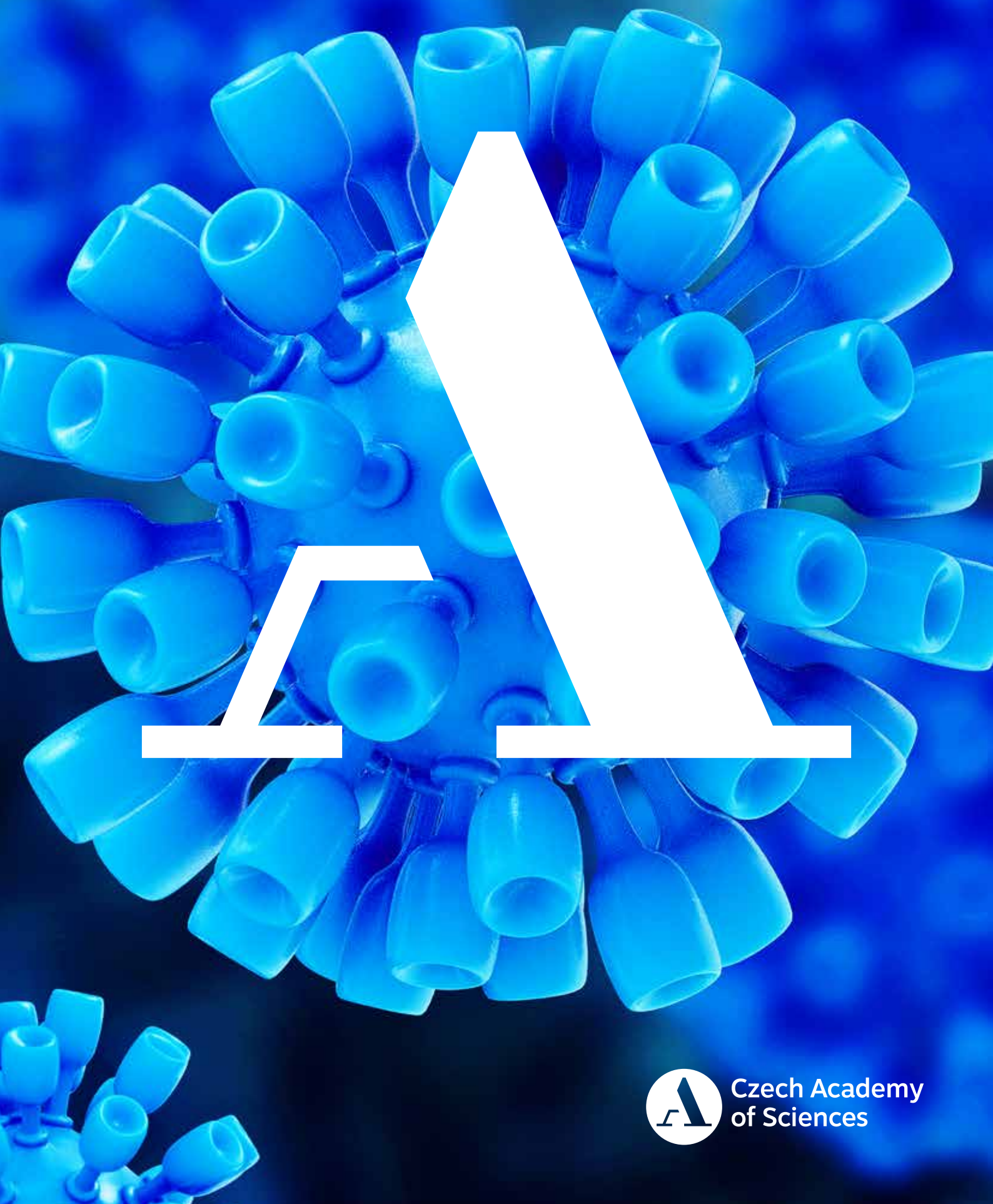
Strategy AV21



Czech Academy of Sciences

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STRATEGY OF THE CZECH ACADEMY OF SCIENCES

Academy Assembly adopted Strategy AV21 in December 2014. Its aim is to present the Czech Academy of Sciences as an institution which is focused on problems and challenges of contemporary society. In 2017, it has entered third year of its realization. It shows that the Czech Academy of Sciences is well aware of its commitments towards the society. Hence its motto: „Top research in the public interest".

I am convinced that it has succeeded in its basic orientation on subjects relevant for our society. This is evidenced by the results of evaluation of individual research programs for the period 2015-2016, which were met with positive response in political as well as entrepreneurial spheres. I am also very pleased to note, that the coordinators of individual research programs manage to establish close collaboration besides academic institutions also with a number of industrial and commercial subjects as well as with institutions of public sector and state administration.

Program flexibility marks an important advantage of Strategy AV21. Its program framework, which at the beginning of 2015 included 14 research programs, was supplemented by the program Global conflicts and local interactions at the end of 2015, and following the evaluation of its first two years by three more research programs: Universe for the mankind, Light at the service of the society and Preclinical testing of potential pharmaceuticals. As indicated by their names, they extend Strategy AV21 with topical and societally important themes in all three scientific areas. This updated brochure contains basic information on all 18 research programs.

I want to emphasize, that all research programs of Strategy AV21 are since their beginning open to partners from universities, entrepreneurial and public spheres, institutions of state administration as well as foreign research institutions. This is the area, where I see wide space for further development and deepening of partnership with educational and application sphere in science and research. Academy of Sciences is also open to new forms of collaborations offered by the Strategy AV21.

Eva Zažímalová
President of the Czech Academy of Sciences

Strategy AV21 is part of the vision of the Academy of Sciences as the place providing stable institutional framework for future generations of our researchers and motivating environment for multidisciplinary research exploiting synergy between its institutes as well as other research institutions. It emphasizes the need for science and research to accept its part of responsibility for the quality of the life of future generations of our citizens.

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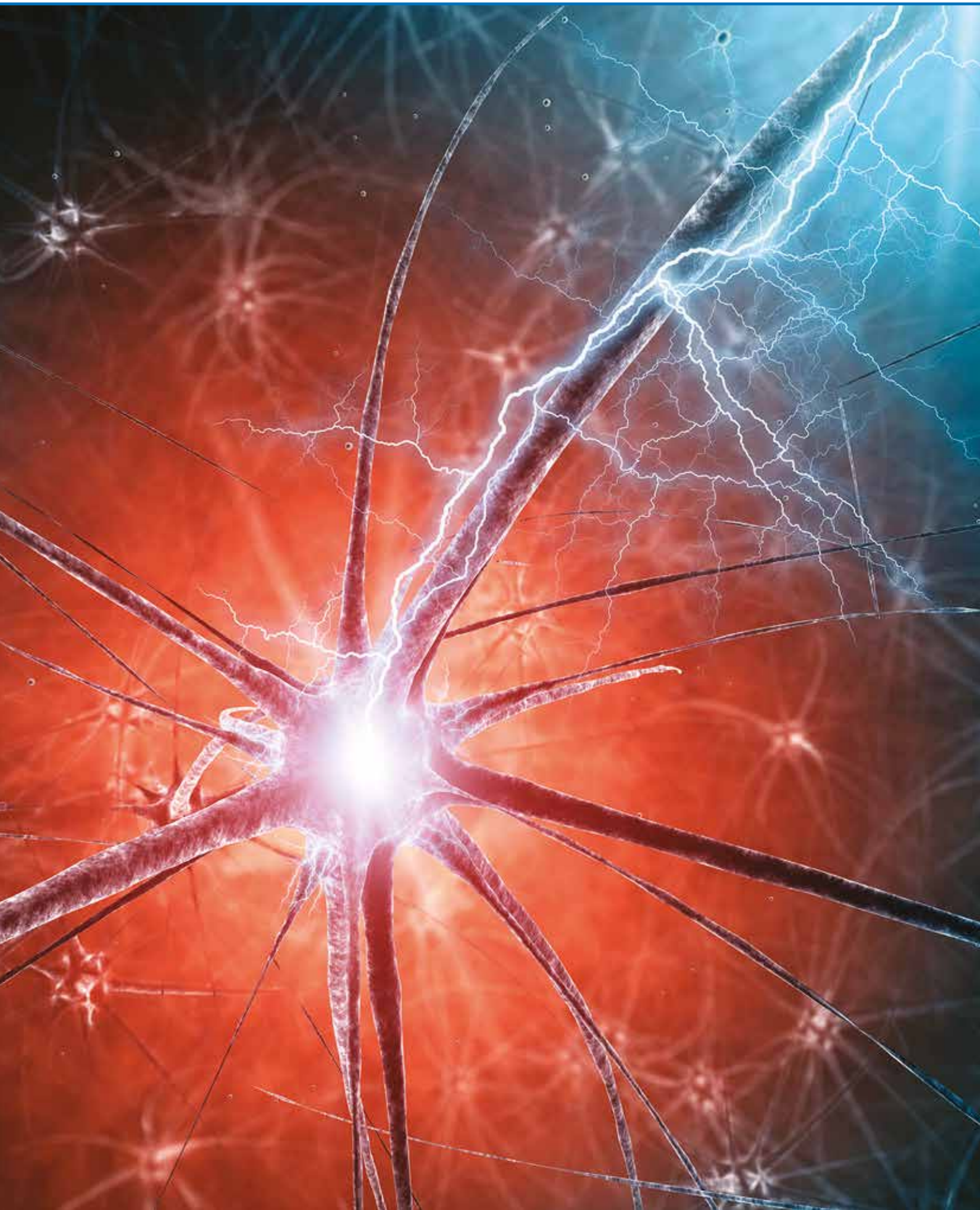


FRAMEWORK OF STRATEGY AV21

Strategy AV21 is rooted in and implemented through a set of coordinated Research Programmes of the closely co-operating institutes of the Czech Academy of Sciences. Research carried out within long-term interdisciplinary Research Programmes focused on contemporary problems and challenges as well as emphasis on practical application of the research results in economically and socially important areas constitute an important part of the mission of the Czech Academy of Sciences. Therefore, an important part of the strategy is the operation of the Application Laboratories of the Czech Academy of Sciences whose aim is to expand direct contacts and collaboration of the Czech Academy of Sciences with the application sector. At the same time, Strategy AV21 respects the key role of basic research which is at the core of development of all scientific disciplines.

The Research Programmes are designed and formulated in close collaboration of the top management of the Czech Academy of Sciences with the directors of the participating institutes, taking into account the trends in science, social relevance and the National priorities of oriented research, experimental development, and innovation. Programme organization, the form of its coordination, the individual activities, and persons representing the programme are determined by agreement between the directors of the involved institutes and the top management of the Czech Academy of Sciences.

Administrative support for a given Research Programme is provided by the parent institute of the coordinator. Directors of the participating institutes or authorized researchers serve as coordinators of the Research Programmes as well as contact persons for the public and the media. The coordinator searches for new, socially relevant research topics, performs synthesis of the state-of-the-art knowledge, and in collaboration with partner institutes and the Research Area guarantor coordinates the preparation of the Research Programme proposal.

Research Programmes are approved by the Academy Council in collaboration with the Council for Sciences for a period of five years. The running Research Programmes can be adjusted depending on the interim achieved results and new programmes can be proposed depending on the identified societal needs and attained level of knowledge. Strategy AV21 can be further supplemented with other affiliated activities which support its mission.

The Research Programmes are based on the long-term Research Areas of the Czech Academy of Sciences defined by the Academy Council in collaboration with the Council of Sciences, covering the whole spectrum of research activities of the Czech Academy of Sciences. The Research Areas are as follows:

- The Structure of Matter and the Universe
- Mathematics and Computer Sciences
- Cells and Organisms
- Human Health
- Society and Communication
- Memory and History
- Earth and the Environment
- Sources and Use of Energy
- New Materials
- Methods and Tools of Knowledge

Each Research Area is represented in the Academy Council by one of its members, who acts as a guarantor and a spokesperson for the Research Area and provides organizational support to the coordinators of the related Research Programmes. The guarantors also coordinate the preparation of the Research Area position papers. After approval by the Council of Sciences these papers are part of the general policy document of the Czech Academy of Sciences. The Academy Council is responsible for the overall organization and coordination of the processes of the design and evaluation of the Research Programmes of the Czech Academy of Sciences.

Czech Academy of Sciences

RESEARCH PROGRAMME 01

HOPES AND RISKS OF THE DIGITAL ERA

The coming digital era is accompanied with the ever growing deluge of data collected and processed in the form of digital signals. Electronic communication, modern methods in medicine, and data for economic and sociological studies are all based on this principle. If the flood of data should not engulf us but, on the contrary, become an important source of knowledge enriching our lives, we need tools of mathematics and computer science which enable us to sort and analyze data more efficiently and search for inherent relationships, with the aid of which we can reliably predict future developments. Today we take it for granted that medical instruments determine the required support levels of vital functions, cellular phones try to guess users' intentions and give them hints, cars are being equipped with elements correcting drivers' imperfect decisions, intelligent buildings adapt themselves to the environment, and automatic systems look after distribution of water and energy. A significant portion of our life is connected with the Internet, from shopping to banking services to communication with the authorities. Computers control power plants, transportation systems and medical instruments.

