administrative Court and the Supreme Court, the constitutional practice in general as well as the doctrinal opinions. Fundamental discussions of individual subsystems of the constitutional system of the Czech Republic and their mutual relations including comparative approaches form a central part of the analysis.

The principal output of the research is a collective monograph on this topic including a reasoned overview of proposed coherent changes to the constitutional system of both normative and organisational nature.

MEDICAL FACULTIES

First Faculty of Medicine
Second Faculty of Medicine
Third Faculty of Medicine
Faculty of Medicine in Plzeň
Faculty of Medicine in Hradec Králové

Cardiovascular diseases

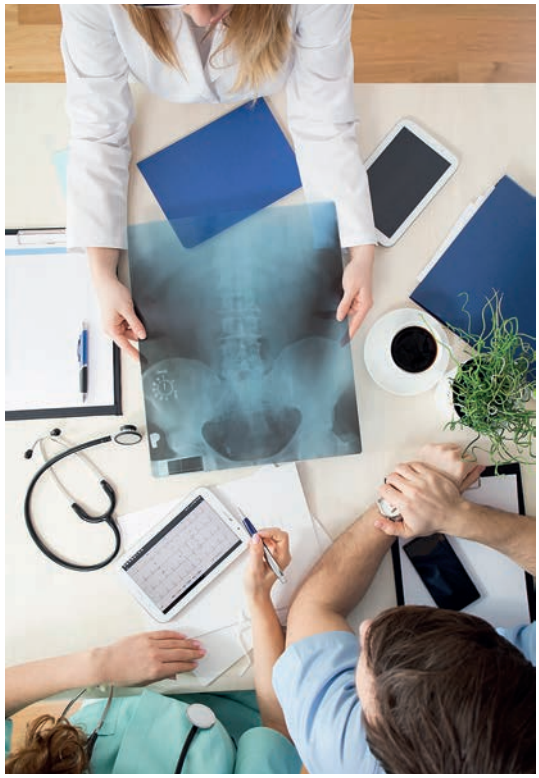
Principal Investigators:
Prof. Petr Widimský
Prof. Aleš Linhart
Prof. Josef Veselka
Prof. Jan Filipovský
Prof. Jan Harrer

The research of cardiovascular diseases at the faculties of Charles University has a long tradition. In 1930, Otto Klein from the Faculty of Medicine in Prague published his unique cardiac output measurement results in 11 patients. It was the world's first diagnostic cardiac catheterisation in human medicine. The tradition continues today – the invasive cardiology area, including hemodynamic and therapeutic catheter interventions is still the most successful area of cardiovascular research at CU. The highest distinction of the European Society of Cardiology in 2014 – the Gold Medal was awarded to Petr Widimský for his research results in the field of transcatheter treatment of myocardial infarction. Other areas of research of cardiovascular diseases at all Five Faculties of Medicine of the CU include: treatment and imaging techniques in coronary heart disease, cardiomyopathy and myocarditis, pulmonary hypertension, peripheral vascular disease, heart failure, arterial hypertension, preventive cardiology, invasive diagnostics and therapy, physiology and pathophysiology of pulmonary circulation, acute coronary syndromes and thrombosis, reperfusion therapy of acute strokes, new technologies in interventional cardiology, surgical and interventional treatment of arrhythmias and new biological markers and prognostic factors and pharmacological and non-pharmacological treatment.

The research thus effectively covers the entire spectrum of cardiovascular diseases, and all CU Faculties of Medicine are involved, which cooperate on many projects (e.g. the internationally unique series of clinical trials "PRAGUE").

Experimental Surgery

Principal Investigators:
Prof. Martin Krbec
Prof. Robert Gürlich
Dr. Andrej Sukop
Dr. Igor Pafčuga
Prof. Ivan Landor
Prof. Vladislav Třeška



Experimental surgery uses animal models for research in the field of regenerative medicine, organ transplantation, traumatology of the locomotor system and soft tissues and organs, study of septic conditions, cardiovascular diseases, etc. It is a combination of basic research with clinical diagnostic and treatment goals. The role of experimental surgery in preclinical testing is absolutely irreplaceable.

Metabolism

Principal Investigators:
Prof. Jan Škrha
Prof. Michal Anděl
Dr. Dana Müllerová

Study of metabolic and endocrine diseases involves the genetic, biochemical, molecular, and cellular mechanisms in their development which may be used both in animal models and in human medicine. Inborn errors of metabolism and their early diagnosis and treatment are one of the key pillars in the clinical research. The intensive study is concentrated on the early stages of obesity, nutrition disorders, lipid metabolism and diabetes as well as on the research of adipose tissue and on its regulatory role. A development of widely occuring metabolic diseases supports the studies of the pathogenesis of complications with orientation to the vessel wall impairment and the markers of these changes. The interventions of the metabolic diseases involving the non-pharmacological (nutritional, regimen or surgical interventions) and pharmacological treatments are evaluated with the help of molecular biology and imunology and with the use of markers characterized the oxidative stress and subclinical inflammation. The discoveries have been used as the effective sources for the prevention. The endocrine disorders involve the diagnoses and treatment of the inflammatory and

tumor processes of all endocrine organs including the research of their metabolic effects and their influence on gravidity.

Neurosciences

Principal Investigators:
Prof. Evžen Růžička
Prof. Jakub Hort
Prof. Cyril Höschl
Dr. Karel Ježek

Neurodegeneration is among the main priorities of European biomedical research due to a significant increase in the incidence of neurodegenerative diseases linked to aging populations in developed countries. Research teams of neurological and psychiatric clinics in collaboration with other CU institutes are involved in this research by studying the mechanism of neurodegeneration in Parkinson's disease and other extrapyramidal disorders, where the work focuses mainly on the genetic background, pathophysiological mechanisms and early biomarkers of neurodegeneration, including sleep and wakefulness disorders. The research of Alzheimer's disease and other dementias includes longitudinal studies in the Czech population focused on risk factors, biomarkers and the possibility of an intervention in early stages of neurodegenerative diseases. Unknown mechanisms of activation of the

memory trace and its propagation across chained neural networks is also studied using neurophysiological methods. This makes it possible to understand the pathophysiology of memory disorders, in particular the development of Alzheimer's disease studied in transgenic animal models. Neuroscience research teams of CU are also engaged in the study of diagnostic markers and the relationship between clinical, imaging, genetic and immunological parameters in multiple sclerosis and other demyelinating and autoimmune diseases. Programmes focused on spasticity mechanisms and actions to influence them in multiple sclerosis and chronic spinal cord injury are also related to the above. Genetic bases and mechanisms of development of impairment in congenital development disorders with a particular focus on childhood seizure disorders are another important item. The research focuses on neurobiological mechanisms and possibilities of their prevention in psychotic disorders, mood disorders and other neuropsychiatric disorders, including eating disorders. Last but not least, many studies of neuropsychopharmacology of pain and drug addiction are in progress.

Oncology

Principal Investigators:
Prof. Aleksi Šedo
Prof. Jan Starý
Prof. Václav Mandys
Prof. Jiří Petera
Prof. Jindřich Fínek

Experimental oncology
covers mechanisms of regulations of basic cell biological programs connected with oncogenesis (apoptosis, proliferation, differentiation, adhesion, migration, invasion and epithelial-mesenchymal transition, immunosurveilance).

Oncohaematology
molecular regulatory mechanisms of blood cell differentiation and their pathologies. Basic, applied and translational research in the field. Namely childhood leukemias, morbus Hodgkin and haematopoetic diseases.

Solid tumors
Namely neurooncology, oncogynaecology, oncourology, pancreatic and skin cancers. Individualization of radical surgical treatment, ultrasound implementation into the gynecological oncology, hereditary syndroms and epigenetic alterations in prediction and early detection of cancer. Optimization of diagnostic and therapeutic processes, establishment of complex biobank. Studies of *in vivo* homing of transplanted cells, tumor immunology, minimal residual diseases in leukemia, monitoring of the response to treatment in multiple myeloma, extracorporeal photopheresis. Characteristics of the mechanisms of the effectiveness of anticancer agents, detection of circulating cancer cells, advanced techniques of radiotherapy.

Organ replacement, support and regeneration

Principal Investigators:
Prof. Martin Matějovič
Prof. Vladislav Třeška

Research activities are focused on several areas: replacement and support of the function of vital organs in critical conditions, kidney transplantation, uremic toxicity and biocompatibility of dialysis therapy. Kidney transplantation replaces all renal functions and is currently the best method of treatment of chronic renal failure. The main problem of transplantation is the development of chronic graft dysfunction

and subsequent graft failure and therefore we focus, in randomised clinical and molecular biology studies, on the influence of viral infection on graft function in particular and we propose new preventive and pre-emptive procedures based on our results. The dominant topic of research in the area of compensation for organ function is the biocompatibility of extracorporeal circulation and uremic toxicity. The long-term goal is to understand the molecular mechanisms responsible for bio-incompatibility of extracorporeal methods and to identify new toxic substances of peptide and protein nature in acute and chronic renal failure using advanced proteomic methods. Unexplained pathophysiology of sepsis and the lacking causal treatment of sepsis are the starting point of systematic translation (which uses clinically relevant large mammalian biomodels) and clinical research focusing on organ, cellular and molecular mechanisms of sepsis, including the development and evaluation of new therapeutic strategies.

FACULTY OF PHARMACY

Study of Toxic and Protective Effects of Drugs on Cardiovascular System

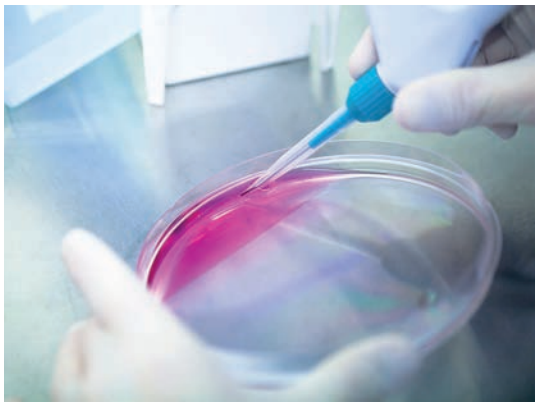
Principal Investigator:
Prof. Tomáš Šimůnek

Cardiovascular toxicity of drugs is among the important complications of today's pharmacotherapy. Numerous drugs have off-target potential to damage the heart and vessels; however, the most important problem has been associated with anticancer chemotherapy.

