2019
Annual Report

of the Czech Academy of Sciences

Top research
in the public interest

Czech Academy
of Sciences

www.avcr.cz

https://cs-cz.facebook.com/
akademieved/

https://www.instagram.com/
akademievedcr/

https://twitter.com/
akademie_ved_cr

TABLE OF CONTENTS

Interview with the President

of the Czech Academy of Sciences

Professor RNDr. Eva Zažímalová, CSc.

How would you characterise 2019 from the point of view of the Academy of Sciences?
2019 was marked by significant progress in the intensity and quality of dialogue between the Academy of Sciences (CAS), the Czech public and the country's political representatives. In this regard, I consider it important that we launched "AVexes", i.e. expert opinions concerning pressing social issues that are elaborated by the Academy of Sciences for the needs of both chambers of the Parliament of the Czech Republic. The first opinion dealt with big data, the second examined the issue of drinking water, the third addressed drought and water scarcity across the landscape and the fourth and most recent AVex discussed genetically modified crops. We are developing further AVexes. Another new initiative in this area is strengthening cooperation with ministries on the basis of joint memoranda. The first was a Memorandum on cooperation with the Ministry of Finance of the Czech Republic (CR), which was followed by a similar agreement with the Ministry of Health of the CR. We are also preparing agreements with the Ministry of Culture of the CR, Ministry of Industry and Trade of the CR and Ministry of Defence of the CR. I appreciate the very positive feedback we have received from the political sector about these new activities of the Academy of Sciences. For example, several Czech members of the European Parliament have expressed interest in AVexes. Looking ahead, we are ready to extend AVexes to other interested parties, e.g. members of the government or diplomatic corps, and subsequently to the public as well.

In December 2019, you signed a memorandum on behalf of the Academy of Sciences regarding support of the R&D&I system in the Czech Republic. In the memorandum the signatories pledge to advocate for an increase in institutional resources allocated to science of at least 4% each year. Do you believe that is enough?
I am very pleased with the signing of this memorandum, which was initiated by the Academy of Sciences. In our view, it is a fundamental document whose fulfilment can play a crucial role in rendering institutional funding of key actors in Czech science and research, i.e. the Academy of Sciences and universities, more stable and predictable. The signatories to the memorandum declare that, in cooperation with the Research, Development and Innovation Council and with respect to the possibilities afforded by the state budget, they will advocate for a systematic increase of state budget funding of at least 4% per year for institutional support of the long-term, conceptual development of research organisations. The long-term goal is to increase direct institutional support to the Czech Academy of Sciences and universities up to seventy percent of their total budgets, as is the case with comparable institutions in Germany and Austria. According to our internal calculations, the Academy of Sciences would achieve this goal in 2030 through 5% year-on-year growth in basic institutional funding, which was the original negotiating position of the Academy of Sciences. An annual increase of four percent is thus an acceptable compromise and one that was reached through arduous negotiations with all of the parties. Achieving the seventy percent goal in the given timeframe will depend, among other things, on the extent to which it will be possible to increase institutional resources year-on-year beyond the minimum four percent. I hope that investing into science and education will continue to be a government priority so that we can fully utilise the high-quality human potential at the Academy of Sciences and universities to benefit Czech society and culture.

A regular evaluation of the Czech Academy of Sciences (CAS) Institutes will also take place in 2020. What are your expectations for the evaluation?
One of the CAS management's most important tasks is persistently emphasising

improvement in the quality of science and research. To this end, the CAS Academy Council and the Science Council co-organise regular international evaluations of CAS Institutes, which also assesses the work of specific scientific teams. 2020 will see the eighth international evaluation, which is fully compatible with the principles of the national Methodology 2017+, whose Module 1 and 2 results will be used for evaluation of CAS Institutes. The CAS evaluation also encompasses a number of features commonly used in evaluations of foreign scientific institutions in developed countries. The most important are: a grounding in informed peer review, respect for subject area differences, reflection of team self-assessment, monitoring of research strategy and management, international collaboration, social relevance of research, teaching and many other activities. Above all, however, the CAS evaluation system places a strong emphasis on the relationship between evaluated teams' past performance and their direction going forward. In sum, the CAS evaluation aims to give feedback to our research institutes, objectively map the scientific quality of our institutes and their focus areas, and lay the groundwork for improving research quality in future. It is by no means a mere bureaucratic tool for funding allocation. On the basis of detailed information from the evaluation, and following discussions with institute directors, the CAS management adopts measures to heighten research quality and its significance to society.