The general public's opinion is that the main key to further improvement of such equipment and systems is, above all, development of technology, including software. However, this idea is right only partly since technology is merely the means of delivery and the real key has to be looked for one level higher. Practical applications are based on mathematical models, and the latter can only describe a part of reality. Hence they have to be continuously verified and refined. A necessary prerequisite for this process is development of new theoretical tools that extend the frontiers of knowledge and enable us to analyze, understand and model the natural and social phenomena and processes. As an example we can mention fluid flow, employed in a wide range of areas from meteorology to blood flow in veins, behavior of materials in machinery, design and operation of deep geological repositories of nuclear waste, creation of fast and reliable algorithms for data processing and coding, error estimates in technical computations, cryptography in Internet communications, as well as other methods for protecting information and revealing relationships in long series of data and phenomena. All of these, and others, inspire new findings in a number of sciences.

"Mathematics is a tool to describe, study and understand the world around us. Computer science helps us in processing data and solving extensive problems. No progress would be conceivable without them."

COORDINATOR
Jan Flusser
Institute of Information Theory and Automation of the CAS

GOALS

- To develop new procedures in mathematical modeling of complex processes
- To develop algorithms for analysis of multidimensional signals and statistical data
- To research into and push forward the frontiers of computer capabilities
- To discover dependencies and causal relationships in time series

Participating CAS Institutes
Institute of Information Theory and Automation
Institute of Mathematics
Institute of Computer Science

Cooperating CAS Institutes
Institute of Geonics
Astronomical Institute
Institute of Philosophy
Institute of Psychology
Institute of Physiology

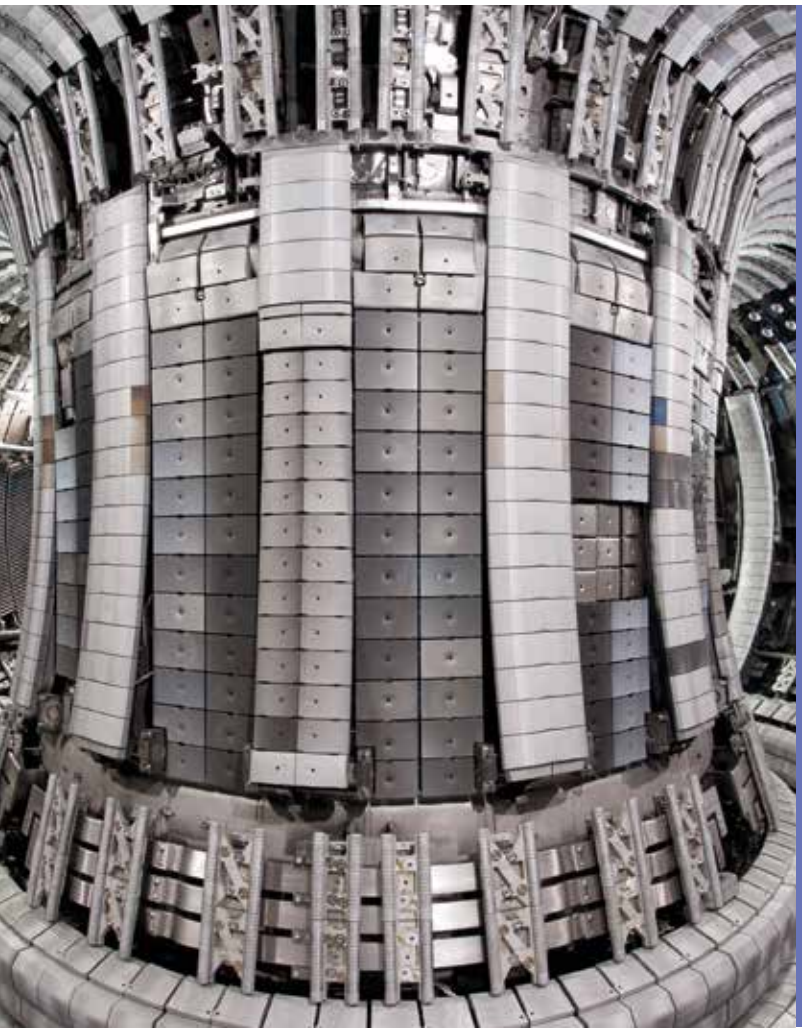
Cooperating partners
Institute for Clinical and Experimental Medicine
National institute of mental health Czech Republic
Škoda Auto, a. s.
Cisco Systems, s. r. o.
Police of the Czech Republic
AVAST Software, a. s.
Czech and foreign universities and other institutes

TOPICS/RESEARCH LEADERS

Mathematical modeling as a tool for efficient control of complex processes
Pavel Krejčí (Institute of Mathematics)
New methods in multidimensional data analysis and signal processing
Jan Flusser (Institute of Information Theory and Automation)
Pushing forward the frontiers of computer capabilities
Petr Cintula (Institute of Computer Science)
Search in time variable data for causes and relations of events
Milan Paluš (Institute of Computer Science)

"Development of mathematical algorithms for technical, natural and social sciences"

Czech Academy of Sciences

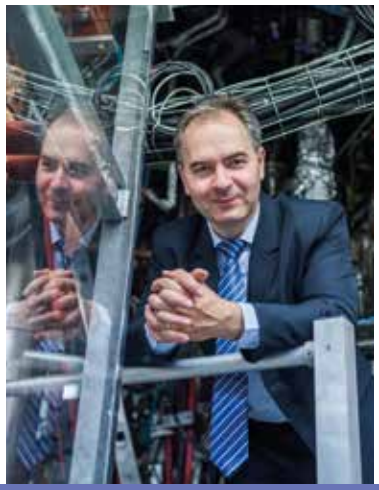


RESEARCH PROGRAMME 02

SYSTEMS FOR NUCLEAR POWER INDUSTRY

Czech Republic in its long-term plan for energy supply security counts on nuclear energy as an essential component of the energy mix and defines the need for research in both advanced fission generation IV reactors, as well as in the field of controlled thermonuclear fusion. Many of the problems associated with the development of generation IV fission reactors with high passive safety is similar to problems associated with development of the fusion reactor, e.g. in terms of materials hardiness to high neutron fluxes, low material activation etc. The difficulties and problems associated with the development of fusion reactor require joint efforts and resources not only within Europe but also worldwide. In accordance, *the National priorities of oriented research, experimental development and innovation* introduce a specific objective – participation in international R&D activities in the area of thermonuclear fusion. The character of the joint effort requires both the long-term strategy and the proper position of the Czech research at European and world scene with emphasis on those areas where our research institutions and industry can significantly contribute.

„Joint effort of our research institutes will contribute to the development and implementation of advanced nuclear technologies as the future safe and nearly inexhaustible source of energy for mankind.“



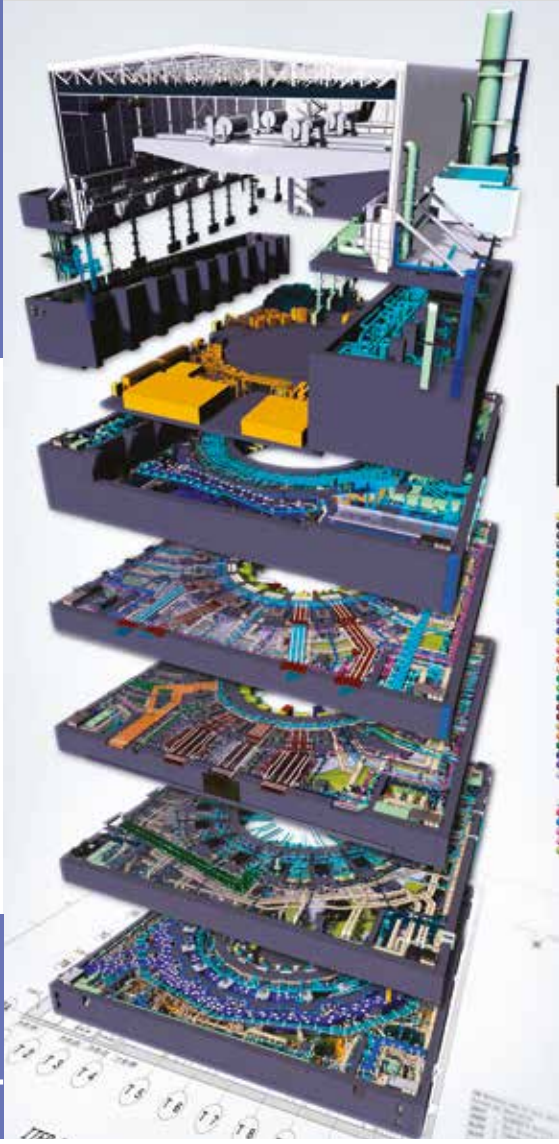
COORDINATOR
Radomír Pánek
Institute of Plasma Physics of the CAS

GOALS

- To address key physical and technological problems associated with the implementation of the ITER reactor and future fusion devices
- To develop new materials, which can withstand extreme conditions in the generation IV reactors and fusion reactors
- To develop new methods for determination of seismic hazard of nuclear installations
- To determine missing data for nuclear reactions in advanced nuclear facilities
- To prepare the next generation of experts for research and operation of the future nuclear installations, especially in the area of nuclear fusion
- To define the main social aspects of nuclear power

Participating CAS Institutes
Institute of Plasma Physics
Nuclear Physics Institute
Institute of Physics of Materials
Institute of Rock Structure and Mechanics
Institute of Sociology

Cooperating partners
Research Centre Řež
Institute of Nuclear Research
Central European Institute of Technology (CEITEC)
NETME Centre (New technologies in engineering)
Czech and foreign universities and other institutes



TOPICS/RESEARCH LEADERS

Participation of the COMPASS tokamak in international project of nuclear fusion research
Radomír Pánek (Institute of Plasma Physics)
Development of materials for advanced nuclear reactors
Jiří Matějíček (Institute of Plasma Physics)
Seismic hazard for nuclear facilities
Jiří Málek (Institute of Rock Structure and Mechanics)
Nuclear data for fusion and advanced nuclear systems
Vladimír Wagner (Nuclear Physics Institute)
Preparation of experts for research and operation of nuclear facilities
Jan Stöckel (Institute of Plasma Physics)
Social aspects of nuclear power
Martin Ďurďovič (Institute of Sociology)

"To solve the problems associated with implementation of the ITER reactor and future fusion devices"

Czech Academy of Sciences

RESEARCH PROGRAMME 03

EFFICIENT ENERGY CONVERSION AND STORAGE

The long-term self-sufficiency and security of the energy supply in the Czech Republic, an enhancement of the export potential for the Czech producers of energy and energy-related technology, and the reduction of the environmental burden – these are the most imminent societal challenges for the research of efficient conversion of various energy sources, energy storage, and smart energy distribution. Numerous institutes of the Czech Academy of Sciences conducting relevant fundamental research strive to look for novel solutions and bring critical innovations to existing energy technologies. The research will focus on renewable energy sources and the associated increased demands on the distribution network and energy storage, on the geophysical conditions for wind, solar and geothermal power generation, on the development of nanostructured materials for conversion and storage of energy, as well as on the search for suitable materials for thermal energy storage or direct conversion of solar energy to hydrogen. Comprehensive research of fuel technologies will include the utilization of separated combustion products and the production of energy from waste. The progress of decentralization of power production requires the development of smart power grids based on advanced statistical and dynamic models. The necessity of balancing the intermittent output of the renewable energy sources calls for adequate energy storage capacities in the form of hydrogen, advanced batteries and supercapacitors, or for example flywheels. The success of the transformation of the energy sector in the upcoming decades will depend on the success of the core research in many areas of technology, physics, chemistry, biotechnology, computer science and even social sciences. Our research program provides a platform for interdisciplinary research in energy technologies and for transferring its results to professionals and the public.

"Efficient coordination of the research within the Academy and a closer collaboration with other research institutions and industrial partners will provide novel solutions to the energy-related societal challenges."