The main objectives of the research are:

(i) research of molecular mechanisms of cardiovascular toxicity of traditional as well as novel anticancer drugs.
(ii) study of possibilities to protect the heart using established and newly synthesized drugs, including the structure-activity and pharmacodynamic/pharmacokinetic relationships, effects on anticancer effectiveness and advanced drug delivery methods.
(iii) study of vascular protection and development of novel drugs with vascular-targeted photodynamic therapy.

This research is characterized by multidisciplinary approach – from rational design and synthesis of potential drugs, through assessment of their therapeutic effects using *in vitro* and *in vivo* experiments, safety/toxicity determinations to analysis their pharmacokinetics. This project aims to bring together complementary skills, knowledge, and resources in new ways, in order to jointly address the research problems. The research team is composed of 20 researchers students from 7 departments of the Charles University Faculties of Pharmacy and Medicine in Hradec Králové.



Study of Drugs and Other Biologically-Active Substances Perspective in Prevention and Treatment of Important Lifestyle Diseases

Principal Investigator:
Prof. Petr Solich

The aim of the project is to study newly used drugs in clinical medicine as well as biologically-active substances of natural origin from the perspective of the prevention and treatment of important lifestyle diseases, especially cardiovascular and oncologic diseases and degenerative diseases associated with human ageing. The project involves studying the influence of significant biological markers in the early diagnosis of these diseases along with the identification of new potential biomarkers and the isolation and identification of new enzymes as a potential targets for the inhibition associated with the therapy of these diseases. An integral part of the project is the isolation and identification of new substances of natural origin, especially those with anti-oxidation activity in relation to the prevention of cardiovascular and oncologic diseases. This multi-discipline project directly follows and significantly extends the collaboration of perspective researchers from several departments of the Faculty of Pharmacy, Charles University in Hradec Králové dealing with study of effect of biologically active compounds in the prevention and treatment of lifestyle diseases.

Development of novel drugs against tuberculosis and its multiresistent forms as a perspective of TB treatment

Principal Investigator:
Prof. Alexandr Hrabálek

The project deals with the development of novel antitubercular agents active against resistant strains of tuberculosis, dissemination of which is a serious global problem. The project is based on the collaboration of the Faculty of Pharmacy of the Charles University in Prague and Centre of Biological Defence in Těchonín. Faculty of Pharmacy deals with the design and synthesis of new molecules, evaluation of their toxicity and in vitro antimycobacterial activity, and with the determination of their mechanism of action. The evaluation of *in vivo* antimycobacterial activity is performed in Centre of Biological Defence in Těchonin, specialized institute fully equipped for handling with the most dangerous infection agents. Moreover, *in vivo* antituberculosis evaluation is not performed anywhere in the central Europe, therefore this research is unique in this European region.

FACULTY OF ARTS

The Czech National Corpus: research infrastructure for empirical language-oriented inquiry

Principal Investigators:
Dr. Václav Cvrček
Dr. Vladimír Petkevič
Dr. Michal Křen

The Czech National Corpus (CNC) project, established in 1994, strives to continually map the Czech language in all available dimensions (from the time, regional and genre perspective). The CNC builds and makes available large electronic text collections (language corpora) serving as a basis for research on current Czech (both written and spoken) as well as historical Czech and other languages. It also develops the methodology of empirical linguistic research and tools for language corpora exploration.

Since 2012 the CNC has been recognized as a research infrastructure for empirical language-oriented inquiry in many fields of social sciences and humanities (esp. linguistics, psychology, sociology, history, etc.). Thanks to its large and high-quality language resources, the CNC is a sought-after partner in many international research projects. Besides these activities, CNC also focuses on consulting, providing analyses for research or popularizing purposes, providing data packages for research on Czech as well as other languages for contrastive research, and automatic text processing.

Sinology for 21st century

Principal Investigator:
Prof. Olga Lomová

The team of sinologists at Charles University continues to work in the spirit of the Prague School established by Jaroslav Průšek. We explore various aspects of linguistic, intellectual and social transformation of China across different periods of time from ancient to present day China. We employ linguistic, literary and historiographic approaches in creative dialogue, always keeping on mind close reading of texts of various types. An important part of our work is critical reflection on the shifts of meanings and creation of new meanings in the process of intercultural exchange between China and the West going on intensively since late 19th century.

Crisis of rationality and modern thought

Principal Investigators:
Prof. Karel Thein
Prof. Tomáš Halík

Today, like always since the birth of our civilization, the crisis of rationality is announced and feared in equal measure. There is, however, something specific about the contemporary shape of this age-old discussion: in the footsteps of Enlightenment, it is believed that rationality shall play the main role not only, for instance, in rational choice theory, but also in ethics and political theory. This framework sets the questions of our project: What are the contemporary forms of both rationality and the diagnosis of its crisis? How, beyond the discourse of humanities, does art reflect this situation, and what is the role of religion today? What are the implications of these questions for a renewed, perhaps not strictly rationalistic, foundations of ethics?

To address these issues, the research team, associated with the Institute of Philosophy and Religious Studies, has three thematic sub-groups: (1) Rationality Crisis and Contemporary Philosophy, Art and Science, (2) Religion and Rationality, (3) Genealogy of Rationality and Its Crises. This structure allows for a smooth continuity with several research projects, including the multi-disciplinary programme "Rationality in human sciences".

Blurred boundaries of Medieval texts: Digital editing and interpreting

Principal Investigators:
Prof. Martin Nejedlý
Prof. Jan Klápště
Dr. Lucie Doležalová

The Middle Ages are not the grey intermediary between the classical Antiquity and the Renaissance that they seem to be. This project aims to connect medievalists of various disciplines (medieval Latin studies, individual vernacular studies, history, art history, archeology, musicology and others) to offer a more nuanced picture of medieval written culture in the Czech lands in European context. Special emphasis is placed on medieval literature in its physical aspects: the manuscript transmission, which is in its manifestations and implications surprisingly close to textual transmission in the contemporary digital age. This is true especially as far as the notions of authorship, text and language are concerned – they escape easy definitions, their boundaries are blurred. The medieval material challenges our preconceptions and calls for revision. At the heart of the project there is a course in digital

editing of medieval texts organized jointly with the University of Siena, Lyon, Queen Mary in London and Klosterneuburg monastic library, taking place within program Erasmus+ Key Action 2, Strategic Partnership.

Identities, Canons, Pop-culture: A Comparative Approach

Principal Investigators:
Prof. Martin Procházka
Prof. Petr A. Bílek
Dr. Jan Wiendl

Focused on the shaping of modern cultural identities, the research ranges from the major features of great cultural epochs, the Renaissance, Romanticism, Modernism and Postmodernism, to the interrelationships of literature and other arts, namely theatre and film. The multidisciplinary approach combining, among others, semiotics, communication theory, philosophy and psychoanalysis explores relations between culture and technology, experimental art and pulp literature. The project is unique in connecting advanced reflection of contemporary critical theories with an internationally relevant research in several prominent specialized fields, including Shakespeare, Joyce and Byron studies, as well as contemporary theatre, poetry, fiction and critical thought of Czech and European Modernism and avant-garde. Research team members are represented in the executives of 6 international academic associations and members of international research groups. International research cooperation also includes doctoral programmes like Erasmus Mundus Joint Doctorate Text and Event in Early Modern Europe (TEEME).

Language and the human mind: understanding the way we communicate

Principal Investigators:
Dr. Mirjam Friedová
Dr. Pavel Machač
Dr. Ronald Kim

The project is concerned with the complex problem of language origin and language evolution, focusing on the permanent variability of grammatical structure. The research is based on close analysis of authentic language material: the everyday conversational usage as well as historical texts. Both perspectives provide invaluable insights concerning (i) the cognitive processes involved in the emergence and evolution of grammatical systems, (ii) the principles of verbal interaction in specific socio-pragmatic contexts, and (iii) the ways human mind processes information. The project combines cognitive linguistics, diachronic linguistics, experimental psycholinguistics, and conversational analysis. In addition to the project's theoretical relevance, some of the findings may reach into certain applied areas as well, e.g. the development of speech recognition tools for spontaneous speech.

Czech Egyptology and research on complex civilisation and resilience processes

Principal Investigators:
Prof. Miroslav Bárta
Dr. Jiří Janák

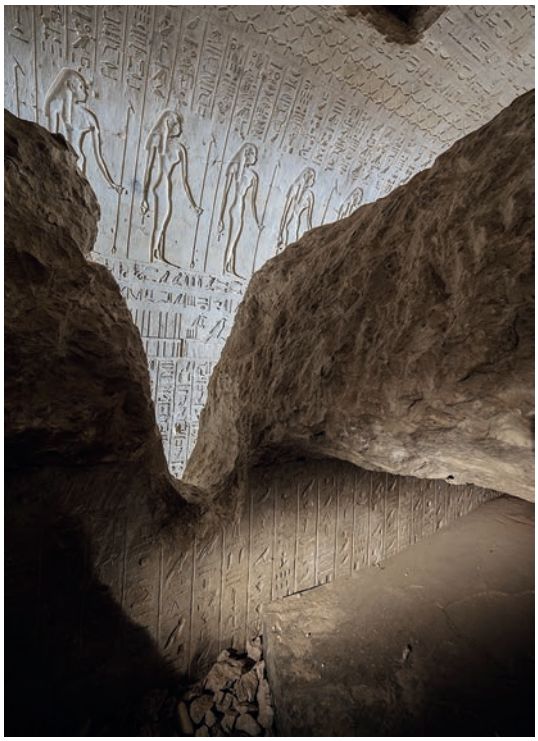
Thanks to an almost a century-long tradition, continuity, high standard of teaching and specialized research, the Czech Institute of Egyptology belongs among the most important Egyptological departments in the world. Its activities revolve primarily around excavations

in Egypt and lately also in the Sudan. In the last few years, it has become well-known also for its comparative research of complex civilizations, resilience processes and their implications for security policies of the state, the European Union and the NATO, which is reflected in numerous conferences and seminars organized at the premises of the Czech Parliament as well as the General Staff of the army of the Czech Republic. The activities of the Institute cover practically all aspects of ancient Egypt. Its defining activities center above all on the study of the 3rd and 1st millennia BC, based on archaeological excavations at Abusir. The expedition of the Czech Institute of Egyptology in Egypt is the largest Czech scholarly mission abroad. The Institute is internationally acclaimed as a leading interdisciplinary institution: it was the first to have undertaken and published detailed satellite imaging and analysis of the pyramid fields, it sets trends in palaeoenvironmental studies and various applied fields in cooperation with the private sector (3D scanning, geophysics, etc.).