Which scientific results from the CAS Institutes are you most pleased about?

The Czech Academy of Sciences has achieved numerous important scientific results across a broad array of scientific fields. I would like to take this opportunity to mention just a few selected recent examples that have high application potential. The basic oscillation components of the El Niño phenomenon were identified. The results, published in the journal Climate and Atmospheric Science, will enable a better understanding and more reliable forecasting of extreme weather events and their impact on the global climate. Secondly, a new highly virulent strain of a natural pathogenic fungus that specifically targets European spruce bark beetle was isolated, which may help eradicate this major spruce forest pest. We also have great hope for the anti-cancer agent MitoTam, which underwent pre-clinical testing at the Oncology Clinic of the General University Hospital. The exceptional therapeutic effects of MitoTam were demonstrated on patients with various types of metastatic tumours which had not responded to any established therapies. Lastly, a study on problems with statistical survey interpretation of social welfare transfer programmes was elaborated. The study shows that existing procedures lead to errors in the reporting of income from poor households and distort information about the extent of poverty. The study results may significantly influence public policy pertaining to social programmes. I also recommend the beautiful two-volume publication *Visible and Invisible Cathedral*, which offers a unique look at the thousand-year history of the St. Vitus Cathedral. The CAS' most important results and activities are summarised in subsequent chapters of the Annual Report. In addition, our long-standing aim is to inform the public about the achievements of CAS scientists regularly through the media.

This year will mark your fourth as the President of the CAS. Has the role met the expectations you began with?

One of the main goals I set forth in my programme statement was the stabilisation of CAS' institutional funding, which we have achieved in part through the signing of the memorandum on increasing institutional resources for science, as mentioned above. I view this memorandum as an important step towards the development of a stable research environment. In practice this means gradually limiting our scientists' excessive dependence on grants so that they can fully dedicate themselves to conceptual work and long-term, significant research projects. Another important point of my programme statement was strengthening the role of the Academy of Sciences in society. In this regard, I am pleased to see that leading state representatives and legislators are increasingly interested in expert support from the CAS and its institutes in key areas of state responsibility, such as the national economy, health care, security and culture, as well as in current social issues. A key factor in outstanding research is, however, highly qualified people. Without commensurate funding, stable and predictable conditions and a supportive administrative and legislative environment, we cannot recruit or maintain the best scientists. I am therefore delighted to note that we have added a new tool new tool to support excellence at the CAS, namely the Lumina Quaeruntur Research Fellowship for promising young scientists founding research groups and initiating their own research in topics they have selected. Lastly, I am happy to see that we are successfully developing communication between CAS Institutes and the management. I am thus very pleased that we have managed these tasks as best as the given conditions allowed and that through our joint efforts we have advanced the Academy of Sciences yet another step forward.