COORDINATOR
Jiří Plešek
Institute of Thermomechanics of the CAS

GOALS

- To ensure efficient utilization of renewable energy sources
- To facilitate storage of energy from renewable energy sources
- To pursue research towards smart distribution of energy
- To develop new fuels for efficient and clean combustion
- To develop new materials for energy conversion

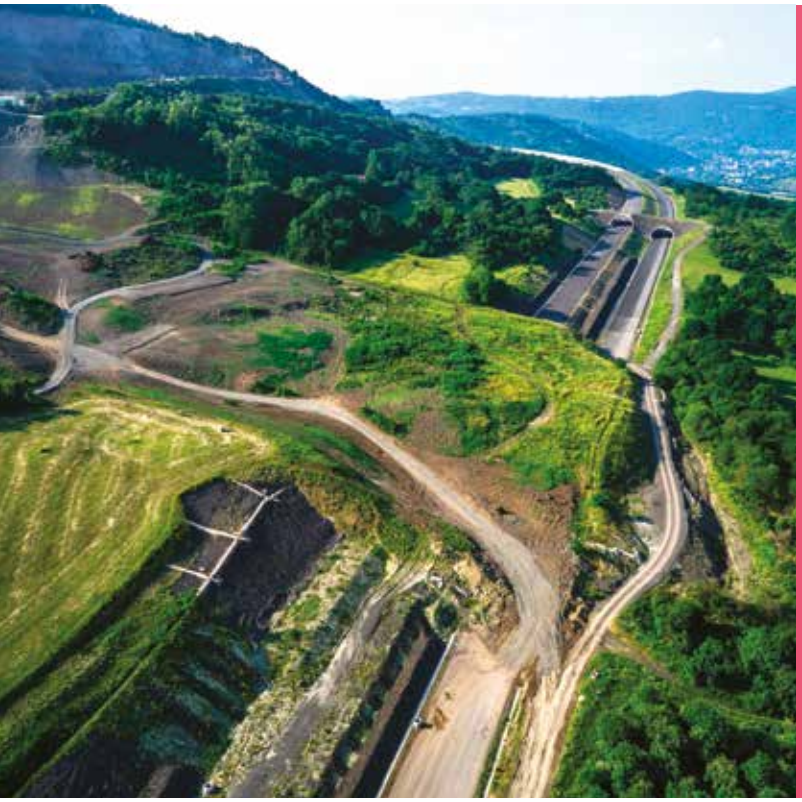
Participating CAS Institutes
Institute of Thermomechanics
Institute of Chemical Process Fundamentals
Institute of Computer Science
J. Heyrovsky Institute of Physical Chemistry
Institute of Physics
Institute of Rock Structure and Mechanics
Institute of Atmospheric Physics
Institute of Physics of Materials
Institute of Macromolecular Chemistry
Institute of Plasma Physics
Institute of Scientific Instruments
Institute of Information Theory and Automation
Institute of Geophysics
Global Change Research Centre

TOPICS/RESEARCH LEADERS

Nanostructured materials for energy conversion
Ladislav Kavan (J. Heyrovsky Institute of Physical Chemistry)
Efficient utilization of renewable energy sources and smart distribution of energy
Emil Pelikán (Institute of Computer Science)
Storage of thermal energy
Jan Hrubý (Institute of Thermomechanics)
New fuels for efficient and clean combustion
Miroslav Punčochář (Institute of Chemical Process Fundamentals)
Direct conversion of solar energy to hydrogen
Miroslav Punčochář (Institute of Chemical Process Fundamentals)
Flywheel energy storage
Jaroslav Zapoměl (Institute of Thermomechanics)

"Conversion, storage, distribution, broader context. Energy for the future"

Czech Academy of Sciences



RESEARCH PROGRAMME 04

NATURAL HAZARDS

Earth's surface is permanently affected by the activity of natural exogenous and endogenous processes. Their dynamics and interactions lead to occurrence of dangerous natural phenomena, which endanger the human society at different scales and may eventually result in its decay or even downfall. Some phenomena (earthquakes, landslides, floods, geomagnetic storms) are in the scope of a permanent public interest. However, beside them there are many other processes and phenomena with less publicity, nevertheless capable of causing serious problems to the whole human civilization or its fundamental part. Extreme droughts, soil degradation or erosion, and water and atmosphere pollution can be named as examples. In the Czech Republic, generally a country with low occurrence of natural disasters, the direct property losses exceeded 113 billion CZK during last 20 years. Besides that, there were 509 casualties, and about 1.6 million people were affected by the consequences of natural disasters. And this excludes the indirect losses, which generally exceed the direct ones several times. However, no systematic and reliable inventory of indirect losses has ever been compiled.

Our knowledge gradually gathered across individual scientific areas indicates that research of most processes and phenomena call for interdisciplinary collaboration between individual scientific areas, ranging from studies of Earth's interior, through landscape formation processes to studies of cosmic influences. Therefore, this program is aimed on deeper and complex understanding of natural hazards and finding possibilities of their prediction in order to reduce considerably the negative impact on the human society.

"The way to protection against natural hazards leads only through their deep understanding, which cannot be achieved without modern multidisciplinary research."

COORDINATOR
Josef Stemberk
Institute of Rock Structure and Mechanics of the CAS

GOALS

- To acquire deeper and more comprehensive understanding of the processes in the Earth's interior, on the surface, and in the atmosphere and space, which lead to natural hazards and risks
- To explore possibilities for their predictions by broad-based interdisciplinary research
- To significantly reduce or completely mitigate their negative impact on the society

Participating CAS Institutes
Astronomical Institute
Global Change Research Institute
GeoInstitute of Physics
Institute of Geology
Institute of Psychology
Institute of Atmospheric Physics
Institute of Geonics
Institute of Hydrodynamics
Institute of Computer Science
Institute of Rock Structure and Mechanics
Institute of State and Law
Institute of Thermomechanics
Institute of Inorganic Chemistry

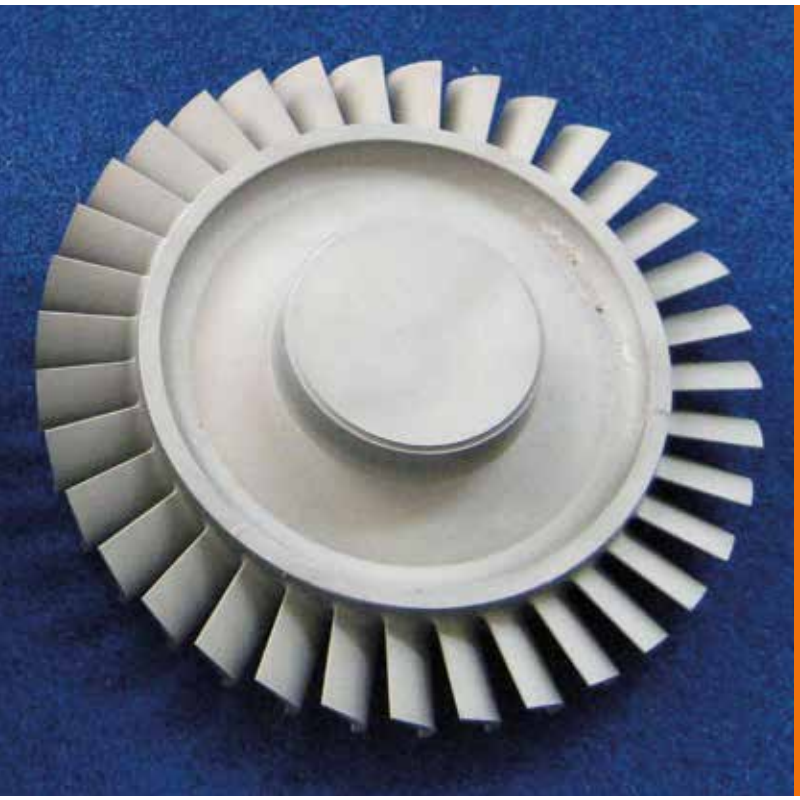
Cooperating partners
Czech Geology Survey
Radioactive Waste Repository Authority
Czech Hydrometeorological Institute
Arcadis CZ, a. s.
GB-geodézie, spol. s r. o.
Geodis, a. s.
CHEMCOMEX, a. s.
ROCKNET, spol. s r. o.
STRIX Chomutov, a. s.
Czech and foreign universities and other institutes

TOPICS/RESEARCH LEADERS

Earthquakes and seismic hazards
Jan Šílený (Institute of Geophysics)
Water and Atmosphere
Miroslav Tesař (Institute of Hydrodynamics)
Drought
Zdeněk Žalud (Global Change Research Institute)
Climatic changes and landscape evolution
Michal Filippi (Institute of Geology)
Man and changes of landscapes
Karel Kirchner (Institute of Geonics)
Space Weather
Dalia Obrazová (Institute of Atmospheric Physics)
Assessment of hazards and consequences of collision of interplanetary body with the Earth
Jiří Borovička (Astronomical Institute)
Care of the natural environment aimed at preventing and averting natural hazards: historical, legal and social dimensions
Hana Müllerová (Institute of State and Law)

"Deeper and more comprehensive understanding of a variety of processes leading to natural hazards and risks"

Czech Academy of Sciences



RESEARCH PROGRAMME 05

NEW MATERIALS BASED ON METALS, CERAMICS AND COMPOSITES

Human society has always been, still is and always will be critically dependent on materials. Engineering materials make a basis for progress of technology and development in all branches of industry: as from high strength steels for industrial applications, superalloys for power generation and aircraft engines, biocompatible metals for life-saving medical implants, building materials, nanomaterials with unique properties, up to functional materials and composites. Sustainable progress cannot be reached without basic material research and without thorough understanding of relations between parameters of material microstructure and material behavior. Obviously, permanent attention is paid worldwide to the advancement of new materials and new processing technologies. The research often receives pronounced support at the governmental level in the advanced countries. Material research should be therefore considered as one of the crucial fields of the strategically oriented research in the Czech Academy of Sciences. It turns out that the complexity, interdisciplinary nature, and expensiveness of experimental work require coordination of the research within the groups of scientists in diverse institutes of the Czech Academy of Sciences and exploitation of newly found and build large research infrastructures. It is believed that this way can create sufficiently broad-based interdisciplinary research environment necessary for effective solving of new challenges in material science. Taking into account the extremely expensive experimental facilities for advanced material research, the high-quality project of long-term targeting and enabling procurement of large investments are necessary in the Czech Republic. This project has to substantially exceed the short-term research projects supported by various grant agencies.

"Development of civilization is inseparably connected to the utilization of materials in the broadest sense. Plentitude of materials, their quality and properties are the limiting factors for development of human society. From the Research Programme I expect getting new basic knowledge on metal based materials, ceramics and composites which will help to maintain the sustainable growth."

COORDINATOR
Ludvík Kunz
Institute of Physics of Materials of the CAS

GOALS

- Research and development of new functional and engineering materials on metal, ceramics and composite base
- Deep understanding of properties of these materials in relation to their structure and to engineering applications
- Development of cooperation in the area of surface treatment of engineering materials
- Integration of research community of the Czech Academy of Sciences and raising awareness of the industrial sector
- Support of development and application of new experimental methods for material research
- Efficient use of large research infrastructures

TOPICS/RESEARCH LEADERS

Severely deformed materials with stabilized structure
Pavel Lejček (Institute of Physics)
Powder materials and their solidification
Tomáš Chráska (Institute of Plasma Physics)
Shape memory alloys with controlled response
Petr Šittner (Institute of Physics)
Surface treatment of materials
Danijela Rostohar (Institute of Physics)
Materials for extreme conditions
Pavel Hutař (Institute of Physics of Materials)
Materials for energy saving and sustainable growth
Aleš Kroupa (Institute of Physics of Materials)
Progressive nanocomposites
Anna Macková (Nuclear Physics Institute)
Theoretical investigation and mathematical modelling of properties of metal based materials, ceramics and composites
Martin Friák (Institute of Physics of Materials)

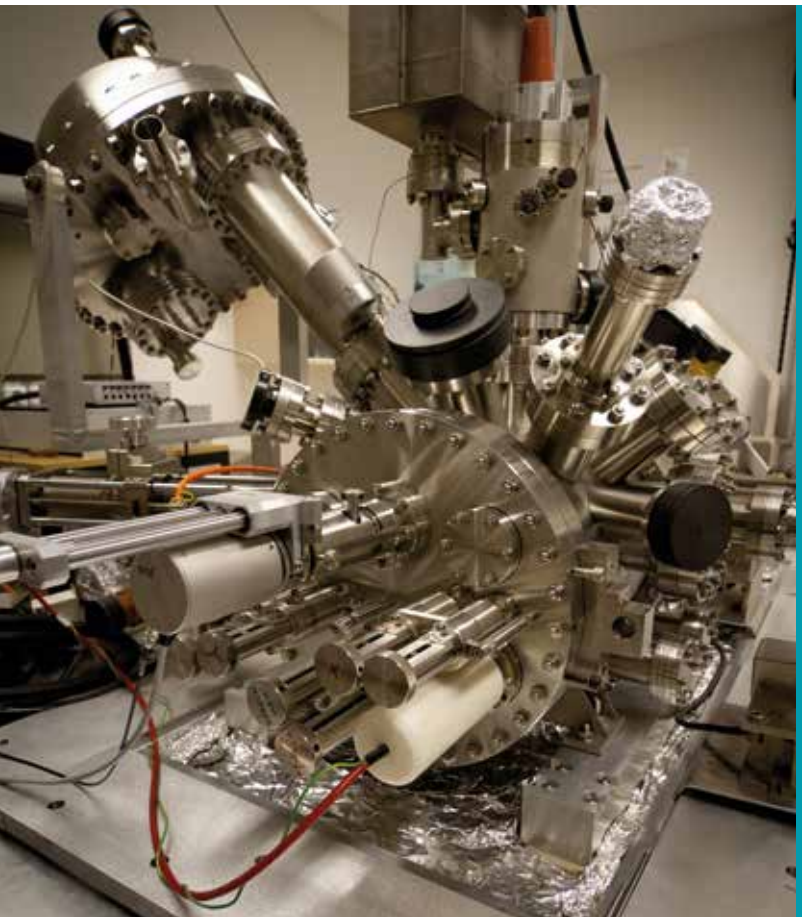
"Integration of research community of CAS in the field of engineering materials, and close cooperation with industry and efficient utilization of large research infrastructures"

Participating CAS Institutes
Institute of Physics of Materials
Institute of Physics
Nuclear Physics Institute
Institute of Plasma Physics
Institute of Scientific Instruments
Institute of Thermomechanics
Institute of Geonics
Institute of Rock Structure and Mechanics

The program could make use besides the laboratories of participating research teams in the institutes of CAS also existing and new build research infrastructures like HILASE, CEITEC, IPMinfra, I4T, CANAM, ALISI.

Cooperating partners
První brněnská strojírna Velká Bíteš, a. s.
Bonatrans, a. s.
ČEZ, a.s.
TESCAN
Research Centre Řež
Research and Testing Institute Plzen
VÚHŽ Dobrá,
Hanon Systems, a. s.
DT- Pointworks and Engineering,
Sunfire, Germany
BeamIT, Italy
Czech and foreign universities and other institutes

Czech Academy of Sciences



RESEARCH PROGRAMME 06

DIAGNOSTIC METHODS AND TECHNIQUES

Czech Republic has a long-standing tradition in the area of precise machinery, electronics, optics, special devices and corresponding advanced technologies. To make sure this tradition is upheld, extended into other areas and further developed at a cutting-edge level, it is necessary to seek new physical, chemical, imaging and diagnostics principles, new procedures and modern technologies, and to develop new methods for the study of microstructures and nanostructures of both living and non-living matter. Original theoretical results in natural and technical sciences are acquired during the evaluation of these principles, as are unique methodical procedures and device elements.