History – transcontinental studies: Europe and/vs the World

Principal Investigators:
Prof. Martin Kovář
Prof. Josef Opatrný

Group of specialists from the Institute of World History, Centre for Ibero-American Studies,



and individuals from other departments and institutes follows up purposefully with the project Europe and (vs.) the World: Intercontinental and intracontinental political, economic, social, cultural and intellectual transfers and their consequences". Under the new title, the members of the team not only study the various dimensions of relations between Europe and the other continents and their mutual influences, but also problem that manifested itself as extremely important in the past years: the transformations of the European identity. They are aware of the fact that the "Old World" is, without exaggeration, standing on crucial crossroads (uncertain future of the process of European integration, economic and social problems, demographic development, disturbances on its peripheries, etc.). All of this is studied with respect to the increasingly more important global context (attention is paid also to the position of Czech society in these relations and the analysis of the image of non-European states and regions in the Czech lands). The team follows up with the existing contacts in Europe and in the world. The main axis is constituted by the institutions in Germany, Austria, France, Britain, Spain, and in Latin America. Other traditional area of cooperation is Asia, especially China.

FACULTY OF SCIENCE

Environmental geochemistry group

Principal Investigator:
Prof. Martin Mihaljevič

Environmental geochemistry group is composed of researchers at the Institute of Geochemistry, Mineralogy and Mineral Resources and at the Laboratories of the Geological Institutes of the Faculty of Science. Their joint research is focused on processes related to biogeochemical cycles of elements near the Earth surface, such as metals and metalloids from anthropogenic sources. In addition, it involves interactions among hydrosphere, atmosphere, pedosphere and waste matter, as well as development of new analytical methods in environmental geology. The research activities are realised in the Czech Republic, in Europe, as well as on other continents, such as Africa and America.

Physical organic chemistry

Principal Investigator:
Prof. Jana Roithová

The research program is focused on studying elementary steps in organic and organometallic reactions using mass spectrometry, ion spectroscopy and quantum chemistry. The aim is a deeper understanding of reaction mechanisms and formulation of new general concepts in organic and organometallic reactivity. Using mass spectrometry with electrospray ionization can be isolated and reaction intermediates from solution their properties and reactivity in the gas phase studied. Ion spectroscopy represents a modern method for investigation of ions. With a new instrument constructed in the laboratory it is possible to record infrared and ultraviolet spectra of mass-selected ions trapped in a cryogenic trap and thus obtain information about their structure in the gas phase. Experimental results are combined with quantum chemical calculations. Combination of all experimental and theoretical approaches provides a comprehensive picture about reaction intermediates and reaction mechanisms.

Organoelement Chemistry, Organic Synthesis and Catalysis

Principal Investigators:
Prof. Petr Štěpnička
Prof. Martin Kotora

Catalytic reactions are studied mainly by the teams at the Departments of Inorganic and Organic Chemistry, Faculty of Science. The research in the Laboratory of Organoelement Chemistry and Catalysis at the Department of Inorganic Chemistry is focused mainly on the synthesis of new phosphinoferrocene ligands modified by functional groups that enable their applications in the catalysis of synthetically important reaction as well as specific ligands in coordination compounds. Typical representatives are ferrocene phosphines bearing functional amide substituents. Attention is being paid to their preparation and structures, but also to their coordination

behaviour and catalytic properties. Naturally, the research encompasses also the adjoining areas such as studies into the biological properties of the synthesized coordination compounds, search for unusual bonding motifs in their structures and electrochemical properties of these ferrocene derivatives to name just few. The Laboratory of Catalysis in Organic Synthesis at the Department of Organic Chemistry aims at development of transition metal-catalysed reactions suitable for the preparation of organic compounds. Reactions studied include [2+2+2]-cyclotrimerisation reactions, alkene metathesis, cycloisomerisation processes, etc. These methods are applied in the synthesis of natural and bioactive compounds or functional molecules derived from polyaromatic compounds.

Nanomaterial Modeling

Principal Investigators:
Prof. Petr Nachtigall
Dr. Filip Uhlík
Dr. Peter Košovan

The Group of Nanomaterial Modeling, a part of the Department of Physical and Macromolecular Chemistry, focuses on the development and applications of computational methods for the investigation of physical and chemical properties of novel nanomaterials.

It employs a variety of models and methods, including ab initio methods for the accurate description of electronic structure as well as methods of statistical thermodynamics which allow for simulations of large molecular ensembles. In close collaboration with experimental researchers, the group's research is focused on modeling of microporous aluminosilicates, carbon nanomaterials, polymers, and metal organic frameworks.

The research topics of the group include the structure and properties of new microporous materials for adsorption and catalysis, properties of metal nanocatalysts on supports (carbon or silica) and properties of these supports, structure and properties of polymeric materials, in particular water-soluble polyelectrolytes for environmental applications. In addition to theoretical description of properties of existing materials also materials that have not been prepared yet are computationally investigated. The aim of the research is to gain an increased understanding of physical and chemical properties (including catalysis) of nanomaterials ranging from the atomic-scale up to the supramolecular level. The theoretical research carried out in close collaboration with experimental groups heads towards the synthesis of new materials with designed properties for specific applications.

Endogenous geodynamics in Geology

Principal Investigator:
Prof. Shah Wali Faryad

The research group focuses on Petrology, mineral transformation and deformation in the Lithosphere. To model the pressure and temperature conditions of magma crystallization and metamorphism in the rocks, principle of thermodynamic equilibrium are used. The research further includes numeric modelling to understand formation of igneous textures and their rheological implication, evolution of state equation of fluid phases and their interaction in the subduction environments and finally their significance for geochemical cycles in the convergence boundaries. The microstructures and interaction of mantle and crust rocks, the emplacement of magma in the crust and large

scale tectonic processes are also investigated. In this direction it includes various geodynamic environments, like the Bohemian Massif with high-grade rocks, the Alpine orogenic belt, known for its thrust-nappe system (Western Carpathians, Eastern Alps), the Collisional belt with thickened and double continental crust (Hindu Kush and Himalaya) and Central Asian Variscan Belt with multiple orogenic processes.

The regulation of cell, tissue and organ development in health and disease

Principal Investigator:
Dr. Jan Brábek

The research is concentrated on cell biology of both plant and animal, including human cells. Basic cell biological processes and structures are analyzed. Important achievement in plant cell biology was the discovery and subsequential functional characterization of plant multiprotein complex exocyst, which has crucial role in vesicle transport, exocytosis, cell growth and motility. In addition, the influence of evolutionary conserved actin nucleators – FH2 proteins – on structure and dynamics of microtubule cytoskeleton in plants was described. In animal and human cell biology, the attention was concentrated on cancer cell transformation and malignant progression, with emphasis on cell signaling, subcellular structures and mechanisms of cell motility. Important achievement was the elucidation of structure of invasive protrusions of cancer cells – invadopodia – in a complex 3D environment. Other important discoveries were related to amoeboid invasiveness of cancer cells (the discovery of primarily amoeboid invasiveness in cells of mesenchymal origin, demonstration of the importance of amoeboid invasiveness in metastasis of sarcomas, identification of key signaling proteins). In relation to analysis of signalling in malignant progression the role of CAS protein in invasiveness, metastasis and mechanoreception was shown and elucidated. In addition, the tyrosine phosphorylation within SH3 domains was identified as a novel general negative regulatory mechanism of cell signalling. The research in the field of developmental biology is mainly concentrated on genetics and cytogenetics of *Xenopus tropicalis* and *Xenopus laevis*. Among most important achievements within this field was the construction of linkage and physical map of *Xenopus Tropicalis*, which subsequently enabled the identification of many genes, responsible for mutant phenotypes of interest for biomedical research. Another important achievement was the evolutional analysis of human X chromosome origin based on sequential and cytogenetic data from *X. tropicalis*. Very important results came from evo-devo analysis of morphogenesis of head tissue/structures, which form the body plan of vertebrates and their developmental plasticity is responsible for the origin of crucial evolutional innovations and adaptive changes.

Cellular and molecular basis of the host--pathogen relationships

Principal Investigator:
Prof. Petr Horák

Research is focused on characterization of mechanisms that participate in transmission of infectious agents, establishment/progress of infection in the host body, and pathogenesis. Virology research aims at the cell defense against infections caused by small DNA viruses (polyomavirus and hepatitis B virus) and HIV virus, particularly at the processes linked with restriction of virus infection by mechanisms

of innate immunity; these mechanisms are operational during the early phase of virus--cell interaction, i.e., during the transport of virus particles into the cell nucleus. Also, the mechanisms of cell defense evasion by viruses are analyzed. As for the most important results, epigenetic control via methylation of virus promotor has been disclosed in HIV replication. Bacteriology research is focused on proteins that modulate immune response; also secondary metabolites exhibiting diverse functions are studied, e.g., their influence on cell physiology including characterization of cytoskeleton, membraneous organelles, energy metabolism, production of oxygen radicals and regulation of cell cycle. In cooperation with the Institute of Microbiology ASCR, adenylate cyclase toxin produced by Bordetella pertussis and having immunomodulatory effects is intensively studied as a model protein. Among the most important results, influence of the toxin on endocytosis has been disclosed. Helminthology research deals with avian schistosomes that may attack humans as accidental hosts and cause cercarial dermatitis. Among the main research topics, the role of parasite peptidases and other enzymes in skin and tissue invasions, cellular and humoral immune response of the host, immune evasion of parasites, and pathogenesis linked with schistosome migration in the host tissues are in focus. Characterization of important parasite proteins is facilitated by recent genomic and transcriptomic projects. As for the most important results, morphological and biochemical characterization of penetration glands and cathepsins B1/B2 of schistosome larvae has been performed, and neuropathogenicity of *Trichobilharzia regenti* disclosed.

Fylogeny and diversity of multicellular organisms

Principal Investigator:
Dr. Pavel Munclinger

Research is focused on evolutionary aspects of plant and animal species diversity at various levels of complexity from populations to processes at the global scale. Trends in biodiversity dynamics are studied in a broader context of geological history, with a special emphasize on the Quaternary period. Phenomena such as speciation, hybridization, genome evolution, phenotypic plasticity, developmental processes, and changes of behavioural or morphological traits are investigated using modern -omics techniques in combination with morphological, ecological and behavioural approaches. Field and laboratory experimental research is done mainly on various non-model organisms and results in scientific publications in prestigious journals as well as practical suggestions for nature conservation and protection of endangered species.

Eukaryotic mikrobiology and protistology

Principal Investigator:
Prof. Jan Tachezy

The research is focused on unicellular eukaryotes (protists) and covers three main directions: research on parasitic and free-living protists, research on phototrophic organisms, and research on yeast colonies.