2

Mission and structure

of the Czech Academy of Sciences

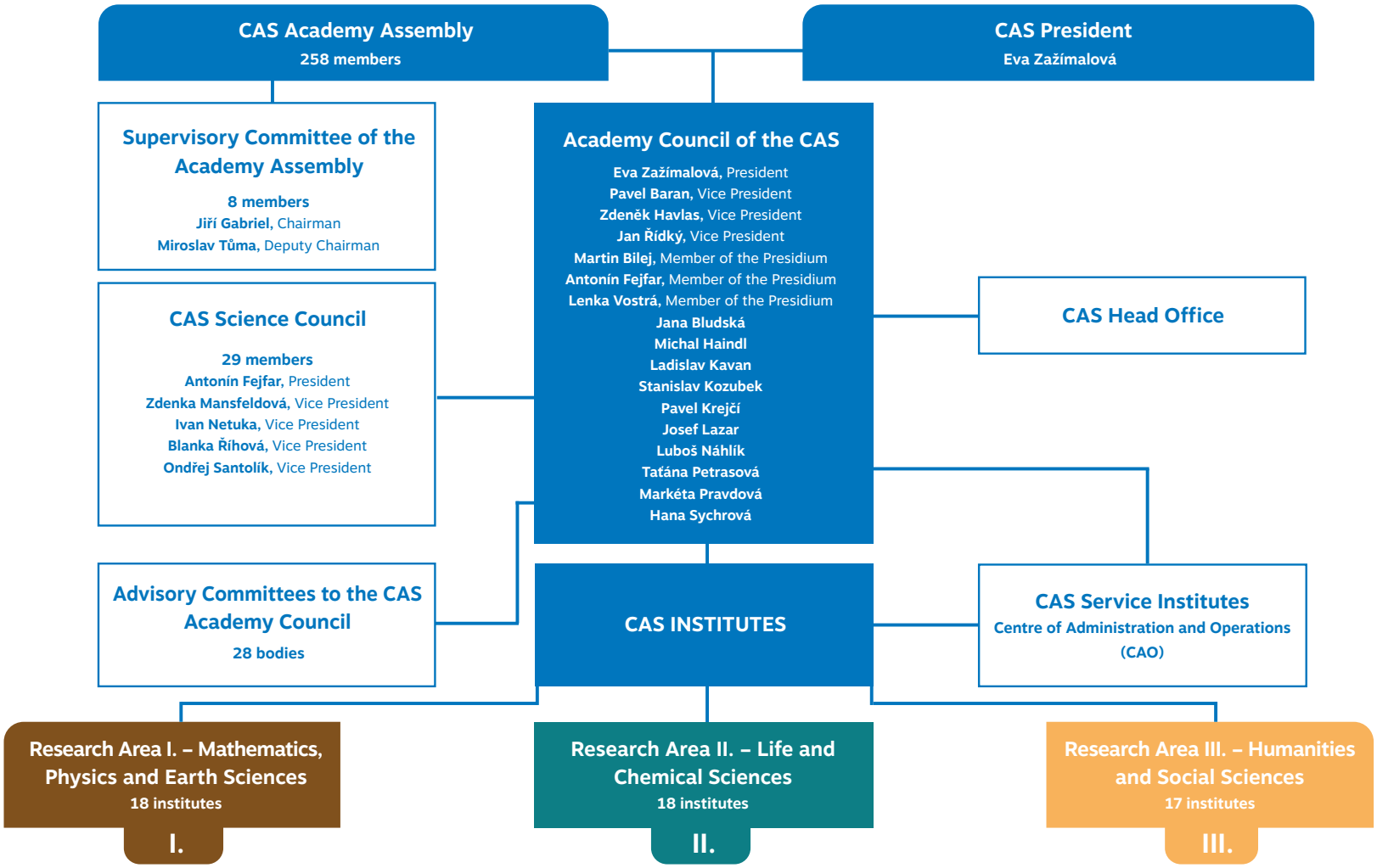
The Czech Academy of Sciences (CAS) was established by Act No. 283/1992 Coll. The CAS conducts research through its institutes which are established as public research institutions. More than 11,000 employees work at the Academy, over 7,000 of whom are university-educated.

The primary mission of the CAS and its institutes is to conduct research in a broad spectrum of natural, technical and social sciences and the humanities. This research, whether highly specialised or interdisciplinary in nature, aims to advance the development of knowledge on an international level, while respecting the current needs of Czech society and culture.

CAS Institutes actively contribute to education, primarily by educating young researchers in doctoral programmes. CAS researchers also teach at universities.