Progress nowadays is unthinkable without interdisciplinary approach, without intensive communication and cooperation among top specialists from a variety of disciplines. Often the time-tested procedures from one area cause a surprising breakthrough and further development in another area, if they are applied in a non-conventional way. The ultimate goal is their use in basic and applied research, predominantly in the areas of biomedicine and physics of materials, in industry and for the education of the next scientific generation.

"High-quality scientific work should blend together basic, experimental, and applied research."

COORDINATOR
Ilona Müllerová
Institute of Scientific Instruments of the CAS

GOALS

- To make the use of low temperature physics for biology and space research
- To develop advanced non-invasive diagnostics procedures for human and veterinary medicine and biology
- To apply electron, ion, and light beams to nanodiagnostics and creation of structures
- To develop advanced measurement methods and metrology for research and industry
- To develop special technologies for extremely precise and technically advanced applications
- Laser microbeam applications

Participating CAS Institutes
Institute of Physics
Institute of Photonics and Electronics
Institute of Information Theory and Automation
Institute of Physiology
Institute of Organic Chemistry and Biochemistry
Institute of Experimental Medicine
Institute of Physics of Materials
Institute of Plasma Physics
Institute of Molecular Genetics
Institute of Inorganic Chemistry

Cooperating partners
FEI Czech Republic, s. r. o.
Frentech Aerospace, s. r. o., Brno
TESCAN ORSAY HOLDING, a. s.
DELONG INSTRUMENTS, a. s.
VIDIA, s. r. o.
Photon Systems Instruments, s. r. o.
RUAG Gmbh
Rigaku ITE, s. r. o.
MESING , s. r. o.
FOCUS GmbH
API Optix, s. r. o.
Research Centre Rez
Czech and foreign universities and other institutes

TOPICS/RESEARCH LEADERS

Liquid matter systems and low temperature physics for biology and space research
Aleš Srnka (Institute of Scientific Instruments)

Advanced non-invasive diagnostics procedures for human and veterinary medicine and biology
Pavel Jurák (Institute of Scientific Instruments), Jiří Homola (Institute of Photonics and Electronics), Lucie Kubínová (Institute of Physiology), Pavel Dráber (Institute of Molecular Genetics)

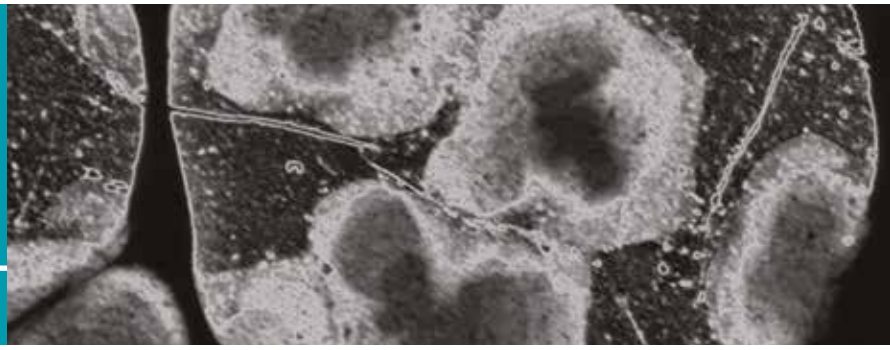
Nanodiagnostics of structures and their creation using electron, ion and light beams
Tomáš Radlička, Vilém Neděla, Vladislav Krzyžánek, Filip Mika (Institute of Scientific Instruments), Jan Lorinčík (Institute of Photonics and Electronics), David Hradil (Institute of Inorganic Chemistry)

Measurement methods and metrology for research and industry
Josef Lazar, Ondřej Číp (Institute of Scientific Instruments), Alexander Kuna (Institute of Photonics and Electronics)

Special technologies for extremely precise and technically advanced applications
Jaroslav Sobota (Institute of Scientific Instruments), Karel Koláček (Institute of Plasma Physics)

Laser microbeam applications
Pavel Zemánek (Institute of Scientific Instruments)

"Nanodiagnostics of structures and their creation using electron, ion and light beams"



Czech Academy of Sciences

RESEARCH PROGRAMME 07

WELLBEING IN HEALTH AND DISEASE

Health is conventionally defined as a state of complete physical, mental and social wellbeing, and together with economic and cultural factors it represents one of the main pillars of an individual's life. Severe illnesses can result in long-term or persistent decline in wellbeing for the individual and their social network/friends and family. In developed countries, diseases of modern civilization are the major health burden. They are predominantly consequences of over-consumption and a sedentary lifestyle and appear to increase in frequency as countries become more industrialized. Access to modern medical care and the availability of early treatment contributes to a longer life span in developed countries, but also increases the number of ageing, chronic disease sufferers. Successful management and reintegration of individuals with severe illness and disability into the community is one of the major challenges of contemporary medicine.

Tackling the causes and understanding the mechanisms of severe illnesses to reduce their personal and social consequences requires an innovative, multidisciplinary program and integration of expertise from various research disciplines including; medicine, physics, engineering, social sciences and the humanities. This comprehensive approach will lead to novel discoveries about the molecular, cellular, systemic and epidemiological basis of these diseases and natural regenerative mechanisms, which are crucial prerequisites for the development of new treatments. Furthermore, this initiative encompasses the legal and ethical disciplines to promote the successful implementation of new therapies into clinical practice.

The main goal of the programme is to develop more effective strategies to prevent and treat lifestyle-choice related diseases. The programme aims to directly develop innovative diagnostic tools and therapies to prevent and treat diseases of modern civilization, minimize their consequences and promote faster recovery. In addition to restoring health, these strategies should also enhance the successful social integration of disease sufferers, their re-employment and ultimately improve the wellbeing of the patient and their carers. There will be added economical benefit of reducing both the direct health costs associated with the treatment, rehabilitation, and formal care and the indirect costs, resulting from the loss of productivity and social welfare payments.

"The Wellbeing in Health and Disease programme represents a collective effort across multiple research disciplines to fight serious illnesses and their consequences. Our joint initiative shall increase human wellbeing in all life conditions."

COORDINATOR
Jakub Otáhal
Institute of Physiology of the CAS

GOALS

- To pursue multidisciplinary biomedical research
- To integrate and support the research groups within the programme research domain
- To focus research on the most important needs of contemporary healthcare

TOPICS/RESEARCH LEADERS

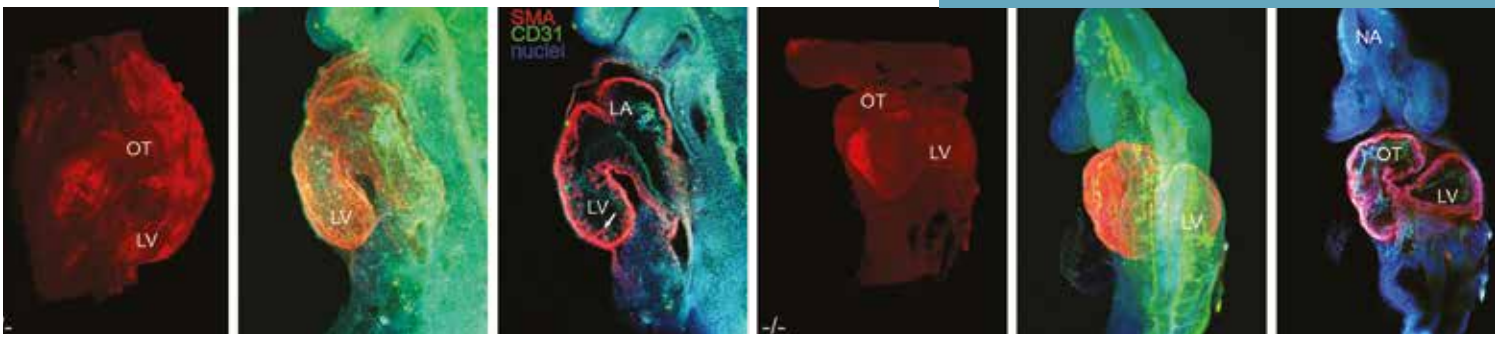
Disorders of the nervous system during development and aging
Přemysl Jiruška (Institute of Physiology)
Chronic inflammation and cellular energetics — the common determinants of the serious diseases development
Tomáš Mráček (Institute of Physiology)
Genetic factors leading to the development and progression of ilnesses
Libor Macůrek (Institute of Molecular Genetics)
Regenerative medicine
Pavla Jendelová (Institute of Experimental Medicine)
Age and gender as key factors underlying disease causes and their progression
Martin Sládek (Institute of Physiology)
State of the art bioengineering tools for biomedical research
Jana Pěknicová (Institute of Biotechnology)
Tomáš Suchý (Institute of Rock Structure and Mechanics)
Ethical, legal and social impacts of diseases
Dana Hamplová (Institute of Sociology)
Influence the newborn with the environment
Jan Topinka (Institute of Experimental Medicine)
Center for epigenetics
Eva Bártová (Institute of Biophysics)
Center for organ cultures
Vladimír Kořínek (Institute of Molecular Genetics)

Participating CAS Institutes
Institute of Biophysics
Biology Centre
Institute of Biotechnology
Institute of Physiology
Institute of Microbiology
Institute of Psychology
Institute of Sociology
Institute of Physics of Materials
Institute of Analytical Chemistry
Institute of Vertebrate Biology
Institute of Experimental Medicine
Institute of Photonics and Electronics
J. Heyrovsky Institute of Physical Chemistry
Nuclear Physics Institute
Institute of Macromolecular Chemistry
Institute of Molecular Genetics
Institute of Organic Chemistry and Biochemistry
Institute of Contemporary History
Institute of Scientific Instruments
Institute of State and Law
Institute of Rock Structure and Mechanics
Institute of Information Theory and Automation
Institute of Thermomechanics
Institute of Animal Physiology and Genetics

The Wellbeing in Health and Disease programme provides a platform for integration of innovative research infrastructures (Biocev etc.) with the existing facilities and research teams of the participating organizations.

Cooperating partners
Motol University Hospital, Military University Hospital Prague, Institute for Clinical and Experimental Medicine (IKEM), The General University Hospital in Prague, Na Homolce Hospital, Hospital Královské Vinohrady
Czech and foreign universities and other institutes

"Effective transfer of research findings into practical outputs"



Czech Academy of Sciences

RESEARCH PROGRAMME 08

FOODS FOR THE FUTURE

Feeding a growing population is the most important challenge for the near future. Food shortage results in human suffering, disturbs healthy growth and development of new generation, leads to political instability and worsens the security situation. On line with the efforts to avert the threat of food shortage, a growing attention is being paid to the quality of food and the efficiency of its production. Human food and animal feed should contain all necessary nutrients and must be free of pets and harmful compounds, including agents causing adverse reactions of the organism. A demand has been growing for food and nutritional supplements with increased content of beneficial compounds and microbes protecting human health. Almost all human foods are plants or organisms that eat plants. However, the crop plant and hence also animal production are being threatened by gradual degradation and loss of arable land and by the changing climate. The solution is to grow new varieties and breeds resistant to diseases and pests, abiotic stress, and with increased yield and better quality. A rich source of such traits is the genetic makeup of wild crop relatives, wild breeds and unicellular algae. To date, these resources have not been exploited fully and one of the reasons has been a limited knowledge of the structure, function and transmission of their heredity information. The Foods for the Future research program responds to the global socio-economic problem through multidisciplinary approaches and state-of-the-art technologies, including the methods of genome editing that contribute to greater efficiency in breeding and agricultural production without negative environmental impacts. The Program also focuses on the prevention of diseases of the digestive tract and on a better use of microalgae in nutrition and production of valuable substances. The attention is paid to wasting food and to new approaches for processing of natural materials and bio-waste. The program comprises top research teams from the Academy of Sciences of the Czech Republic who cooperate with university departments and other research organizations. The new knowledge, resources and methods will be used by breeders, companies engaged in the production of plant and livestock products, state administration and various non-profit and patient organizations.

"Coordination of research activities and collaboration among the partners of the programme contributes to the production of safe and healthy food in sufficient quantity in ecologically and economically sustainable manner."