The first topic includes the study of organisms at the level of diversity, evolution and ecology of obligate anaerobic protists. Studied include both free-living organisms occurring in freshwater and marine anoxic sediments, symbionts as well as parasites of different groups of invertebrates

and vertebrates, including humans, who inhabit mainly gastrointestinal or genitourinary tract. Attention is also paid to various types of symbiosis between anaerobic ciliates and prokaryotic organisms. Research of aerobic protists is mainly focused on free-living and parasitic protists of Euglenozoa group. For free--living protists, emphasis is given to evolution of secondary plastids in the group Euglenida. Studies of parasitic protists of Kinetoplastida group are focused on leishmania, serious pathogens of humans and domestic animals, and their development in vectors. We have defined the current view of interspecies differences in Leishmania-vector relationship, demonstrated sexual multiplication of Leishmania in vectors, and introduced a unique method for determining the risk of infection using antibodies against the saliva of vectors. In addition to laboratory experiments, we carry out field investigations in endemic areas of leishmaniasis. At the subcellular level, we study evolution and function of semiautonomic organelles (mitochondria, plastids), particularly specific adaptations of these organelles in relation to the evolution of parasitism and adaptation to anaerobic environments. Emphasis is given to investigations of the role of reductive evolution and lateral gene transfer in transition of classical mitochondria to their anaerobic forms: hydrogenosomes and mitosomes. The main findings include the discovery of complete loss of mitochondria in a specific lineage within Preaxostyla group. At the molecular level, we studied complete genomes of selected organisms, changes in transcriptomes under various environmental conditions, and proteomes of isolated subcellular structures.

The second direction is concentrated on research of phylogenetic diversity of phototrophic unicellular eukaryotes. Using techniques of molecular phylogenetics, microscopy and metabolomics, the research deals with the mechanisms that generate and maintain diversity and structure of micro-algae communities in nature. Part of this activity is the study of the molecular diversity of micro-algae habitats (sub-aeric biofilms, microbentos). Parallel direction is also studying precipitation of inorganic crystals and colloidal nanostructures in algal cells. The main model groups include flagellates of Stramenopiles , diatoms and unicellular green algae.

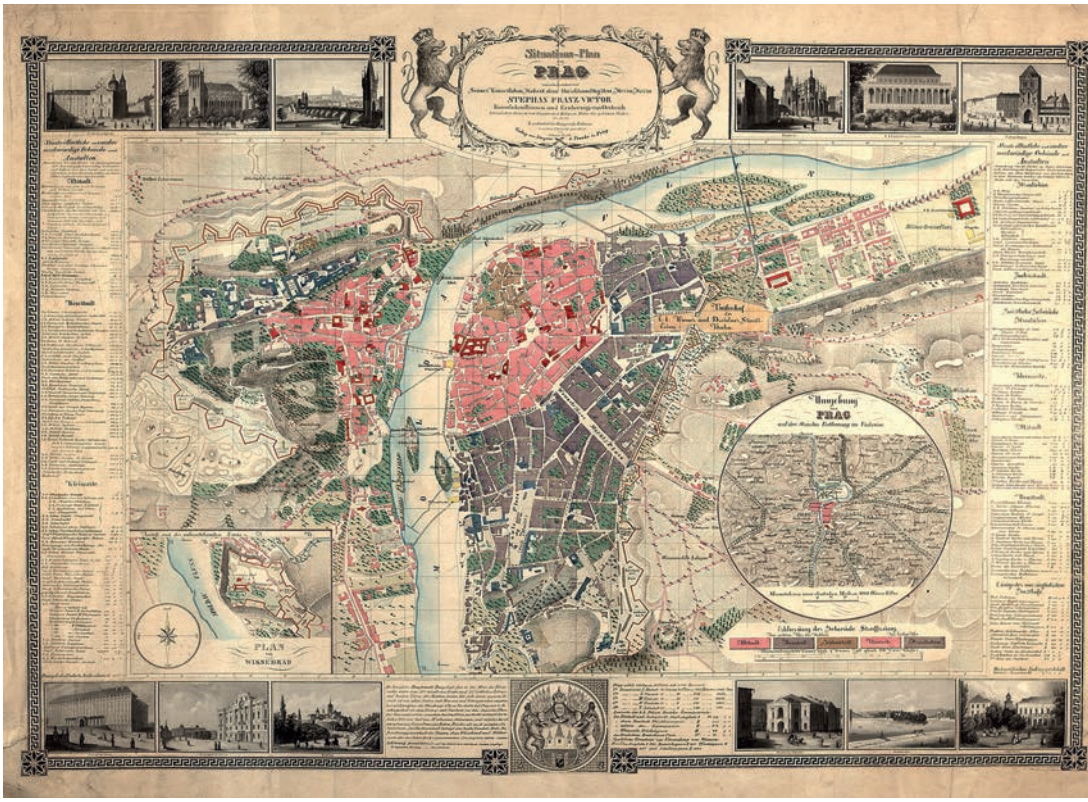
The most important result in the third direction of research is the finding that yeast colonies behave as primitive multicellular organisms in which the cells differentiate and form specialized cell populations, which mutually cooperate or compete. One of the studied subpopulations, which is long-lived and resistant to metabolic stress, is markedly similar to cells of mammalian tumors. Specialized subpopulations of biofilm colonies are important for protection against external influences.

Transformation of socio-geographic and demographic realities of Czechia in European and global contexts

Principal Investigator:
Dr. Dušan Drbohlav

The main topics of the research are as follows:

(i) a critical review of key concepts and methodological approaches;
(ii) empirical analyses of the regional, demografic, socio-economic and socio-cultural differentiation of society, the development of population growth, the demographic aging process and its impact on social/pension and health systems, the development of the settlement system, the urbanization process, the transformation and restucturalization of cities and countryside, mechanisms of



the development of peripheries; migration processes, the impact of migration on demographic, social, economic, cultural, political and geogaphical structures, analyses of migration and integration policies, the integration of migrants into the majority society; assessment of the integration of border regions into European structures, the impact of EU policies; the globalization process, analyses of the impact of the economic crisis, the transformation of economic ties, flows of goods and capital, the formation of transportation systems, global problems of the world and foreign aid; assessment of territorial loads, consequences for local and regional communities and settlement systems;

(iii) a synthetizing assessment of the socio-spatial and demographic changes in Czechia in European and global contexts with special regard to an interpretation of driving forces, mechanisms, actors/subjects of the change on various regional-hierarchical levels and analyses of the demographic situation in Czechia within the EU.

Results of the research are used in academic, research and decision-taking circles (namely, city, regional, national offices, EU institutions, UN, non-governmental sector etc.).

Physical Geography, Cartography and Geoinformatics

Principal Investigator:
Prof. Bohumír Janský

The focus of the research is analysis of dynamics of spatial and time relations in physio-geographical sphere and the impact of these dynamics on the society. The combination of Geography, Cartography, Geoinformatics and Remote sensing within one research project is caused by the fact that physical Geography works with cartographical data and uses the tools of IT and GeonInformatics.

Current enhancement of Physical Geography and Geoecology has been influenced by recents boost of research of environmental threats and risks and of all environmental changes on global scale. At the forefront of the interest of physical geographers is especially the impact of climate changes on the different components of the environment. The second large field of research interest lies in comparison of current environmental processes with their past shape and their progress. Crucial findings about the dynamics of physio-geographical phenomena can be derived from such comparison and can facilitate prediction of regional and global changes of the environment.

The individual research topics involve:

(i) environmental threats and risks and their impact on human society
(ii) paleographical development of environment in Quarternary
(iii) changes of dynamics of hydrological processes and ecology of watercourses as indicators of global climate changes and anthropogenetic envronmental changes
(iv) landscape research by using landscape and socio-ecological methods on different time and spatial scales
(v) recent development of the environment and its physio-geographical constituents
(vi) development of qualitative and quantitative indicators of phenomena in data obtained via remote sensing
(vii) algorithms of visualisation and analysis of topographical data in digital modelling of (Earth)surface.

FACULTY OF SCIENCE, CENTER FOR THEORETICAL STUDY, ENVIRONMENT CENTER

Ecology and biodiversity – from individuals to the biosphere

Principal Investigators:
Prof. David Storch
Prof. Jan Frouz
Dr. Adam Petrusek

Ecology is a major biological discipline which deals with the relationships between individuals, populations, and their environment, and with the structure and dynamics of ecological communities and ecosystems. There are close links to other biological disciplines, namely evolutionary biology, parasitology, physiology, behaviour or conservation biology. For this reason, ecological issues are studied at many departments within the Charles University. Our team studies ecology of all taxa, ranging from bacteria to flowering plants, insects or vertebrates, including humans. The research comprises all spatial scales, from the detailed studies of subtle interactions between individuals within local ecological communities up to the exploration of the origin of macroecological patterns at continental scale. We study both aquatic and terrestrial ecosystems, mostly in Europe, but also in relatively exotic environments, namely tropical rainforests and savannas in Africa or microbial communities in Arctic and Antarctic environments. We are interested, for instance, in the evolution of life histories, in the origin of adaptations to extreme environments or in ever changing interactions between organisms and biodiversity variation in space and time. We combine theoretical and mathematical approaches with experiments and traditional field research. Ecological research has many practical applications, stemming for instance from our studies of spatial spreading and effects of invasive plants and animals, the role of post-industrial sites for preserving biodiversity, or studies of host--parasite interactions.

FACULTY OF MATHEMATICS AND PHYSICS

Algebraic and geometric structures of the modern mathematics

Principal Investigator:
Prof. Vladimír Souček

Recent decades brought to the world mathematics an explosion of new methods and theories based on an intensive interaction between mathematics and modern theoretical physics. The project of the E. Čech Institute (ECI) reflects this evolution. Carefully chosen topics bridge categorical and cohomological algebra, differential geometry, algebraic topology and geometric analysis, to string theory and integrable systems in physics. The research is organized in teams around J. Rosický, J. Slovák, R. Von Unge in Brno, V. Souček, J. Trlifaj, M. Markl, B. Jurčo a M. Schnabl in Prague, and M. Engliš, M. Marvan in Opava. The main part of the budget is used to support a broad international cooperation. ECI opens a competition for 9 post-doctoral positions every year, steered by an international Board. This burst of activities provides a multiple effect on the overall productivity of the Czech research in a very broad and challenging spectrum of relevant topics. Two monographs and almost 80 papers in IF journals were published during the first 3 years of the project.