The CAS also develops collaborative ties with applied research and industry. The Academy's numerous joint international projects and exchanges of researchers with partner institutions abroad reinforce the integration of Czech science into the international context.

The diagram on the following page illustrates the structure of the CAS.



Section 1
of Mathematics, Physics and Computer Science

Astronomical Institute (ASÚ)
Institute of Physics (FZÚ)
Institute of Mathematics (MÚ)
Institute of Computer Science (ÚI)
Nuclear Physics Institute (ÚJF)
Institute of Information Theory and Automation (ÚITA)

Section 2
of Applied Physics

Institute of Photonics and Electronics (ÚFE)
Institute of Physics of Materials (ÚFM)
Institute of Plasma Physics (ÚFP)
Institute of Hydrodynamics (ÚH)
Institute of Scientific Instruments (ÚPT)
Institute of Theoretical and Applied Mechanics (ÚTAM)
Institute of Thermomechanics (ÚT)

Section 3
of Earth Sciences

Institute of Geophysics (GFÚ)
Institute of Geology (GLÚ)
Institute of Atmospheric Physics (ÚFA)
Institute of Geonics (ÚGN)
Institute of Rock Structure and Mechanics (ÚSMH)

Section 4
of Chemical Sciences

Institute of Analytical Chemistry (ÚIACH)
Institute of Inorganic Chemistry (ÚACH)
J. Heyrovský Institute of Physical Chemistry (ÚFCH JH)
Institute of Chemical Process Fundamentals (ÚCHP)
Institute of Macromolecular Chemistry (ÚMCH)
Institute of Organic Chemistry and Biochemistry (ÚOCHB)

Section 5
of Biological and Medical Sciences

Institute of Biophysics (BFÚ)
Institute of Biotechnology (BTÚ)
Institute of Physiology (FGÚ)
Institute of Microbiology (MBÚ)
Institute of Experimental Botany (ÚEB)
Institute of Experimental Medicine (ÚEM)
Institute of Molecular Genetics (ÚMG)
Institute of Animal Physiology and Genetics (ÚŽFG)

Section 6
of Biological-Ecological Sciences

Biology Centre (BC)
Institute of Botany (BÚ)
Institute of Vertebrate Biology (ÚBO)
Global Change Research Institute (ÚVGZ)

Section 7
of Social and Economic Sciences

CAS Main Library (KNAV)
Economics Institute (NHÚ)
Institute of Psychology (PSÚ)
Institute of Sociology (SOÚ)
Institute of State and Law (ÚSP)