COORDINATOR
Jaroslav Doležel
Institute of Experimental Botany of the CAS

GOALS

- We are obtaining new insights into the hereditary information of agricultural crops to help in breeding crops with high and stable yield and with better quality
- We are developing methods for genome editing that are the foundation of new plant breeding techniques
- We are dealing with molecular technologies for livestock breeding, production, processing and use of food of animal origin
- We are focusing on the prevention of digestive tract diseases and, in particular, the influence of gluten and probiotics on human health
- We are exploring opportunities to make better use of microalgae in the nutrition of man and farm animals
- We are studying valuable substances of plant and animal origin and their use
- We are elaborating new biotechnological methods for processing natural materials and bio-waste
- We are finding out why people waste food and we contribute to the reduction of unnecessary losses

Participating CAS Institutes
Institute of Animal Physiology and Genetics
Institute of Biophysics
Institute of Chemical Process Fundamentals
Institute of Experimental Botany
Institute of Microbiology
Institute of Sociology

Collaborating CAS Institutes
Biology Centre
Institute of Botany
Institute of State and Law

Cooperating partners
Agritec, Ltd.
Agrotest fyto, Ltd.
Central European Institute of Technology (CEITEC)
Centre ALGATECH
Centre of the Region Haná for Biotechnological and Agricultural Research
Crop Research Institute
DLF-Trifolium Hladké Životice, Ltd.
Food Research Institute Prague
Hop Research Institute Co., Ltd.
Institute of Animal Science
Milcom, a. s.
Oseva UNI, a. s.
Perník, Ltd.
Research and Breeding Institute of Pomology Holovousy, Ltd.
Selgen, a. s.
Czech and foreign universities and other institutes

TOPICS/RESEARCH LEADERS

Genomics and plant biotechnology for efficient breeding
Jaroslav Doležel (Institute of Experimental Botany)
Modern methods of genome editing: tools to ensure the accessibility and quality of food
Roman Hobza (Institute of Biophysics)
Molecular technologies for breeding farm animals; production, processing and use of food of animal origin
Jan Kopečný (Institute of Animal Physiology and Genetics)
Use of microalgae in the nutrition of man and farm animals
Ondřej Prášil (Institute of Microbiology)
Health safety of new and alternative food raw materials
Helena Tlaskalová-Hogenová (Institute of Microbiology)
Research on valuable substances of plant and animal origin and their use
Olga Šolcová (Institute of Chemical Process Fundamentals)
Wasting food as a social problem
Tomáš Kostelecký (Institute of Sociology)

"Producing enough healthy food"

Czech Academy of Sciences

RESEARCH PROGRAMME 09

DIVERSITY OF LIFE AND HEALTH OF ECOSYSTEMS

Conservation of the quality of the environment is one of the major challenges faced by contemporary society. In some areas, the lack or decline in the quality of ecosystems' major components, such as soil or water, have already manifested themselves very negatively. Nevertheless, only healthy ecosystems can be the basis for the proper functioning of society and they are an essential condition for its development. The disturbance of natural variety of life – biological diversity (biodiversity) – and the weakening of basic ecosystem functions (ecosystem services) strongly increase the risks for the future of human society and its welfare.

The programme topics involve the study of biodiversity at the molecule, gene, species, community, and ecosystem levels as well as research targeted on the understanding of the key biogeochemical cycle mechanisms and flows of substances and energy among the components of the ecosystem. The hierarchical classification of biodiversity offers an extraordinary opportunity for interdisciplinary cooperation. The programme will also involve the study of co-evolution and interrelationships of species, the research of invasive species and their influence on native ecosystems, and the assessment of genetic variation in populations and speciation processes.

Methodologically, the programme combines biological, ecological, geological, and social disciplines with the ambition to bring an original and comprehensive understanding of biodiversity and its importance for human society against the background of abiotic components of the environment as well as knowledge about the structure and functions of terrestrial and aquatic ecosystems.

The results will find their use in proposals of sustainable systems of plant protection and, more broadly, in agriculture, forestry, fishery, and other fields related to the ecosystem services. The output will also include both theoretical and practical approaches to environmental care, modern nature and landscape conservation, and other recommendations following the effective and sustainable use of natural resources by human society, providing a good quality of life as a result. An important part of the programme will be communication with the general public and the education of all target groups.

"Understanding of biological diversity is essential not only for sustainable exploitation of organisms, biological processes, and current ecosystem services but also for its protection and preservation for the future generations."

COORDINATOR
Miloslav Šimek
Biology Centre of the CAS

GOALS

- To deepen understanding of the processes of biodiversity and the origin of new species
- To extend understanding of the ecosystem structure and dynamics
- To Identify key mechanisms of co-evolution and inter-species relationships
- To clarify the dynamics of dispersal of invasive and introduced species
- To better understand the nature of stress responses that ensure the survival of organisms
- To understand the mobility and accumulation of environmentally significant trace elements
- To analyze the current landscape structure and the human interaction with it
- To analyze values, attitudes, opinions and declared behavior of the population to preserve biodiversity and sustainable development
- To analyze opinions on possible public political provisions to protect biodiversity and ecosystems

TOPICS/RESEARCH LEADERS

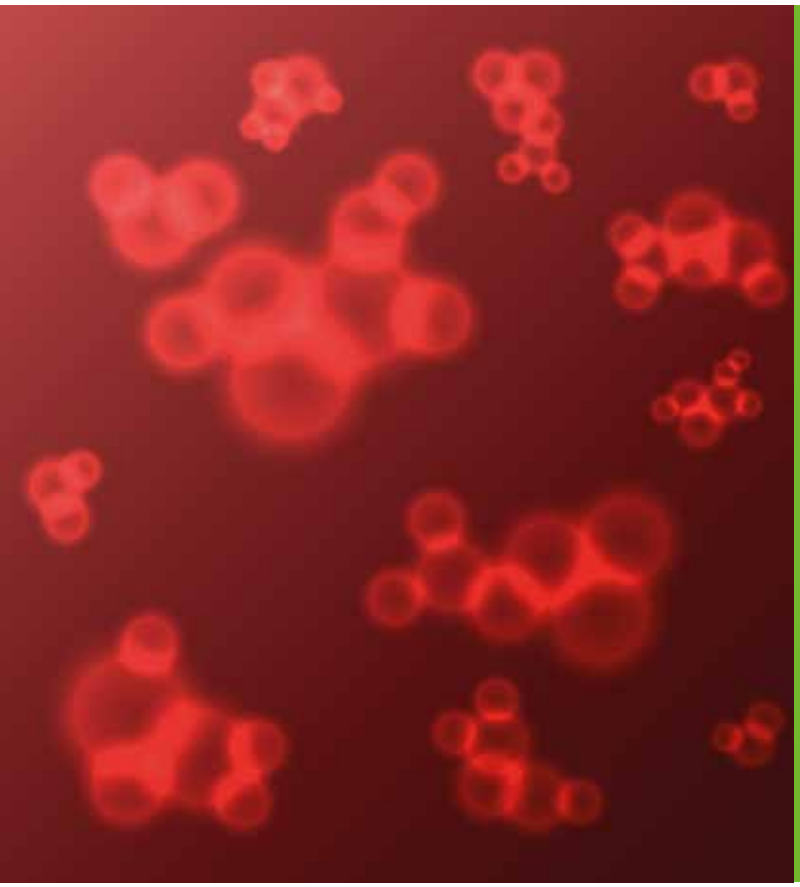
Biological collections, Genetic banks, and Databases - a unique source and treasury of information
Jan Zima, Barbora Zemanová (Institute of Vertebrate Biology)
Biodiversity in time and space - the basis for knowledge of biodiversity and landscape protection
Petr Petřík (Institute of Botany)
Co-evolution of organisms, Invasive organisms and Biodiversity
Jan Štefka (Biology Centre)
Protection of biodiversity, ecosystems and territories – the ensuring of quality ecosystems services for the future
Tomáš Cajthaml (Institute of Microbiology)
The social dimension of biodiversity protection, Public education, Popularization of research results, Technology Transfer
Miloslav Šimek (Biology Centre)

"Understanding of the processes of biodiversity and the origin of new species"

Participating CAS Institutes
Biology Centre
Institute of Botany
Institute of Geology
Institute of Microbiology
Institute of Sociology
Institute of Vertebrate Biology
Institute of State and Law
Institute of Animal Physiology and Genetics

Cooperating partners
Nature Conservation Agency of the Czech Republic; Biopreparáty, spol. s r. o.; The Charles University Environment Centre; Center for Theoretical Studies; Envisan-GEM, a. s., Rudolfov; Ekovermes, s. r. o.; Eurovia CS, a. s.; The Faculty of Environmental Studies, Czech University of Life Sciences, Prague; Hydro-Kov, s. r. o.; The Faculty of Forestry and Wood Technology, Mendel University in Brno; Forests of the Czech Republic, Hradec Králové; Municipality of Olomouc; Municipality of Pilsner; Metrostav, a. s.; Municipality of Tábor; Ministry of the Environment of the Czech Republic; Palivový kombinát Ústí n. Labem, s. p., Všebořice; Elbe River Basin, Hradec Králové; Morava River Basin, Brno; Odra River Basin, Ostrava; Ohře River Basin, Chomutov; Vltava River Basin, České Budějovice; Pöyry Environment, a. s., Brno; Propher, s. r. o., Březová u Zlína, Slušovice; Faculty of Sciences, Masaryk University in Brno; Faculty of Sciences, University of South Bohemia in České Budějovice; Faculty of Sicences, Charles University; Rybnikářství Pohořelice; Sokolovská uhelná, a. s.; The Krkonoše Mountains National Park; The National Park and protected Landscape Area of Šumava; The Bohemian Switzerland National Park; Podyjí National Park; Vitens Evides International, Netherlands; Vodohospodářský rozvoj a výstavba, a. s.; The Silva Tarouca Research Institute for Landscape and Ornamental Gardening; Czech and foreign universities and other institutes

Czech Academy of Sciences



RESEARCH PROGRAMME 10

MOLECULES AND MATERIALS FOR LIFE

The program focuses on the research of new chemical technologies that would address contemporary challenges and needs of the society, emphasizing environmental protection and development of new medical preparations as tools for improving the quality of life. Increasing accents on the environmental protection require introduction of more efficient chemical technologies, in which selective catalytic systems would play a decisive role by decreasing the energy consumption and thus enable more efficient use of natural resources. Medicinal chemistry, taking advantage of detailed knowledge of structure-to-function relationships, will bring new, selectively active drugs. Progress in macromolecular chemistry and physics will afford well defined synthetic polymers, macromolecules with a capacity to self-organize in higher supramolecular structures and in a controlled manner interact with selected target molecules in cells and tissues of the organisms. New approaches will thus open ways for the development of targeted drugs, biomaterials supporting the regeneration of tissues or new tissue formation, as well as devices for selective medical diagnostics. The programme builds on an interdisciplinary effort, combining the approaches of medicinal and macromolecular chemistry on one side with those of inorganic and physical chemistry on the other, all the traditionally strong scientific disciplines in the Academy of Sciences. In addition to broad application potential in the fields of new compounds and materials for medicine or more effective catalytic systems for industry and environmental protection, the Research Programme will bring substantial progress in elucidation of mechanisms governing the self-organization of molecules and provide deeper understanding of structure-to-function relationships of new materials.

"Without the natural macromolecules, there wouldn't be any life, without synthetic macromolecules – polymers, our daily life wouldn't be so safe and comfortable."

COORDINATOR
Jiří Brus
Institute of Macromolecular Chemistry of the CAS

GOALS

- To develop new catalysts for efficient chemical processes with lower energy requirements
- To prepare more selective biologically active compounds for modern medicine and better quality of life
- To develop new generation of polymers applicable as carriers for targeted drug delivery, biomaterials for tissue regeneration and engineering, and for selective diagnostics
- To elucidate mechanisms governing the self-organization of macromolecules into supramolecular structures and controlling of their interactions with target molecules in living cells and tissues

Participating CAS Institutes
Institute of Macromolecular Chemistry
J. Heyrovsky Institute of Physical Chemistry
Institute of Organic Chemistry and Biochemistry
Institute of Inorganic Chemistry
Institute of Chemical Process Fundamentals
Institute of Analytical Chemistry
Institute of Physiology
Institute of Microbiology
Institute of Molecular Genetics
Institute of Experimental Medicine

Cooperating partners
Institute for Clinical and Experimental Medicine (IKEM); The Institute of Molecular and Translational Medicine, Palacky University Olomouc; Gilead Sciences, Inc.; Zentiva, a. s. (Sanofi Group); Wake, s. r. o.; Beznoska, s. r. o.; ELLA-CS, s. r. o.; VÚAnCh, a. s.; Euro Support Manufacturing Czechia, s. r. o.; Elmarco, s. r. o.; Pardam, Ltd.; Aqua obnova staveb, s. r. o.; Barvy a Laky Teluria, s. r. o.; Denas Color, a. s.; Advanced Materials-JTJ, s. r. o.; Czech and foreign universities and other institutes

TOPICS/RESEARCH LEADERS

Nanostructured materials for catalysis and environmental protection
Ladislav Kavan (J. Heyrovsky Institute of Physical Chemistry)
Biologically active molecules
Michal Hocek (Institute of Organic Chemistry and Biochemistry)
Macromolecular Systems and Biomaterials for Modern Medicine
František Rypáček (Institute of Macromolecular Chemistry)

"New catalysts for efficient chemical processes"

Czech Academy of Sciences

RESEARCH PROGRAMME 11

EUROPE AND THE STATE: BETWEEN BARBARISM AND CIVILISATION

The programme studies the transformations of both historical and present form of the (Central) European state as a phenomenon. The focus is not on its historical development from primitive to complex types but on the historical oscillation between the positive and negative forms of an organisation that sometimes tyrannises society (barbarism) and other times brings it to humanity and culture (civilisation). The analysis of the role of the state seems to be useful for the public, which needs enough information and arguments to make qualified decisions on its attitude towards the state.

The Research Programme thus includes primary analyses of the state as an organisational and functional principle as well as of our society's perception of itself, its value systems, its own culture etc. A part of the research into the issues of the European state is to understand the complicated relations and conflicts introduced by the state – both in the present and in the course of history. Its aims are to study the tension between the European state and individuals, but also to analyse the normative concepts of the state as well as conflicts between the state and the culture of its society and to compare the European state with its non-European models. The expected outcomes should contribute to the social discussion on both positive and negative aspects of the state and on the issues of social morality and ethics, which are closely associated with the form, status and function of the state. Another objective is to draw attention to the role of the humanities in society in defining social phenomena and interpreting their origin and function. The research results of the programme are intended for the general and professional public, including those active in politics and the public sector. They will therefore be presented to the Czech parliament (in particular its specialist committees) for discussion, to which the researchers responsible for the individual themes will contribute. A broader discussion with the public will be stimulated by collaboration with Czech Television, Czech Radio and the media, since it belongs to the essential prerequisites for the functioning of contemporary society to explain and accept the role of the state and its positive as well as negative potential. The programme outcomes will be applicable to the area of education and schooling on various levels of social discussion and argumentation. Therefore, it will also be important to cooperate with museums and other memory institutions.