Applied computer science

Principal Investigators:
Dr. Tomáš Skopal
Dr. Tomáš Bureš
Dr. Jaroslav Křivánek

Three departments at the school of computer science focus on applied computer science (software-related), where an excellent research is conducted including modeling and formalizing of algorithms, data structures and software architectures. The research standards include development of prototype implementations of software systems, intensive experimentation using standardized benchmarks with an emphasis on repeatability of experiments.

The Department of Software Engineering deals with search in big structured and unstructured data, such as multimedia, graphs, scientific and bio data. We focus on database methods for similarity search (performance, scalability), modeling and development of alternative means of retrieval, and also similarity modeling in particular data domains. In the multimedia retrieval field we work with complex image descriptors and modern means of retrieval using database methods based on massively parallel processing. In the bioinformatics domain we focus on the development of algorithms and computational tools to aid analysis of biological data and computational drug discovery. This includes approaches to analyze RNA and protein

data or discovery of new bioactive small molecule compounds. In the big data domain, we develop methods which can be used to automate data integration and extraction. Therefore, individuals can concentrate on the information and knowledge instead of tedious reading and browsing of tons of documents and databases. We develop methods which allow people to integrate large heterogeneous data and explore and browse it in a user friendly way. Our approach fully applies the so called Linked Data principles which provide a unified framework for publishing and interlinking data on the Web. This allows us to enrich given data with the context of thousands of data sources already available on the Web. On top of the integrated data we apply various statistical, machine learning and natural language processing methods for information and knowledge extraction. We apply results of our research in cooperation with commercial partners. We also lead a non-profit initiative OpenData.cz which promotes the principles of Linked Data among governmental organizations. Our aim is to convince the organizations to publish their data on the Web for free reuse so that we (and anyone else) can show the value hidden in their data.

The Department of Distributed and Dependable Systems focuses on methods and models that enable systematic development of dependable software for smart cyber-physical systems (CPS). This covers approaches for (i) goal-based requirements engineering, (ii) component-based architectural models specifically tailored for dependable real-time systems, (iii) models and techniques for runtime self-adaptivity and self-awareness (including awareness of own performance), (iv) communication models for opportunistic knowledge sharing in networks with limited connectivity (e.g. MANETs, VANETs), (v) methods and tools for assessing performance and resource consumption, (vi) methods and tools for network-precise simulations of large-scale deployment of smart CPS, and (vii) runtime platforms for analysis and experiments with smart CPS (targeting Android and very low-power embedded devices such as ARM Cortex M family). The department further focuses on analyses of software systems. This includes verification of properties of software systems implemented in C/C++ and Java languages and analysis of web applications written in PHP, such as web-based banking interfaces, content-management systems (WordPress), etc. For verification of complex systems, which cannot be analyzed directly, we have developed methods for automatic model extraction and its analysis proving the properties on the model level. The

department regularly participates in industrial and EU projects (FP7, H2020); its most recent project being the FP7 FET project ASCENS, which focused on theoretical foundations of autonomous networked systems.

The Computer Graphics Group is one of the leading groups in Computer Graphics research worldwide, with a strong focus on highly realistic image synthesis. Though mostly theoretical in its nature, the group's research is strongly rooted in problems encountered in practice: many of the results have been adopted by the renowned graphics production houses, such as Weta Digital, PIXAR Animation Studios, or Chaos Group. Two leading figures contribute to the scientific excellence of the group. Alexander Wikie focuses on physics-related aspects of light transport, material modeling, and color science. Jaroslav Křivánek focuses on radiative transport, Monte Carlo methods, and visual perception. In 2014, he was selected for the New Europe 100 list, "a list of outstanding challengers who are leading world--class innovation from Central and Eastern Europe", for "taking computer graphics to the next level".

Combinatorics and graph theory

Principal Investigator:
Prof. Jaroslav Nešetřil

The group collaborates with the theoretial computer science group and several groups abroad. Modern discrete mathematics consists of several interrelated disciplines. The research and teaching is performed on two main fronts.

Combinatorics and graph theory
Discrete situations, relations and structures, usually involving only finitely many objects, are modelled. A typical problem is of assigning numbers (codes of transmission channels) to nodes (transmitters) so that two adjacent nodes (close transmitters) get numbers with difference at least 2 (to avoid interference). Close relation to practical applications is obvious. Other research topics include investigation of data structures (numbers of calls to the memory, expected complexity etc.).

The group has excellent results in structural graph theory, graph and hypergraph colorings, in Ramsey theory and in intersection of combinatorics and computational complexity. The projects being solved by the group are "Complex Structures – Regularities in Combinatorics and Discrete Mathematics (Cores)" and "Center of Excellence – Institute for Theoretical Computer Science", which also involves the other three groups, namely the geometry group, the computational complexity group, and the algorithms and optimization group.

Discrete and computational geometry
Geometry is perhaps the oldest branch of mathematics, but Discrete and computational geometry is much younger. It is busy with questions on possible configurations of points, lines, curves and so on, and with the computational aspects. For illustration we mention an important problem of the trisector curve, solved by the late J. Matoušek and his collaborators from Japan.

The group has excellent results on both geometric and topological graphs, in graph drawing, in computational geometry, in topological methods in combinatorics, in geometric Ramsey theory.

General relativity and gravitation

Principal Investigator:
Prof. Jiří Bičák

The general theory of relativity and its applications in astrophysics and cosmology is

a field that has been taught and pursued at the FMP CU systematically since the 1970s and its advancement has been associated primarily with the Institute of Theoretical Physics and the name of Prof. Jiří Bičák. A number of researchers still active in the field today – working not only at the FMP CU but also at other universities and institutes of the Academy of Sciences of the Czech Republic, ASCR—began their professional carriers under his supervision. The research profile encompasses mainly mathematical problems of general relativity and its higher--dimensional versions, particularly the search for and interpretation of exact solutions of Einstein's equations, investigation of spacetimes involving gravitational radiation, formulation of conservation laws and their relation to various types of symmetries, physics of black holes and of massive discs as gravitational sources, behaviour of particles and fields in curved spacetimes, the issue of cosmological perturbations, and, more recently, also the application of computers to non-stationary problems involving very strong fields (the so-called numerical relativity), approximation methods in theories of gravitation, non--homogeneous cosmological models, and gravitational lenses. The group continues educating students in the fields of relativistic physics and methods based on differential geometry. It has extensive international contacts and has completed successfully a number of grant projects. Currently, its operation is supported particularly by Albert Einstein Center for Gravitation and Astrophysics, a Project of Excellence awarded by the Czech Science Foundation. Within the Center, the group has also enhanced its collaboration with colleagues from the Astronomical Institute of the ASCR, the Institute of Mathematics of the ASCR, and from Silesian University in Opava.

Geometric Function Theory

Principal Investigator:
Prof. Jan Malý

This project includes study of spaces of functions and mappings with the emphasis on the properties needed in applications such as theory of Nonlinear Elasticity, Partial Differential Equations and Calculus of Variations. The natural problems studied in this area are the optimal condition that guarantee continuity (material cannot break and no cavities are created), null sets are mapped to null sets (material cannot be created from nothing), invertibility (interpenetration of matter), properties of the inverse mapping (backward deformation should be nice) and many others. Another aim of the study is the optimal conditions for various embeddings of function spaces.

Machine Translation and Multilingual Technologies

Principal Investigator:
Prof. Jan Hajič

Machine translation is an attractive interdisciplinary task relying on computer science, linguistics, statistics and mathematical modeling, with specific challenges to software engineering – as the volume of the data processed typically reaches tens of billions of words.

At the Institute of Formal and Applied Linguistics, several prototypes of machine translation systems have been created and implemented. Two approaches have been adopted. First, *phrase-based statistical translation* which uses machine learning based on very large text corpora; second, a *deep linguistic analysis* of whole sentences is used. Combination of both

approaches, e.g. in a form of grammatically-based corrections of the phrase-based translation output, seems highly promising. In addition to text-to-text machine translation, cross-language search which operates on multimodal data and multilingual dialogue systems enabling natural human--computer interaction are being developed.

Translation systems developed at the Institute focus especially on translation between the Czech language and other European languages (esp. English, German, French and Spanish); however, a phrase-based translation system can be quickly adapted for any language pair for which a sufficient amount of language data can be obtained.

Further development of machine translation methods and systems is being pursued in collaboration with many academic and commercial partners within several European, U.S.-based and national projects as well as in direct cooperation with industry.

Mathematical modeling and methods for high performance computing

Principal Investigator:
Prof. Zdeněk Strakoš

Mathematical modeling aims to describe and study various phenomena using the language of mathematics. It represents an indispensable tool in natural sciences, engineering, life and also social sciences. Mathematical modeling in mechanics and thermodynamics of continuous media is the

research subject of the mathematical modeling group at Mathematical Institute of Charles University.

The uniqueness of this research group consists in the fact that it is able to cover –at a very high scientific level –all aspects of the mathematical modeling workflow, in particular development of mathematical models, mathematical analysis of their properties, development of the suitable numerical methods and implementation of the numerical methods optimally exploiting the available computational power of the current and near future high performance computing systems.

Modern materials

Principal Investigator:
Dr. Miloš Janeček

Ultra-fine grained and nanocrystalline materials belong to an important group of modern materials with unusual properties that are very attractive for different structural and functional applications. Modern techniques of preparation of these materials are based on the imposition of very high strains leading to exceptional grain refinement without any significant change of the overall dimensions. High hydrostatic pressures are applied during these processes which introduce high densities of lattice defects (e.g. dislocations or vacancies) and result in the formation of special structures. Materials fabricated by these techniques, called severe plastic deformation, exhibit several unique properties including very high-strength, ductility and fatigue endurance, increased superplastic capabilities as well as multifunctional behaviour when materials exhibit enhanced functional (electric, magnetic, corrosion, etc.) and mechanical properties.