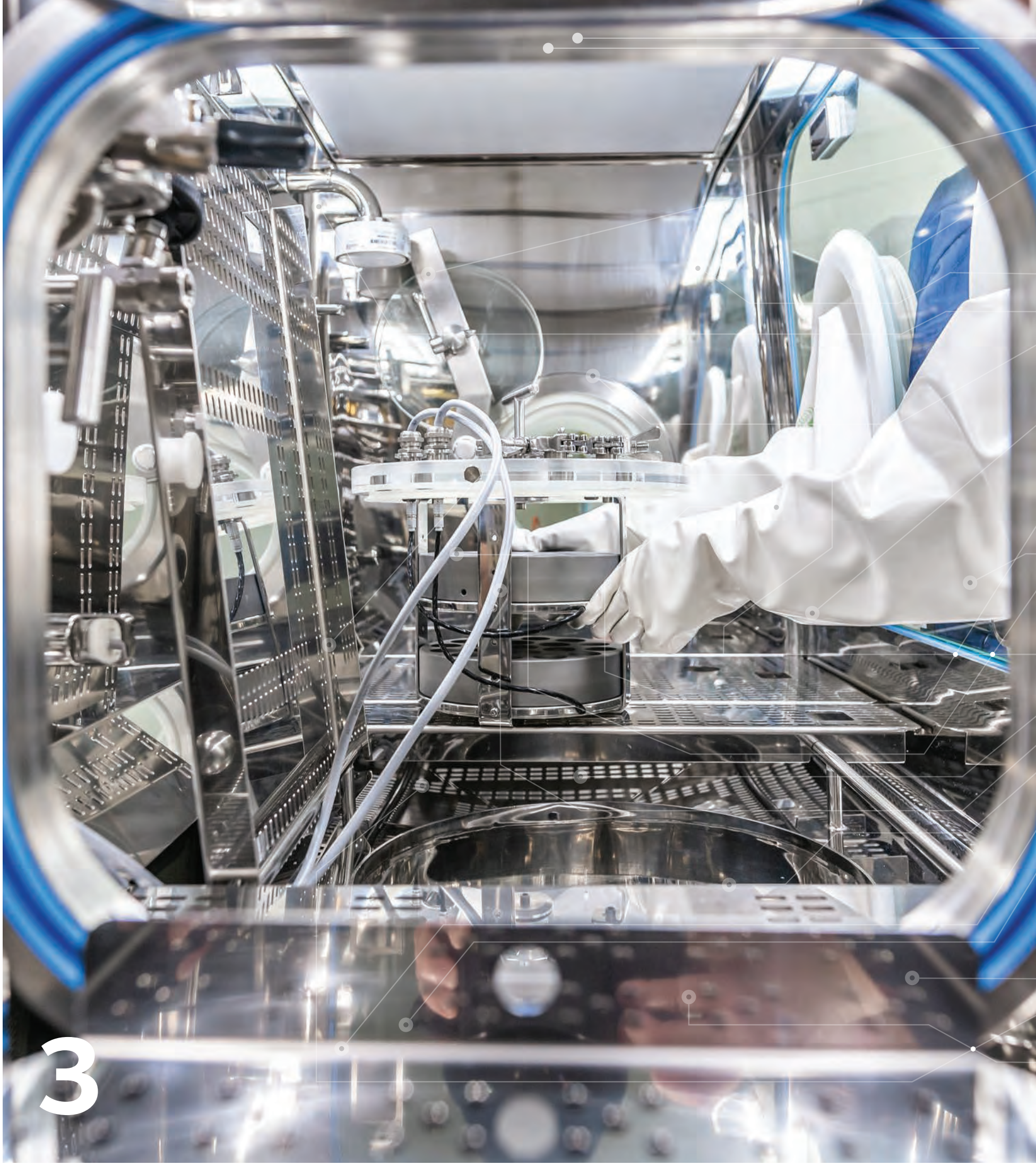
Section 8
of Historical Sciences

Institute of Archaeology, Brno (ARÚB)
Institute of Archaeology, Prague (ARÚ)
Institute of History (HÚ)
Masaryk Institute and Archives (MÚA)
Institute of Art History (ÚDU)
Institute of Contemporary History (ÚSD)

Section 9
of Humanities and Philology

Institute of Ethnology (EÚ)
Institute of Philosophy (FLÚ)
Oriental Institute (OÚ)
Institute of Slavonic Studies (SLÚ)
Institute of Czech Literature (ÚČL)
Institute of the Czech Language (ÚJČ)


MDCCCLXXXXVI.
SVĚT MOZKU
12.–18. 3. 2018



3

Czech Academy of Sciences

in the system of research, development and innovation

In 2019, the Czech Academy of Sciences continued to act as a highly productive component of the research, development and innovation system in the Czech Republic (R&D&I), while also implementing its scientific and research activities on an international level and contributing to society in a plethora of valuable ways. Although the CAS represents only part of the Czech Republic's research capacity, it is the most efficient producer of high-quality results: thirteen percent of the total body of researchers produce more than a quarter of all important research results in the Czech Republic.

Collaboration with the application and public sectors was further deepened in 2019, both through the Strategy AV21 research programmes and strengthening of cooperation with ministries and legislators. Educational activities were supported, particularly in relation to education of doctoral students, and further development of partnerships with universities. The most CAS significant results and activities are highlighted in the subsequent chapters of this report and documented in the annexes.