GOALS

- To elucidate the organisation of society and its tools
- To deepen the understanding of the civilisation process formation and destruction
- To clarify the legal, philosophical, ethical and religious reflections of the state
- To study the relations between culture, arts and the state
- To extend the understanding of the European state in non-European contexts

Participating CAS Institutes
Institute of Archaeology, Brno
Institute of Archaeology, Prague
Institute of Ethnology
Institute of Philosophy
Institute of History
Library of CAS
Masaryk Institute and Archives
Oriental Institute
Institute of Slavonic Studies
Institute of Sociology
Institute of Art History
Institute of Czech Literature
Institute of the Czech Language
Institute of Contemporary History
Institute of State and Law

Cooperating partners
Parliament of the Czech Republic
Czech Television
Czech Radio
National Archives of the Czech Republic
National Museum
Moravian Museum
Czech and foreign universities and other institutes

TOPICS/RESEARCH LEADERS

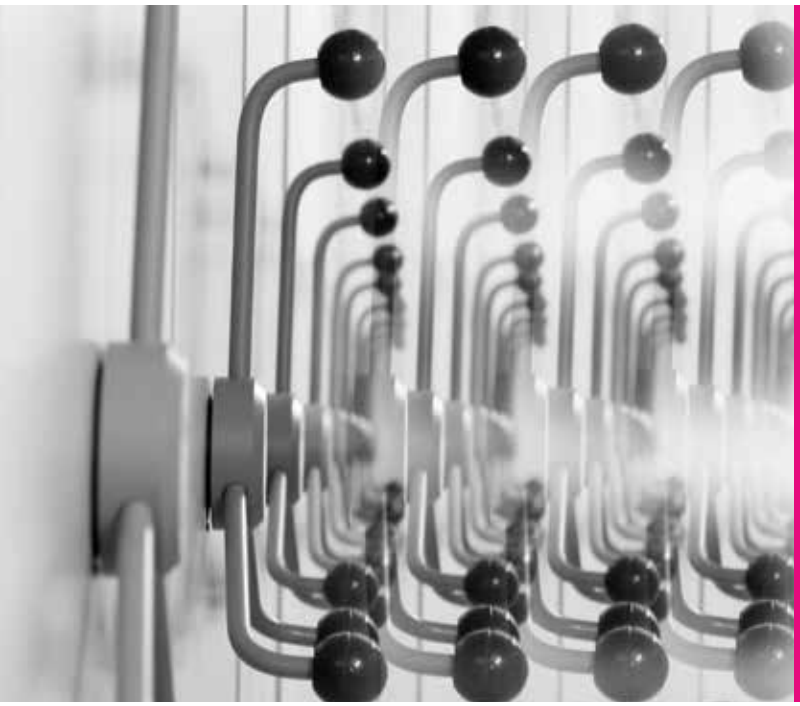
The State as a Form of Organisation: Violence or Freedom?
Eva Semotanová (Institute of History),
Society and the State or Society Versus the State?
Oldřich Tůma (Institute of Contemporary History)
Philosophical Reflections on the Organisation of State Power
Miloslav Bednář (Institute of Philosophy)
Culture in the European State, the State in European Culture
Petr Kratochvíl (Institute of Art History)
Europe in Non-European Context
Jaroslav Strnad (Oriental Institute)

"The relationship between European states and individuals, analysis of the formation and destruction of civilisational processes"

"The study of the state as a form of organisation of human society will bring a number of arguments for social discourse on the current role of the state and its historical roots."

COORDINATOR
Petr Sommer
Institute of Archaeology of the CAS, Prague
Institute of Philosophy of the CAS

Czech Academy of Sciences



RESEARCH PROGRAMME 12

MEMORY IN THE DIGITAL AGE

Human memory – individual and collective – is one of the key research topics in the humanities and the social and natural sciences. Modern science is confronted with a phenomenon that has many layers as well as a sort of secrecy. Research on memory over the entire range of ways of its understanding and investigating is very important to society. Interdisciplinary methods can be used to study it and the institutes of the Academy of Sciences, thanks to their research potential, constitute a unique research center. The humanities and social sciences see memory primarily as something that creates culture, which is reflected in the complex and often traumatic history of the twentieth century and its interpretation.

Memory in and of itself is selective and subjective. Combined with the accelerated dynamics of progress, changes in the society and the family, as well as new technological possibilities, these aspects of human memory stand out and naturally or purposefully newly form (and deform) the cultural memory, the culture of remembering or purposeful "forgetting." We lack an interdisciplinary platform to record and analyze memory processes, which would devote itself to research individual and collective memory in a complex way and would thus provide a space for the reflection of the general questions of how it works, how it's formed and how it's then transferred back into the thoughts of individuals and the society. Researching memory in its socio-cultural, psychological or cognitive forms is only one side of this coin. Just as important are the questions and problems connected to the recording and accessibility of memory and the cultural memory of the society. The construction of relevant research infrastructure is part of this goal. The research outputs will be monographs, papers in journals, academic conferences, databases, web interfaces, expert methodology and reviews. They can be used in: a) research and development; b) education (in schools, museums and libraries); c) media (radio, television, film, educational publishing houses) and cultural industry (tourism, etc.); d) state administration (counseling and other collaboration with the departments of the Ministry of Education, Youth and Sports and the Ministry of Culture).

"Memory is often called the warehouse of our ideas. Today, we would like to organize this warehouse more systematically and make it more accessible to the public."

COORDINATOR
Luboš Velek
Masaryk Institute and Archives of the CAS

GOALS

- To pursue research into individual and collective memory
- To analyze the culture of remembering and "forgetting"
- To trace the transformations of traditional values and social structures
- To develop research infrastructures for the preservation and analysis of memory
- To make the historical memory accessible

TOPICS/RESEARCH LEADERS

Memory: its formation and transformation
Dagmar Hájková (Masaryk Institute and Archives)
Islands of reliable knowledge. The encyclopedic basis of the digital age
Karel Piorecký (Institute of Czech Literature)
Digital Humanities – access, preservation and saving sources in the digital age
Martin Lhoták (Library)
Treasures of memory: critical access and interpretation of Czech historical and cultural sources
Jiří Flaišman (Institute of Czech Literature)

Participating CAS Institutes
Institute of Archaeology, Brno
Institute of Archaeology, Prague
Institute of Ethnology
Institute of Philosophy
Institute of History
Library of CAS
Masaryk Institute and Archives
Oriental Institute
Institute of Slavonic Studies
Institute of Sociology
Institute of Art History
Institute of Czech Literature
Institute of the Czech Language
Institute of Contemporary History
Institute of State and Law

Cooperating partners
National Archives
Ministry of the Interior of the Czech Republic
Czech Television
Czech Radio
National Museum
The National Gallery in Prague
National Library of the Czech Republic
The Ministry of Education, Youth and Sports of the Czech Republic
Ministry of Culture of the Czech Republic
Czech and foreign universities and other institutes

"Tracing the transformations of traditional values and social structures"

Czech Academy of Sciences

RESEARCH PROGRAMME 13

EFFECTIVE PUBLIC POLICIES AND CONTEMPORARY SOCIETY

The programme aims to help the wider public, as well as the academic community, to understand the complex and rapidly changing 21st century society in which we live in. The programme's interdisciplinary research projects are looking for answers to key questions about how today's society and public policies function, for example: To what extent do taxes and benefits influence economic behaviour and lead to ineffectiveness? Does the latest knowledge in physics, evolutionary theory, and neuroscience shift the boundaries of human freedom, and how? What are our attitudes towards morality, ethics and the law, and how do those attitudes affect our behaviour? Has the concept of free will changed the meaning and purpose of responsibility in civil and criminal law, and the meaning and purpose of punishment? How extensive is the shadow economy and to what extent is corruption slowing down business? What are the pros and cons of public support for home ownership and rental? Can social and housing policy react on local and global crises? What are the benefits from education, how high they are and how does education affect employment and long-term economic and social development? What effects does the minimum wage have? What threats and opportunities do immigration and emigration present? What kind of social and economic phenomena does the demographic aging represent and how can public policies react to it? Which forces keep heterogeneous societies together and which forces divide them?

The programme puts strong emphasis on public policies in various areas. The scientific outcomes are therefore widely communicated with the policy makers, stakeholders as well as general public. The knowledge gained from our research provides independent feedback and contribution to more effective governance of our democratic society. The programme will also contribute to training the next generations of researchers in the social sciences, who will become familiar with both Czech and international contexts, as well as with modern methodological approaches and standards in scientific research.

"Public policies, in tax, education, immigration, housing and many other areas, cannot be practiced well without being supported by knowledge gained through high quality empirical social science research. Our research programme will provides that knowledge to the state and to the general public."

COORDINATOR
Daniel Münich
Think tank IDEA at the Economics Institute of the Czech Academy of Sciences

GOALS

- To examine socio-economic, normative and philosophical factors and problems that dynamically affect public policies
- To provide insight into the causality of social phenomena and processes
- To present the results and scientific knowledge to the wider public in a comprehensible form
- To participate in public debates and contributing with independent and critical insights

TOPICS/RESEARCH LEADERS

Education, educational policy and the labour market
Daniel Münich (Economics Institute),
Jiří Večerník (Institute of Sociology)
The demographic aging
Daniel Münich (Economics Institute)
The effects of the tax and benefits system
Daniel Münich (Economics Institute)
Mobility: the movement of people, goods and information
Zdeněk Uherek (Institute of Ethnology)
Dynamics of change in Czech society
Pat Lyons (Institute of Sociology)
Poverty, wealth and the middle class
Jiří Večerník (Institute of Sociology)
Housing markets and their regulation
Martin Lux (Institute of Sociology)
Freedom, responsibility and their consequences for society
Tomáš Doležal (Institute of State and Law)
Contemporary ethics
David Černý (Institute of State and Law)

Participating CAS Institutes
Institute of Ethnology
Institute of Philosophy
Economics Institute
Institute of Sociology
Institute of Contemporary History
Institute of State and Law

Cooperating partners
Ministry of Labour and Social Affairs of the Czech Republic and labour offices
Czech Social Security Administration
Expert Committee on Pension Reform
Ministry of Education, Youth and Sports of the Czech Republic
Czech School Inspectorate
Ministry of Regional Development of the Czech Republic
Ministry of the Interior of the Czech Republic
Ministry of Justice of the Czech Republic
Ministry of Foreign Affairs of the Czech Republic
Technology Agency of the Czech Republic
Establishes advisory bodies of the Office of the Government of the Czech Republic
Public Defender of Rights
Union of Towns and Municipalities of the Czech Republic
Czech-Moravian Confederation of Trade Unions
The Czech Chamber of Commerce
Confederation of Industry of the Czech Republic
European Commission
Council of Europe Development Bank
OECD
International Monetary Fund
Czech and foreign universities and other institutes

"Participate in and enrich public debate by contributing independent information and constructive criticism"

Czech Academy of Sciences

RESEARCH PROGRAMME 14

FORMS AND FUNCTIONS OF COMMUNICATION

The programme is focused on investigating the social, cultural and psychological functions of communication, the conditions of understanding among individuals and social groups, and the sources of communication failures. The subjects of the research include the development of forms of communication and their function in generating, maintaining, and disrupting social structures, the role of communication in shaping personality and its contribution to the emergence of personality disorders, the possibilities of formal analysis and modelling the processes through which linguistic utterances are understood and language is acquired, the nature of communication among scientific disciplines and between the scientific community and society, the communicative functions of art, and the social conditions for their fulfillment. Each of the ten main research topics is conceived as a basis for collaboration among representatives of various disciplines and Academic institutes. The typical outputs are collective monographs, thematic issues of journals, interdisciplinary (and in most cases international) conferences, exhibitions etc.

In view of the key role played by communication in all spheres of social life, it can be expected that the research results will find relevant practical applications and will be of use to (among others): a) institutions regulating the (potentially contentious) relations between social groups, including those whose participation in the social dialogue is for various reasons limited; b) institutions active in the sphere of education and edification; c) institutions responsible for directing scientific research, for creating the necessary conditions for its development and for the social applications of its results; d) institutions responsible for implementing state cultural policy and for creating favorable conditions for the social functions of art.

"I have never had the opportunity to communicate with such a broad interdisciplinary team—and if the research topic is communication itself, its possibilities and its failures, then that makes the challenge all the more attractive."