Optical spectroscopy of individual nanoobjects

Principal Investigators:
Prof. Jan Valenta
Dr. Anna Fučíková

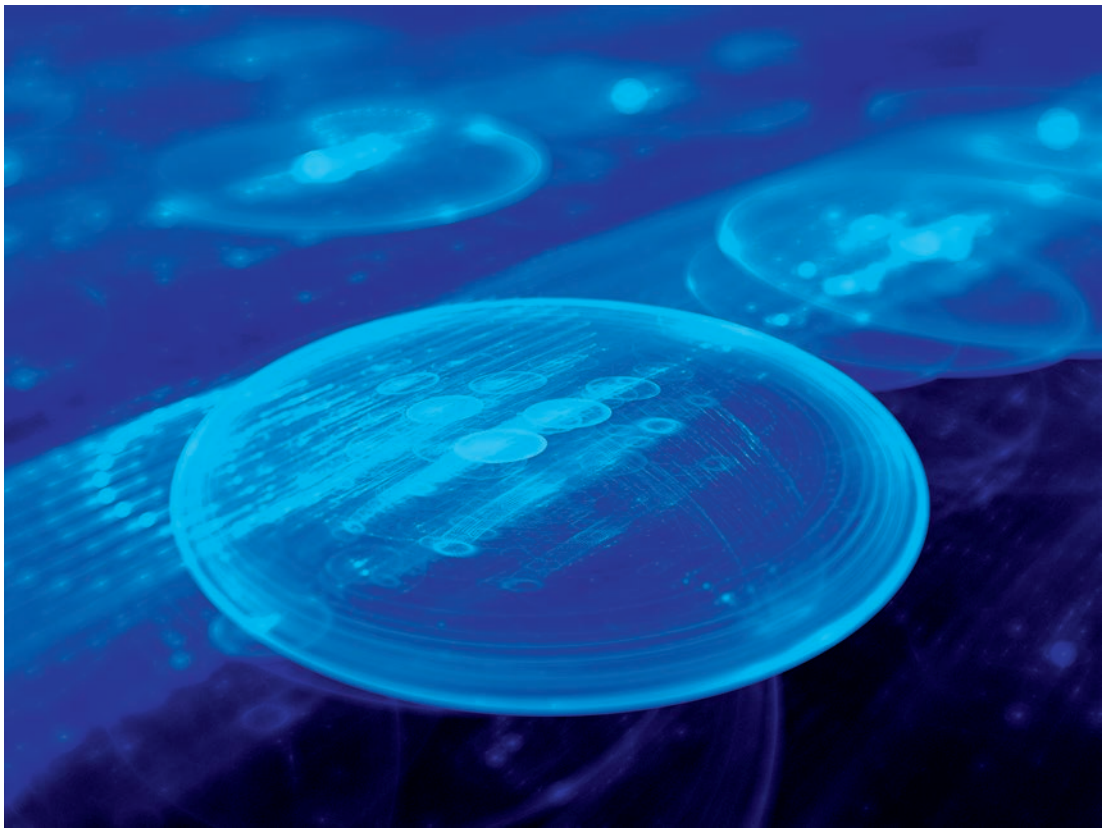
Optical spectroscopy of individual nanoobjects (e.g. semiconductor nanocrystals, nanowires, luminescent defects, dopants centers etc.) enables to overcome inhomogeneity in ensembles of such objects that is omnipresent due to impossibility of production of identical objects by the up-to-date nanotechnology. Common measurements on ensembles suffer from the so called inhomogeneous broadening, which obscure detailed information on energy levels and transitions in individual nanoobjects. Therefore, starting from 1970s, researchers developed various spectroscopic techniques that can indirectly reveal some information hidden by the inhomogeneous broadening, e.g. spectral hole-burning techniques. Following progress of detection devices enabled detecting luminescence spectra directly from single nanoobjects. Such techniques are being developed in the laboratory for more than 10 years. Between the possible approaches we prefer the luminescence microspectroscopy in a broad optical far-field, which is much less explored than confocal approaches. The reason for such choice is our focus on studies of silicon nanostructures, whose luminescence flux is extremely low due to the indirect band gap energy structure and related long excited-state lifetimes. Thus, our experimental techniques must achieve the maximal sensitivity and position stability in order to allow for long acquisition times (typically 30–60 min). Our main competitive advantage was gained by successful incorporation of a cryostat in the micro-spectroscopy set-up – this unique cryo-micro--spectroscopy device is exceptionally stable, giving the typical sample drift below 1 μm per one hour acquisition at 10 K. Using this set-up we performed several foreground studies, e.g. showing coexistence

of quasi-1D and 0D excitons in silicon nanowires, revealing narrow zero-phonon lines and phonon--replicas in Si nanocrystals at low T or energy levels of single dopants in Si nanocrystals. Recently we extended our micro-spectroscopy technique into the near-infrared (NIR) spectral region, setting up two parallel detection branches covering a broad range from 350 to 1650 nm. The latest development consist of incorporation of a time-resolved luminescence detection for both VIS and NIR regions (but the sensitivity is not on the single nanoobject level). We apply our micro-spectroscopy device also to study other inorganic and organic materials and also to measurements in living cell cultures.

OptoSpintronics

Principal Investigator:
Prof. Petr Němec

Spintronics is a new dynamic branch of electronics that uses magnetic moment – spin – of charge carriers for data storage and processing. Recently, utilization of light in spintronics has established its new "optospintronic" branch. The application of ultrafast laser spectroscopy, which has a long term tradition at MFF UK, for the research of ferromagnetic materials enabled us to discover



several new phenomena. They can be used to modify and to study magnetic order in materials on ultrashort time scales (down to femtoseconds), which is by several orders of magnitude faster than other existing experimental techniques. In particular, the discovered phenomena combine the photo-effect, a phenomenon which is at the very heart of semiconductor optoelectronics, with the non-relativistic spin-transfer-torque and the relativistic spin-orbit coupling effects. These new phenomena are expected to find applications in the development of magnetic random access memories. For this work, members of the joint Laboratory of OptoSpintronics of MFF UK and FZU AV ČR, which is headed by P. Němec, were awarded the Bedřich Hrozný Prize of the Charles University in 2014.

Particle and Nuclear Physics

Principal Investigator:
Prof. Rupert Leitner

The research focuses on experimental and theoretical study of elementary particles and atomic nuclei with the goal to contribute to the detailed tests of the standard model (SM) of fundamental interactions, to search for physical phenomena beyond the SM, and improve the present knowledge of the nuclear structure and nucleon interactions.

Theoretical and Experimental Particle Physics. Research in theoretical particle physics concentrates mainly on an adequate description of the Higgs sector of the electroweak theory, possible phenomena beyond the SM, the study of low energy meson interactions, a deeper study of some specific mathematical methods of quantum field theory. Research in experimental particle physics is performed within the framework of the world leading accelerator experiments with an emphasis on the exploitation of the full potential of the Czech Republic's membership in CERN. These experiments are: ATLAS at CERN (study of the properties of the Higgs boson and the top quark; B physics; heavy ion interactions; diffraction physics), NA62 at CERN (investigation of the CP violation and of rare decays of K mesons), Belle and SuperBelle at KEK (study of rare decays of bottomonium and of CP violation). Important parts of the research are neutrino physics (Daya Bay, NOvA and SuperNEMO experiments) and astroparticle physics (experiment AUGER). Research activities are oriented also on the development, production and testing of components of detector complexes.

Theoretical and Experimental Nuclear Physics. Research in the physics of atomic nuclei and related strongly interacting many-body systems is aimed at the following areas:

(i) Experimental study of nuclear properties at high excitation energies. Subjects of investigation are various statistical features of excited nuclear states and their decays. We participate in the measurement of cross sections of the neutron-induced reactions in experiment n_TOF at CERN.
(ii) Microscopic theory of collective nuclear dynamics. The research include calculations based on realistic two-nucleon potentials as well as related phenomenological functional approaches.
(iii) Theory of quantum phase transitions and chaos in algebraic models of nuclei and similar systems. Here we focus on approximate conservation of dynamical symmetries and the onset of chaos, and on an analysis of various singularities in quantum spectra.

Stochastic geometry, stochastic analysis and spatial statistics

Principal Investigator:
Prof. Viktor Beneš

Stochastic geometry is the theory of random sets, which form random processes of points, particles, fibres or surfaces in the Euclidean space. They may also fill the whole space in a form of a tessellation with systems of vertices, edges and faces. There is a variety of models of these random processes which may involve inhomogeneity, marking, anisotropy, temporal dynamics and different kinds of interactions. Complex models are described by simpler characteristics which are based on moment measures, packings, distances, while individual objects are described by their number, size, shape or orientation. Invariant global characteristics come from integral geometry and form curvature measures. The spatial geometrical statistics makes statistical inference on these random processes and their characteristics. In parametric and semiparametric models it develops estimators of parameters and investigates their asymptotic properties. For some classes of characteristics also nonparametric estimators are available. Various related statistical tests have to be developed. Edge effects present a special issue for an observation in a compact window. Stereological analysis concerns geometrical data based on sections or projections and their inference to higher dimension. While in theory the dimension is arbitrary, the applications concern typically two- or three-dimensional random sets. They are useful especially for the investigation of microstructures in biology, medicine and materials research, but also in macroscale in geology, environmental sciences, physics, etc. Additionally, stochastic analysis is the theory of random processes; in the present case the research is focused on space-time models described by stochastic partial differential equations which are used in various fields of mathematical physics and mathematical biology.

Structure of thin layers and nanoparticles

Principal Investigator:
Prof. Václav Holý

We use a broad range of x-ray-based methods, such as x-ray diffraction, x-ray scattering and x-ray spectroscopy for the study of various types of nanostructures. In the last decade we have dealt with semiconductor and metallic nanoparticles and quantum dots in single-crystalline and amorphous matrices. We have investigated the structure of these objects by x-ray diffraction, small-angle x-ray scattering, and x-ray absorption spectroscopy (methods EXAFS and XANES). We are also studying defects in semiconductor epitaxial layers by reciprocal-space mapping method and by numerical simulations based on the Monte-Carlo approach. Quite recently we have started a study of the structure of new materials, like antiferromagnetic semiconductor layers and topological insulators. We perform the experiments in the x-ray lab of the Department of Condensed Matter physics, however we are frequently using various synchrotron sources – ESRF (Grenoble), ANKA (Karlsruhe) and ELETTRA (Trieste).

Surface physics

Principal Investigator:
Prof. Vladimír Matolín

Physical and chemical processes on the surfaces of solids are the governing factors in modern nanotechnological applications in energy economy,

chemical industry or environmental protection. The work group of Surface Physics develops and applies refined experimental and theoretical methods in order to understand surface physico-chemical phenomena on the fundamental research level and applies the knowledge in the development of new nanotechnologies, thus reaching out into the applied research domain. One predominant research field is the development of catalysts for energy conversion in fuel cells, in which the group has been successfully optimizing the Platinum efficiency and minimizing the resource cost of the advanced catalysts. The successes in the area of catalyst development result from a solid instrumental foundation, which covers synthesis and characterization of novel nanostructured materials and the analysis of surface physico-chemical phenomena down to atomic level. Other research topics due highlighting are the research and development of sensors of non-electrical observables and development of semiconductor nanostructures. The Surface Physics laboratory (SPL) commands a broad range of laboratory techniques including a synchrotron beam line laboratory (the Materials Science Beamline, MSB) at the synchrotron Elettra in Italy. This research infrastructure (SPL-MSB) is open to international user access as the Czech representing laboratory in the Central European Research Infrastructure Consortium (CERIC-ERIC). The Surface Physics group participates in a number of European and international collaborative scientific projects and, presently, also it is a coordinator of the EU 7th Framework Programme project chipCAT.

Theoretical computer science

Principal Investigators:
Prof. Václav Koubek
Dr. Michal Koucký
Prof. Jiří Sgall

Finding the shortest path between two cities takes a GPS navigation a fraction of a second. Finding the best way to pack a large number of boxes of various sizes into shipping containers is beyond anyone's computational resources as we do not know any fast enough algorithm for this problem. What are the best algorithms for various problems? How to efficiently implement them? What makes computational problems hard to solve by an algorithm? These are some of the main questions theoretical computer science tries to answer. Hence, theoretical computer science aims to design new algorithms and algorithmic methods to solve various problems, design efficient data structures that would support fast implementation of these algorithms and understand for which problems our current algorithmic solutions are already the best possible.

The group of theoretical computer science addresses various aspects of these questions. It is supported by European Research Council (ERC) project Lower bounds for combinatorial algorithms and dynamic problems, and by other grants. Members of the group regularly publish in the top conferences (STOC, FOCS, SODA) and top journals. We have extensive connections with top research centers abroad and also closely collaborate with other Czech groups, most notably the logic and complexity group at the Czech Academy of Sciences lead by P. Pudlák. We list several areas (and group members active in them) with outstanding results.

Computational complexity. The questions of how efficiently various computational problems can be solved, how optimal algorithms for various problems look like, what makes problems hard to solve by a computer, and where is the boundary of what can be solved efficiently are analyzed. We focus on the study of boolean circuits, which is the standard model of computation, on communication complexity, which measures the amount of communication necessary to solve problems by several parties, on extension complexity, which is an approach to understanding intractable problems, on limits of efficient data structures. Our group achieved outstanding results in the area of lower bounds for various computational models, in understanding the relationship between various computational resources, in computational geometry and semidefinite programming.

Algorithms and optimization. For many combinatorial and other problems it is easy to find some solution, on the other hand, it is significantly harder to find a good or even optimal solution for some measures of quality. For such problems we study approximation algorithms which find, at a reasonable speed, a solution which is close to the optimal one. One of the fundamental issues for algorithm design is the knowledge of input data. We study this area in two ways: First, we study online algorithms that learn the input piece by piece but have to produce a partial output immediately. Second, we study the problems of interval arithmetic, which assumes that the numbers on input are known only with some precision. Our group has excellent results both in the area of approximation and online algorithms for scheduling and related problems, and in the area of interval arithmetic, esp. for problems of linear algebra and linear programming. We also study linear and semidefinite programming and its algorithmic applications.

Knowledge representation. In representation of knowledge we study problems related to

efficient knowledge representation using tools of propositional logic, namely using propositional formulas. There are various areas of knowledge representation, among those we mainly concentrate on knowledge compression and knowledge compilation. In knowledge compression our interest is to find a smallest possible (e.g. in a sense of the length of a formula) representation of given knowledge base. In knowledge compilation we want to translate the given knowledge base into a form which is suitable for answering particular kinds of queries.

Hypercubes. Hypercubes form a class of graphs that is exploited in many applications; it is also an important model of parallel computers. Today they serve as a tool for modeling of network computers (or users). A Hamiltonian path in hypercube is a Gray code that has applications in many directions, in informational retrieval, signal encoding, image process or data compression. Therefore we orient our research on graph properties of hypercubes with special attention to paths covering a hypercube and study of hypercubes with faulty vertices.

FACULTY OF EDUCATION

Development of professional training of teachers

Principal Investigators:
Prof. Radka Wildová
Prof. Zdeněk Helus

The school is now confronted with urgent new challenges, arising primarily from the development dynamics of contemporary society, from the need to ensure equality of educational opportunities, from changes in childhood and youth caused by factors within contemporary society, from the benefits of new discoveries, especially in the field of pedagogy, didactics, psychology of effective teaching and learning, from changes in the educational reality caused by developments in the sphere of information and communication technologies and their penetration of structures and functions in society, from evaluation of the differences in the effectiveness of educational systems and the necessity of international cooperation in achieving common goals.

The aim of the research is development and usage of the innovative potential contained in research discoveries relevant for education, schools and teachers' work in the following areas:

(i) development of the theory of schools and the teaching profession, including the methodology of their research;
(ii) creation of programmes of undergraduate training and lifelong learning for teachers in order to increase the effectiveness of educational activity;
(iii) didactic measures addressed to pupils from different levels and types of schools;
(iv) methods and organisational forms of education;
(v) measures ensuring the inclusion of disadvantaged groups of pupils in educational streams;
(vi) creation of standards for teachers and school directors and policies for career growth and attestation degrees;
(vii) counselling support system for teachers and other educational staff.

Subject didactics research

Principal Investigators:
Dr. Jan Slavík
Dr. Naďa Vondrová
Dr. Jarmila Robová
Dr. Martina Šmejkalová
Dr. Miroslava Černochová
Dr. Ondřej Hník
Dr. Jana Stará

The research focuses on developing theories and research in subject didactics on the basis of a common (trans-didactic) approach to teaching and learning, which includes three basic interrelated research areas:

(i) Theory of didactic transformation of content for teaching research and assessment of its quality

The aim of the research work in professional didactics is to analyse, describe and explain the *personal, social and cultural conditions and intentional learning processes of pupils in*

tuition and based on it, to formulate suggestions and recommendations for *improvements of educational practice*, especially through the *professional training of teachers*.

Didactic transformations of content processes are analysed and interpreted in the research with regard to the degree of so-called *cognitive activation of pupils*, i.e., with respect to the active motivated formation of pupil's knowledge.

Cognitive activation of pupils is one of the key determinants of tuition which by its occurrence and the actual state in tuition determines the degree of quality of education; therefore, it is one of the most important categories (or variables) which justify subject didactic or trans-didactic research.

(ii) Research and theory of conduct and thinking of teachers in leading, planning and reflection of teaching

The aim of didactic research and development of the theory of professional conduct and thinking of teachers is to understand the determinants which determine the quality of teachers' didactic impact on pupils in tuition. The research and development of the theory of conduct and thinking of the teacher is based on three key constructs: (1) *professional sight,* (2) *reflective competence* as a part of *professional competence*, (3) *didactic knowledge of content*. We perceive such constructs as a mental framework which falls within the context of reflections and discussion on teacher training, on the development of their professionalism and improvement of the quality of teaching through reflection on practice.

(iii) Research and theory of pupils' ideas in relation to activities, competencies and learning content.

The aim of didactic research and development of the theory of pupils' ideas in relation to activities, competencies and learning content is influenced by the contemporary culture of teaching and learning, which draws inspiration from social and pedagogical constructivism. In it, the pupils' ideas (preconceptions) are related to the activities with the curriculum by one of the key entry conditions of intentional learning because their inter-subjective diversity encourages critical discussion and thinking about the studied content and motivates its cognition.

The aim of research into pupils' ideas is therefore to gain understanding of the didactically functional relationship between the development of ideas, the quality of activities and the improvement of competencies in socially conditioned learning.

Research of the psychological development of a child under the influence of scholarization

Principal Investigator:
Dr. Anna Kucharská

The research in this area focuses on the theory of the psychological development of pupils and adolescents in the context of school, family and their own individual activities, including interactions, both in terms of basic research and application approaches (the creation of diagnostic tools).

Areas of research

(i) the child and pupil on the developmental trajectory (from pre-school age to adolescence) and in the context of school demands and requirements – the concept of the social role of the pupil and student in the perspective of education formation, personal development and productive social inclusion; emotional, social and motivational aspects of learning (e.g., fear and boredom at school, the time perspective of secondary school students, including the possibility of diagnostics, diagnostic tools);

(ii) development of literacy with the search for psychological aspects and measures of this

process, the dynamics of the development of reading, writing, reading comprehension, the variability of development in high-risk groups (children with learning disabilities, with dysphagia, with Asperger's syndrome, poor readers, etc.) diagnostic options, diagnostic tools;

(iii) influence of the family and family circumstances, education and upbringing (including the issue of equal opportunity), communication between the school and the family, the theme of the relationship between the family and child with a behavioural disorder and the school.

(iv) monitoring the development and transformation of children's culture, the family and gender relations and connections with upbringing and education;

(v) research of the position of minorities in school, social factors and their influence on the formation of pupils' personality and social inclusion;

(vi) people (children, adolescents) with special educational needs, concepts, options and strategies of inclusive education as an urgent task for the present and future school, counselling and prevention in school-age children (problems in child development, childhood disorders, gifted children and their position and upbringing at school, etc.).

Support for people with special needs

Principal Investigator:
Dr. Jan Šiška

Research of the early development of children with multiple disabilities and its support, strategies of subsequent rehabilitation and education of children with cochlear implants. Searching for and verification of knowledge of how different social policies strengthen the full-value and effective participation of people with disabilities in the social and economic life of the society.

The European labour market is only partially able to offer employment to people with disabilities. Gender, age and disability determine the variety of job opportunities. Differences in the availability and use of new technologies in various types of disabilities can strengthen active citizenship or, on the other hand, weaken it. This is especially true for people with mental disabilities. Public and Social Administration determines the access to new technologies.

Adapted new technologies effect changes in the life of an individual, including short-term changes in education, employment, life in the community, but also long-term fundamental changes that will improve the economic independence and social integration of a person with disabilities.

Obstacles in terms of finance, technology and availability limit the options to acquire customized technology. Information barriers hinder individual choice in the market of tailored technology and procedural barriers limit effective access to it.

FACULTY OF SOCIAL SCIENCES

Modelling of rational inattention in economics

Principal Investigator:
Dr. Jakub Steiner

The research focuses on the implications of rational inattention to economic decisions of individuals and companies. Models of rational inattention focus on situations where it is costly for individuals to collect relevant information about a certain problem and rationally limit the amount of information they receive. Filip Matějka, for example, studied the issue of price dynamics of a monopolist when it is costly for the monopolist to collect information about the demand for their product. The model is able to replicate a wide range of facts observed in reality, for example, that prices vary between several fixed values, or that persistent shocks in prices are manifested with a delay. Matějka also studied the problem of discrete choice, when individuals can choose from a limited number of options (such as investments) and the detection of revenues is costly. Michal Bauer and Filip Matějka study rational inattention empirically. Specifically, they study how information on the ethnic origins of tenants or applicants for a job affect the amount of information the other side finds out about them.