COORDINATOR
Petr Koťátko
Institute of Philosophy of the CAS

GOALS

- To analyse the forms, tools and risks of public communication
- To investigate the role of communication and social interaction in the development of personality
- To demonstrate the historical forms and transformations of communication
- To propose new methods for the formal analysis and modelling of communication
- To analyse the possibilities and functions of interdisciplinary communication and of the dialogue between the scientific community and society
- To investigate the communicative potential of art

TOPICS/RESEARCH LEADERS

Forms, tools and risks of public communication
Marek Hrubec (Institute of Philosophy)
The role of communication and social interaction in the development of personality
Marek Blatný (Institute of Psychology)
Communication in Middle-Ages: symbols–words–images
Robert Novotný (Institute of Philosophy)
Communication in Early modern period: forms–structures–media
Martin Holý (Institute of History),
Vladimír Urbánek (Institute of Philosophy)
Reasoning, understanding and their formal models
Ondřej Majer (Institute of Philosophy)
Cognition, communication, mind, brain
Juraj Hvorecký (Institute of Philosophy)
Science in Czech society (paradigms, institutions, comparations)
Antonín Kostlán (Institute of Contemporary History),
Martin Franc (Masaryk Institute and Archives)
Responsible research and innovations: communication and interaction between science and society
Tereza Stöckelová (Institute of Sociology)
Language and methodology of natural science
Vladimír Havlík (Institute of Philosophy)
Art as a form of communication
Tomáš Winter (Institute of Art History)

"To analyse the functions, tools, and risks of public communication"

Participating CAS Institutes
Institute of Ethnology
Institute of Philosophy
Institute of Physics
Institute of History
Masaryk Institute and Archives
Oriental Institute
Institute of Psychology
Institute of Sociology
Institute of Art History
J. Heyrovsky Institute of Physical Chemistry
Institute of Computer Science
Institute of Czech Literature
Institute of the Czech Language
Institute of Contemporary History
Institute of State and Law

Cooperating partners
Ministry of Foreign Affairs of the Czech Republic
Ministry of Education, Youth and Sports of the Czech Republic
Prague City Assembly
Association of Educational Psychology Advisory Centre Employees (APPPP)
National Institute of Public Health (SZÚ)
Czech Television
Czech Radio
National Archives in Prague (NA ČR)
National Library of the Czech Republic
National Museum
Parliament of the Czech Republic
Government of the Czech Republic
National Gallery in Prague
Moravian Gallery in Brno
National Film Archives
Czech and foreign universities and other institutes

Czech Academy of Sciences

RESEARCH PROGRAMME 15

GLOBAL CONFLICTS AND LOCAL INTERACTIONS: CULTURAL AND SOCIETAL CHALLENGES

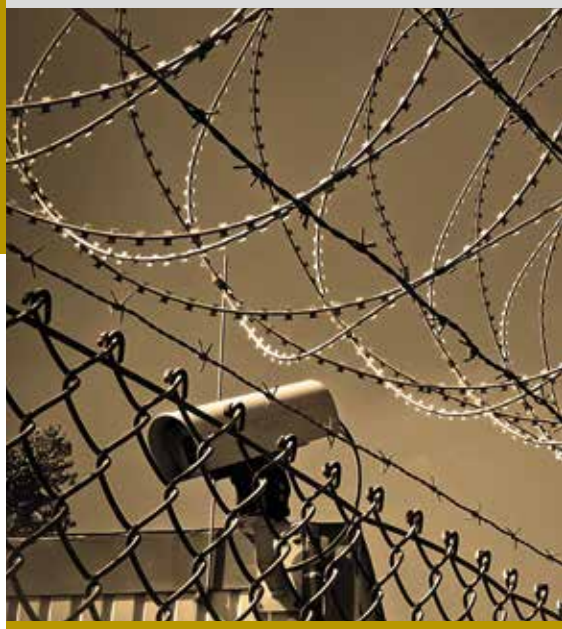
Research programme focuses on global conflicts and their local interactions, which present important cultural and social challenges in the 21st century. It analyses cultural and social transformations with regard to interactions of global and local dynamics in the contemporary and historical development of cultures and societies, especially in Europe, but also in the Americas, Africa and Asia, particularly with respect to interactions with the local processes in the Czech Republic. It examines not only problems connected with armed conflicts but also various important social, cultural, civilizational or economic conflicts, which are also preconditions and causes of diverse violent clashes. The research programme analyses internal and transnational migrations of various groups of populations, territorial integration and secessionism, cultural and social diversities, social tensions and consensus, security and suicides. It examines conflicts with regard to particularism and universalism and with regard to interactions between global, macro-regional (especially European), national and local orders. It analyses cultural contradictions and inter-cultural dialogue, social, gender and economic divisions and disparities, and problems of moral responsibility. It makes research of development and historical roots of selected conflicts (e.g. World War II, Cold War, both enforced and spontaneous mass migrations, etc.), with regard to processes leading to assertion or imperilment of democracy, justice, law order, international law or formation of global constitutionalism. In this context, the research programme also studies reflections of conflict changes from the perspective of the actors, with emphasis on changes of forms of their identity, sociability and world perception, including their material and spiritual production, behaviour and action. In this way, the research programme develops interdisciplinary and transdisciplinary cooperation of scholars from various institutions across the particular disciplines. The research programme provides its findings to the civil society, local and national governance, UNESCO and other organisations, and to contribute to public discussions on these important themes

GOALS

- To make research of global and local conflicts, territorial integration and secessionism, plurality of societies and cultures and their interactions
- To study internal and transnational migrations of various groups of populations and development of social, cultural, economic and other contradictions and disparities
- To examine the historical roots of conflicts with reference to their impact in the area of social and ethnic composition and migration processes
- To analyse changes in assertion of justice, democracy, human rights, transformations of forms of identity and perception of the world, including their material and spiritual production, behaviour and action
- To provide the outcomes of the research to the public, civil society, local and national governments, UNESCO and other organizations

Participating CAS Institutes
Institute of Sociology
Institute of Philosophy
Oriental Institute
Institute of State and Law
Institute of Ethnology
Institute for Contemporary History

Cooperating partners
Czech Radio, Czech Television and other media
Parliament of the Czech Republic
Ministry of Foreign Affairs of the Czech Republic
Embassies
European Academy of Sciences and Arts
UNESCO
United Nations
Czech and foreign universities and other institutes



TOPICS/RESEARCH LEADERS

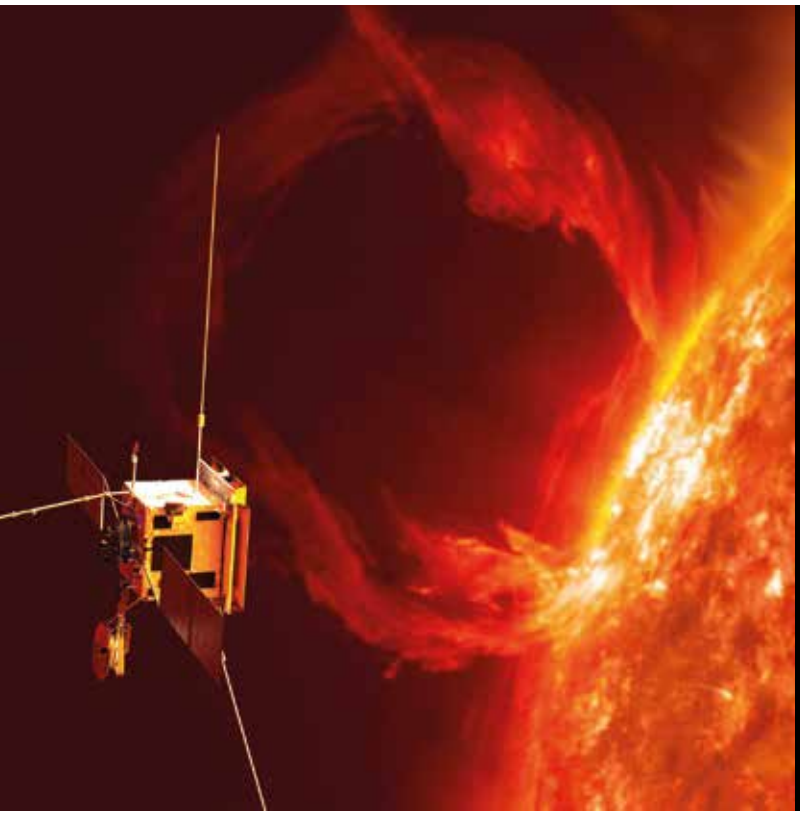
Interactions of the global conflicts in local contexts
Marek Hrubec (Institute of Philosophy, Institute of Sociology)
Social and cultural aspects of global and local interactions
Tomáš Kostelecký (Institute of Sociology)
Historical roots of conflicts and their consequences in transnational interactions
Ondřej Beránek (Oriental Institute),
Kateřina Čapková (Institute for Contemporary History)
Actor interactions and legal changes in transnational contexts
Zdeněk Uherek (Institute of Ethnology),
Petr Agha (Institute of State and Law)

"Global conflicts and their local interactions present important cultural and social challenges in the 21st century."

COORDINATOR
Marek Hrubec
Institute of Sociology of the CAS

"Developing interdisciplinary and transdisciplinary cooperation of scholars from various institutions across the particular disciplines"

Czech Academy of Sciences



RESEARCH PROGRAMME 16

SPACE FOR THE MANKIND

This programme aims to strengthen the co-operation between the scientific community and the technical teams in development and testing of new technologies for space research. This includes especially the spacecraft instruments for direct exploration of space surroundings around the Earth, exploration of the Sun and planets in the Solar System, and astronomical observations, which are the key elements for deeper understanding of the physical nature of matter. The focus is also given to the transfer of achieved technologies to applied physics and support of related industrial innovations. The topics of the programme include the involvement in the large X-ray observatory Athena, the mission to the icy moons of the Jupiter (JUICE), measurements on the Moon surface, preparation of the X-ray polarimetry mission XIPE, the project of the European space mission to the Sun (Solar Orbiter), the development of high-technology opto-mechanical systems for satellites, and space research of lightning in the upper layers of the Earth atmosphere.

TOPICS/RESEARCH LEADERS

Hot and Energetic Universe – beyond the limits of ground-based laboratories
Jiří Svoboda, Vladimír Karas (Astronomical Institute)
European Space Mission to the Sun
František Fárník (Astronomical Institute)
High-technology Opto-mechanical Systems for Space Research
Vít Lédl (Institute of Plasma Physics)
Mars and Jupiter – European Space Targets for the 21st century
Ondřej Santolík (Institute of Atmospherical Physics)
Ionospheric Events over the Storm Areas
Ivana Kolmašová (Institute of Atmospherical Physics)
Dosimetry of the Cosmic Radiation
Iva Ambrožová (Nuclear Physics Institute)

"We put emphasis on the transfer of achieved technologies to the application sphere and on the support of the innovative technological industry that is connected with the space research."

COORDINATOR
Petr Heinzel
Astronomical Institute of the CAS

GOALS

- To increase the involvement and co-operation between institutes of the CAS in the space research
- To bring new knowledge about the Earth ionosphere and magnetosphere, the Sun, the Solar System and distant Universe based on space observations
- To share the experience achieved during the development of scientific instruments for space explorations
- To strengthen connections between the CAS and industry
- To inform the public about the exploration of near and distant Universe, popularise space research in relation to the society

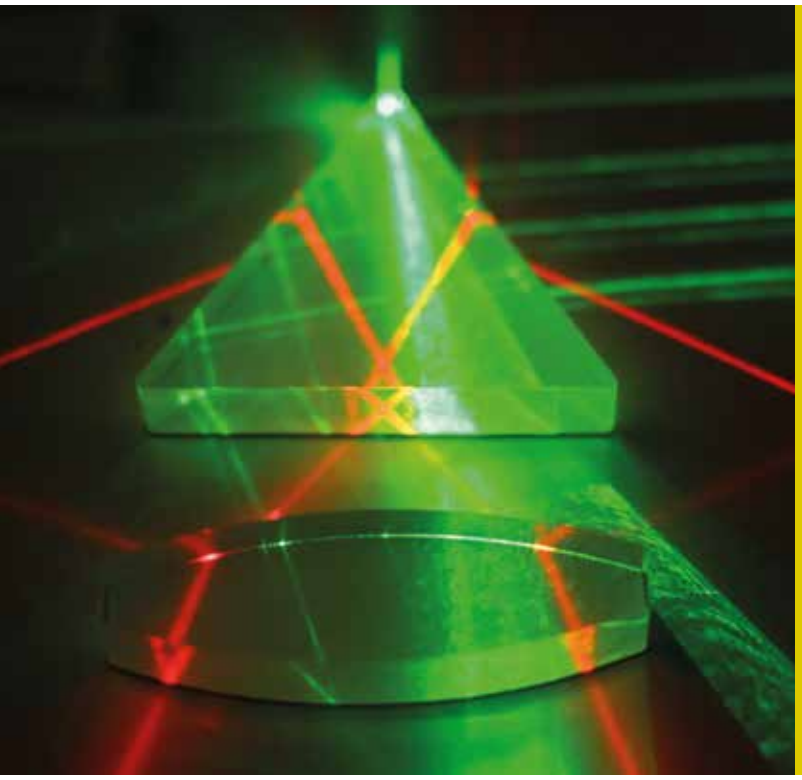
Participating CAS Institutes
Astronomical Institute
Institute of Atmospheric Physics
Institute of Plasma Physics
Nuclear Physics Institute

Perspectively
Institute of Scientific Instruments
Institute of Psychology

Cooperating partners
Faculty of Mathematics and Physics, Charles University, Prague
Masaryk University, Brno
FJFI Czech Technical University, Prague
FEL Czech Technical University, Prague
Technical University of Liberec
Silesian University, Opava
ESA
NASA
PRODEX
TOPTEC (IPP CAS)
CSRC Brno
G. L. Electronic, s. r. o. Brno
Czech Aerospace Research Centre (VZLÚ, a. s.), Prague
ESC, s. r. o., Prague
Airbus Defense and Space
Thales Alenia Space
CGS
Centre Spatial de Liege
LENAM
TL Electronics, Crytur, s. r. o.
Pragoboard, s. r. o.
CNES
CNRS
Matra electronique
Beatronic, s. r. o.
Universities and other academic institutes in the Czech Republic and abroad

"Participation in the European space mission to the Sun (Solar Orbiter) and participation in the mission towards the icy moons around Jupiter (JUICE – Jupiter Icy Moons Explorer)"

Czech Academy of Sciences



RESEARCH PROGRAMME 17

LIGHT AT THE SERVICE OF SOCIETY

The programme is focused on the development of existing and progressive photonics technologies in which the Czech Republic can be soon world leading. An example of these technologies is „additive manufacturing“, where laser technologies are a base for the rapidly-evolving technologies of 3D printing, medical diagnostic methods including invasive and non-invasive methods of treatment or technology of production and preservation of optical components. As lasers are a fundamental component of these technologies, the programme also develops these sources of high intensity radiation.