Research of public administration employees in the Czech Republic

Principal Investigator:
Dr. Arnošt Veselý

Research of public administrative structures is based on the traditional understanding of officials (public policy analysts in the Anglo-Saxon tradition) as impartial executors of well-defined tasks from their superior political decision-makers. This traditional approach, based on the ideas of Max Weber and others, has, however, been recently challenged by numerous studies pointing out the complex nature of everyday work of public--administrative staff which goes beyond normal routine actions. These studies, particularly the Canadian, Dutch and British ones, together with the theoretical concepts of the role of officials in policy-making processes, stood at the birth of a specific orientation of public-administrative research into the nature of activities of employees of public administration institutions (policy work research).

A research team from the Institute of Sociological Studies FSV CU, led by Dr. Arnošt Veselý, conducted research into the activities of the staff of Czech ministries and regional authorities. Two quantitative surveys were used for the research to identify the activities, tasks and methods of interaction in the everyday activities of these workers. In order to obtain sufficient added value, the survey of the ministerial staff also focused on ascertaining their professional capabilities, values, accountability and politicisation.

The main research results so far known demonstrate the significant diversification of workflow incl. ways of interaction (superiors, colleagues, clients, other offices) in comparison with sparse quantitative data analysis and evaluation. The available records also demonstrate a low level of appointing directly politically engaged people to managerial positions in ministries (except for the positions of deputies). Overall, the research results suggest that thanks to the use of various professional-administrative styles, current public administration employees of the Czech Republic take on some defining features of a professional bureaucracy so far attributed to members of the regulated professions.

Collective memory as a theoretical and research concept

Principal Investigator:
Dr. Jiří Vykoukal

A research group centred around the UNCE workplace pays attention to the issue of collective memory in its socio-cultural, political and historical context in the 20th century. The multidisciplinary approach and cooperation of the project exceeding the boundaries of institute and faculty is typical. Research topics include:

(i) Memory of Totalitarian Regimes
(ii) Traumas of post-conflict societies (the Holocaust, the civil war in Yugoslavia, colonialism)
(iii) The role of memory in international relations and cultural diplomacy
(iv) Memory in art, education and culture.

International interactions: relations, security, and space

Principal Investigator:
Dr. Jan Karlas

This research programme deals with three areas that all concern international interactions: international relations, international security, and geopolitics. In the area of international relations, the research team concentrates on the analysis of international institutions. It proceeds from an assumption that international institutions facilitate the mutual coordination of states' policies. In this way, they help to the resolution of global problems, which cannot be anymore tackled by the independent effort of individual states. Apart from global institutions, the members of the research team also pay attention to the European integration process.

In the area of security, the research programme concentrates especially on strategic studies and critical security analysis. Strategic studies deal e.g. with the role of military technologies in international politics. The concern with strategic studies is balanced with the research in critical security studies. This stream brings to the study of security the emphasis on the ideational and discursive segments of security.

The geopolitical part of the programme explores the relationship between international politics and human geography. It examines the key theories of geopolitics, as well as the relations between space and politics in the key regions of the contemporary world. It aims at uncovering the dynamics that results from the global character of the current world and from its constantly shifting internal boundaries.

Media in the public sphere

Principal Investigator:
Dr. Alice Němcová Tejkalová

Several groups involved in international teams which approach the topic from different theoretical perspectives are involved in this research. The group focused on the research of journalism around Alice Němcová Tejkalová focuses on the analysis of media content, the working conditions of journalists and changes in them, ethical principles, the relationship between journalists and their sources, the influence of media ownership on the media industry, the relationship between politics, business and journalism, and so on. The team is involved in the largest ever international comparative research in this area, the Worlds of Journalism Study – www.worldsofjournalism.org. The PolCoRe group around Václav Štětka primarily focuses on the transformation of political communication research, with a focus on the so-called new media and their potential for political and civic participation. The group is involved in several international comparative studies of political communication in the COST framework. The research into the history of media has recently focused on the implementation of the three-year project "Czech media in 1945–1948". The research in the field of cultural studies performed by the focuses on the study of popular culture, especially television shows and in the Czech environment significantly anchored television series.

FACULTY OF PHYSICAL EDUCATION AND SPORT

Biomedical determeninants of movement

Guarantee:
Prof. Václav Bunc

The profilling and unique activities of the Faculty include: the evaluation of predispositions for movement loading, and thus also for the independence and self-serving of seniors and selected groups of patients – obese, dialyzed, disabled, cardiac – and evaluation of the effect of individual regime measures.

The predispositions for movement and sport performance at different levels of performance are evaluated, starting with children and ending with seniors, and at the same time an effect of applied training and regime measures is evaluated with the aim of adaptation of lifestyle, reduction of negative contemporary lifestyle, increase in performance, cultivation of movement skills, reduction of weight, etc.

Active lifestyle and quality of life

Principal Investigator:
Prof. Pavel Slepička

Research focuses on two basic areas connected with the role of various forms of sport and movement activities in influenclng psycho-social dimensions of quality of life. It deals with the individual and micro-social level (the individual, family, school class; research on the influence of movement on mental processes, self-concept, values, moral development, motoric performance, etc.) as well as the macro-social level (the analysis of the role of sport as a social phenomenon, the organization governance and ethics and integrity of sport, researchlng relationships of social stratification and participation into various kinds of movement activities). Special emphasis is put on disadvantaged groups in the population, such as children and youth, children with ADHD, persons with special needs, minorities, seniors, in relation to possible social exclusion.

Further, this area studies the meanlng of movement for the formation of life-style and for the development or preservation of movement and psychosocial skills that are necessary for the adequate adaptation of various groups in the population in changlng conditions in society (e.g. the creation of positive value orientation in children and enhanclng of quality of life of seniors) and creatlng a cooperative environment and the stimulation of social capital.

Biomechanical aspects of interaction of man and environment

Principal Investigator:
Dr. Karel Jelen

Biomechanics researches into questions of the functional and structural response of connective tissues, organs and systems to a dynamical stress field. The aim of the research is a mathematical

expression of rheological parameters of thermo--visco-elastic tissue structures (ligaments, tendons, bones and muscles). The output is then a parametrical expression of artificial materials (nanomaterials – scaffolds, implants) as the inputs for their production; the recommendation of stress programs during restoration of the organism after an injury or an operation; and reconditionIng procedures. Another focus is on issues concernIng the motor interactions of man (with an emphasis on concrete tasks with respect to work security, transport, ballistic safety and the safety of free--time activities, e.g. sport), and the development of physiotherapeutic products (e.g. unstable electro--mechanical platforms, motion splints).

The department is recognized as an Expert Institute of Forensic Biomechanics of Charles University in Prague – the application of biomechanics into the area of justice, the law and expert evidence.

FACULTY OF HUMANITIES

German and French Philosophy (EuroPhilosophie)

Principal Investigator:
Dr. Karel Novotný

The main focus of research and teaching is newer German and French philosophy, particularly phenomenology. The core of its most recent research activities has been the investigation of the relationship of body-based subjectivity with both the milieus of experiencing, as well as with the objectified environment of a naturalised world. "Environment" ("Umwelt") is a central concept already used in early phenomenological philosophy and philosophical anthropology. Primarily, phenomenological analyses show to what extent the concept of 'environment' is not objective, but is subjective. This lays the ground not only for clarifying the concepts of "nature" and "natural environment" in correlation to bodily subjectivity, but also for unveiling the potential

imagination, sign and language play within the process of the interaction of subjectivity and its surroundings.

Historical Sociology

Principal Investigators:
Dr. Jiří Šubrt
Prof. Johann Pall Arnason

The key theme is modernisation, with the assumption that modern society and modernisation processes are rooted in long-term history and are influenced by trends, traditions, and specific historical constellations. Other topics include issues of social change, globalisation trends, civilisation analysis, religious and cultural pluralism, or the formation of states and nations.

The department works on research projects focusing on the issues of collective memory, national elites, Central Europe (in collaboration with the University of Cologne), and the Arab revolutions.

The editors of *Historická Sociologie* journal (B. Šalanda, executive editor K. Soukalová) work at the department. The journal is on the list of reviewed journals in the Czech Republic, is included in scientific databases, and publishes texts in Czech and English.

Expertise in Longevity and Long-term Care

Principal Investigator:
Dr. Iva Holmerová

The CELLO-ILC is specialised interdisciplinary research centre focused on longevity and aging-related issues with emphasis on applied research, public policies and policy-oriented research, and evidence-based practice in the management and delivery of long-term care and support services. Recently, the Centre implemented several research and development projects for the Czech Government (Ministry of Health) and for the regional governments. It is a member of the Global Alliance of International Longevity Centres. The CELLO co-operates with international organisations (WHO, EUGMS, INTERDEM, Alzheimer Europe, Eurocarers, etc.) and participates in international projects (ELTECA, FRAM, INNOVAGE, PALLIARE, INDUCT etc.).

CENTRAL LIBRARY OF CHARLES UNIVERSITY

Modern methods in education

Principal Investigators:
Dr. Jitka Feberová
Prof. Stanislav Štípek

Charles University is systematically developing e-learning tools for education (dl.cuni.cz). The central installation of LMS Moodle CU, a system for creating e-learning courses, is among the biggest Moodle installations worldwide (about 5,000 courses and 50,000 users). Development of methodology for the evaluation of e-learning courses is also in progress at CU (www.certik.cz).

The central installation of Adobe Connect (webinars, video conferencing) and Streamserver CU (distribution of educational videos) is also available to teachers. Subject Wiki are operated

at a number of faculties. CU also deals with the issue of standardization of tests. The Medical Faculty of Charles University in Prague contributed significantly to the creation of MEFANET (Medical Faculties Network www.mefanet.cz), aimed at sharing electronic educational materials of medical faculties in the Czech Republic and Slovakia. Three main tools are operated within this network – a portal platform, LMS Moodle and WikiSkripta, where Moodle and WikiSkripta are operated for the entire MEFANET network at Charles University. WikiSkripta (www.wikiskripta.eu) is the most visited repository of materials for undergraduate medical education in the Czech Republic. It contains more than 8,000 articles and 20,000 to 30,000 readers go there daily for information.

Further information on the MRA can be found on http://www.cuni.cz/UK-7114.html

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