The programme will include social experts on the history of natural and exact sciences, who will search and study the historical bases of successfully developed optical, photonic, plasma and related fields. Knowing the origin and development of supporting research directions guides the appropriate government authorities' work on the concepts of planning, management and promotion of scientific and technological activities in the Czech Republic.

The main goals of the program include support for industry-wide use of intense sources of radiation as effective tools for research, development and application of new technologies, development of collaborative applied research, strengthening synergies between the CAS institutes and creating a feedback between the research community and the public represented by education, industry and government.

"We develop existing and progressive photonics technologies in which the Czech Republic can be soon world leading."

COORDINATOR
Tomáš Mocek
Institute of Physics of the CAS

GOALS

- To support industry-wide use of intense sources of Radiation as effective tools for research and development
- To develop and apply new Light-based technologies
- To boost research cooperation with Czech Photonics industry
- To strengthen synergies between large Laser Research Infrastructures

Participating CAS Institutes
Institute of Physics
Institute of Thermomechanics
Institute of Plasma Physics
Institute of Scientific Instruments
Institute of Photonics and Electronics
Institute of Physics of Materials

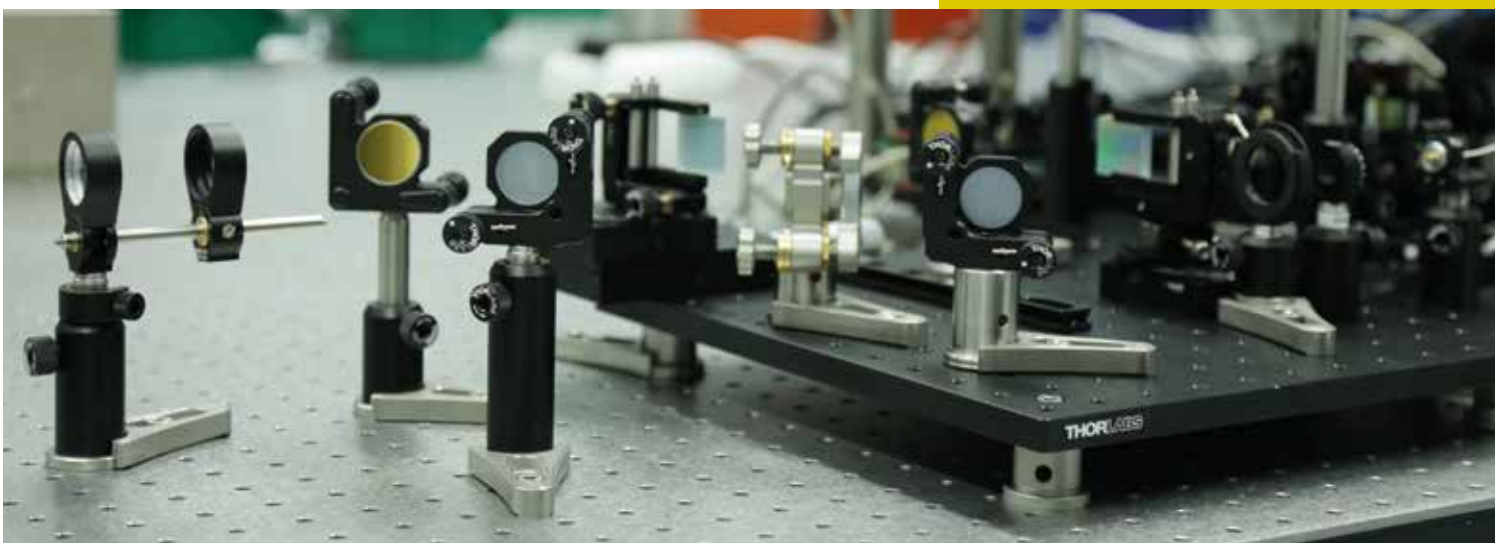
Prospective Participating CAS Institutes
Institute of Experimental Medicine
J. Heyrovsky Institute of Physical Chemistry
Institute of Biophysics
Astronomical Institute
Institute of Contemporary History

Cooperating partners
Meopta – optika, s. r. o.
Crytur, a. s.
IQ Structures, s. r. o.
ČZ, a. s.
Škoda, a. s.
SQS Vláknová optika, a. s.
Rigaku Innovative Technologies Europe, s.r.o.
Gigaphoton Inc.
CARDAM, s. r. o.
Czech and foreign universities and other institutes

TOPICS/RESEARCH LEADERS

New laser technologies for 3D printing and micro-machining
Libor Mrňa (Institute of Physics of Materials)
Enhancing resistance of materials
Jaromír Chalupský (Institute of Physics)
Public safety, critical infrastructure safety, health and life
Pavel Honzátko (Institute of Photonics and Electronics)
Design of laser sources and systems for light transmission
Martin Smrž (Institute of Physics)
Bright light sources to achieve, study and use extreme states of matter
Libor Juha (Institute of Plasma Physics)

"New discoveries in materials, nanotechnologies, medicine, imaging and diagnostics are enabled by smart use of Light"



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RESEARCH PROGRAMME 18

PRECLINICAL TESTING OF POTENTIAL PHARMACEUTICALS

The preclinical testing of potential pharmaceuticals on animals under OECD GLP conditions (GLP-Good Laboratory Practice) is a key element of new pharmaceutical development. The successful completion of preclinical studies is an essential prerequisite for starting clinical trials on humans. The CAS has professionally equipped facilities and quality workers who, through logical participation in the proposed programme, will provide effective and comprehensive testing of new promising pharmaceuticals (including under GLP conditions). The programme will thus significantly help to commercialize the results of basic research and help in negotiations with potential future sponsors of clinical studies. The programme will also enhance the possibility to engage in tenders for contracts from the commercial sphere with the potential for providing future income from patents and licenses. The programme will utilize existing scientific equipment and facility capacities for basic research and will thus secure additional sources of financing. The overall plan for the performance of preclinical testing at the CAS is a perfect fit for the Strategy AV21, since it will facilitate the transfer of the results of basic research into promising therapeutic agents to possible commercial use and clinical practice. IPHYS will act as the main testing facility (performing tests on small laboratory animals) certified by the State Institute for Drug Control (GLP certification). The other involved institutes will act as test sites, with an established GLP quality system in the area of their competence (excepting the IBT, where it is not necessary). IPHYS will coordinate the whole programme and, in cooperation with the other three institutes, will ensure the further growth and development of the Preclinical Testing Programme in the future. The Institute of Physiology will also coordinate commercial and promotional activities.

"The overall plan for the performance of preclinical testing at the CAS is a perfect fit for the Strategy AV21, since it will facilitate the transfer of the results of basic research into promising therapeutic agents to possible commercial use and clinical practice."

COORDINATOR
Jan Kopecký
Institute of Physiology of the CAS

GOALS

- Coordination of research and development for potential pharmaceuticals and their comprehensive preclinical testing at CAS institutes
- To enhance synergy in the utilization of resources for basic and applied research, and reduce the cost of research into pharmaceuticals
- To facilitate the introduction into practice of potential pharmaceuticals developed at CAS
- To foster collaboration between the academic sector and commercial entities
- To enhance the general perception of the importance of achievements in the academic sector

Participating CAS Institutes
Institute of Physiology
Institute of Molecular Genetics, Czech Centre for Phenogenomics
Institute of Biotechnology
Institute of Animal Physiology and Genetics, Pigmod Centre

These institutes form the Centre for Preclinical Testing (CPT)

Potential future participants
Other relevant teams at CAS that can provide essential knowhow and services for other types of preclinical tests (e.g. testing of radiopharmaceuticals, utilization of in vivo imaging techniques, testing in the areas of neurobiology and immunology, pharmacological testing on xenografts, genotoxicity testing, etc.) will be invited to participate soon.

Cooperating partners
Pharmakl, s. r. o.
Czech and foreign universities and other institutes

TOPICS/RESEARCH LEADERS

Synthesis of active substances with potential for human therapy, certification of synthesised substances and development of suitable application
Lukáš Werner (Institute of Biotechnology)

Toxicity studies including toxicokinetic studies of promising agents on lab animals (mice, rats, guinea pigs, rabbits, mini-pigs)
Světlana Žufanová (Institute of Physiology), Štefan Juhás (Institute of Animal Physiology and Genetics, Pigmod Centre)

Bioanalytical, haematological and biochemical testing of samples from toxicity studies on lab animals
Světlana Žufanová (Institute of Physiology), Karel Chalupský (Institute of Molecular Genetics, Czech Centre for Phenogenomics)

Development and validation of bioanalytical methods for various test systems
Karel Chalupský (Institute of Molecular Genetics, Czech Centre for Phenogenomics), Tomáš Čajka (Institute of Physiology)

Histopathological testing on/examination of tissues from toxicity studies on lab animals
Šárka Suchanová (Institute of Molecular Genetics, Czech Centre for Phenogenomics)

"The programme will significantly help to commercialize the results of basic research and help in negotiations with potential future sponsors of clinical studies."

Czech Academy of Sciences

LIST OF CAS INSTITUTES

Mathematics, Physics and Earth Sciences

Section of Mathematics, Physics and Computer Science

Astronomical Institute (www.asu.cas.cz)
Institute of Physics (www.fzu.cz)
Institute of Mathematics (www.math.cas.cz)
Institute of Computer Science (www.cs.cas.cz)
Nuclear Physics Institute (www.ujf.cas.cz)
Institute of Information Theory and Automation (www.utia.cas.cz)

Section of Applied Physics

Institute of Photonics and Electronics (www.ufe.cz)
Institute of Physics of Materials (www.ipm.cz)
Institute of Plasma Physics (www.ipp.cas.cz)
Institute of Hydrodynamics (www.ih.cas.cz)
Institute of Scientific Instruments (www.isibrno.cz)
Institute of Theoretical and Applied Mechanics (www.itam.cas.cz)
Institute of Thermomechanics (www.it.cas.cz)

Section of Earth Sciences

Institute of Geophysics (www.ig.cas.cz)
Institute of Geology (www.gli.cas.cz)
Institute of Atmospheric Physics (www.ufa.cas.cz)
Institute of Geonics (www.ugn.cas.cz)
Institute of Rock Structure and Mechanics (www.irsm.cas.cz)

Life and Chemical Sciences

Section of Chemical Sciences

Institute of Analytical Chemistry (www.iach.cz)
Institute of Inorganic Chemistry (www.iic.cas.cz)
J. Heyrovsky Institute of Physical Chemistry (www.jh-inst.cas.cz)
Institute of Chemical Process Fundamentals (www.icpf.cas.cz)
Institute of Macromolecular Chemistry (www.imc.cas.cz)
Institute of Organic Chemistry and Biochemistry (www.uochb.cz)

Section of Biological and Medical Sciences

Institute of Biophysics (www.ibp.cz)
Institute of Biotechnology (www.ibt.cas.cz)
Institute of Physiology (www.fgu.cas.cz)
Institute of Microbiology (mbu.cas.cz)
Institute of Experimental Botany (www.ueb.cas.cz)
Institute of Experimental Medicine (www.iem.cas.cz)
Institute of Molecular Genetics (www.img.cas.cz)
Institute of Animal Physiology and Genetics (www.iapg.cas.cz)

Section of Bio-Ecological Sciences

Biology Centre (www.bc.cas.cz)
Institute of Botany (www.ibot.cas.cz)
Global Change Research Institute (www.cvgz.cas.cz)
Institute of Vertebrate Biology (www.ivb.cz)

Humanities and Social Sciences

Section of Social and Economic Sciences

Library (www.lib.cas.cz)
Economics Institute (www.ei.cas.cz)
Institute of Psychology (www.psu.cas.cz)
Institute of Sociology (www.soc.cas.cz)
Institute of State and Law (www.ilaw.cas.cz)

Section of Historical Sciences

Institute of Archaeology, Brno (www.arub.cz)
Institute of Archaeology, Prague (www.arup.cas.cz)
Institute of History (www.hiu.cas.cz)
Masaryk Institute and Archives (www.mua.cas.cz)
Institute of Art History (www.udu.cas.cz)
Institute of Contemporary History (www.usd.cas.cz)

Section of Humanities and Philology

Institute of Ethnology (www.eu.cas.cz)
Institute of Philosophy (www.flu.cas.cz)
Oriental Institute (www.orient.cas.cz)
Institute of Slavonic Studies (www.slu.cas.cz)
Institute of Czech Literature (www.ucl.cas.cz)
Institute of the Czech Language (www.ujc.cas.cz)

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16 **Space for the Mankind** – Petr Heinzel
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17 **Light at the Service of Society** – Tomáš Mocek
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18 **Preclinical Testing of Potential Pharmaceuticals** – Jan Kopecký
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