CAS representatives responded to current issues of critical import to the development of Czech science and research throughout 2019, as demonstrated by their active role in the preparation of several important conceptual documents concerning the entire R&D&I sector. They include the following documents in particular:

- Implementation of the Innovation Strategy of the Czech Republic 2019–2030: "Czech Republic: The Country for the Future"
- Implementation of Methodology M17+
- Development of the National Research, Development and Innovation Policy of the Czech Republic 2021+
- Minor amendment to the Act on Support of Research and Development from Public Funds
- Update of the National RIS3 Strategy
- Development of the Czech state budget for 2020–2022
- Preparation of a memorandum regarding support of research, development and innovation in the Czech Republic

Implementation of the Innovation Strategy of the Czech Republic 2019–2030: "Czech Republic: The Country for the Future"

The Innovation Strategy opens up opportunities to anchor research and development as key components of the transformation of the Czech economy and public policies.

Members of the bodies of the Czech Academy of Sciences took part in implementation of the innovation strategy, as they did in the previous year.

Prior to each session of the Research, Development and Innovation Council (RDI Council) in 2019, a regular meeting of the guarantors of the pillars of the Innovation Strategy of the Czech Republic 2019–2030 was held to discuss implementation of the strategy action plans. For the purposes of coordinating and evaluating strategy implementation, the Ministry of Industry and Trade drafted a document titled "Management and Coordination System for the Innovation Strategy of the Czech Republic 2019–2030", which outlines roles, principles and management and coordination mechanisms for cross-sector cooperation.

Another important part of the Innovation Strategy is the goal of reducing the administrative burden on science and research. The corresponding working group is led by Pavel Baran, who is both the RDI Council Deputy Chairman and a CAS Vice President. The Innovation Strategy is an ambitious document that builds on the National RIS3 strategy and focuses on presenting the Czech Republic as a country that aims to become a leading innovator during the next ten years. The Innovation Strategy is also an essential background document for the forthcoming National Economic Strategy of the CR 2030.

Implementation of Methodology M17+

2019 was the second pilot year of Methodology M17+ implementation. Evaluation of Module 1 continued, i.e. evaluation of the quality of selected results through peer review using remote evaluators, and Module 2, focused on bibliometric analysis. The Methodology M17+ implementation conference series also continued, where the results to date and current conclusions were consulted with the broad academic public. The RDI Council also established an Expert body of evaluators (OOH) as its expert advisory board for the purpose of Methodology M17+ evaluation. The CAS welcomes Methodology M17+; the results from Modules 1 and 2 will be fully utilised in the internal academic evaluation of CAS Institutes.

Minor amendment to the Act on Support of Research and Development from Public Funds

A very important issue affecting the entire R&D&I sector in the Czech Republic, including the CAS, is the minor amendment to Act No. 130/2002 Coll., on Support of Research and Development from Public Funds, approved by the Chamber of Deputies of the Parliament of the Czech Republic in late November 2019. The amendment aims to provide a legislative anchor for an evaluation system that fully corresponds to the new Methodology M17+, which will serve as motivation for achieving quality and excellence rather than quantity and mediocrity. After lengthy, strenuous negotiations, agreement was reached on the wording of key clause 7 (7) of the act and several other related provisions which thoroughly eliminated wording supporting ineffective evaluation mechanisms overly focused on points. The amendment then went to the approval process of the Senate of the Parliament of the Czech Republic, which passed it on 29 January 2020.

Major amendment to the Act on Support of Research and Development from Public Funds

Another issue critical to the future of the R&D&I system, as well as the CAS, is the elaboration of a major amendment to Act No. 130/2002 Coll., on Support of Research and Development from Public Funds. It is apparent that some issues in the law have been resolved as practice has evolved, while other sections still require modification. During the preparation of the minor amendment, some parties voiced opinions that the entire law needs to be shortened, simplified and clarified to minimise ambiguous interpretation. Other equally important tasks include harmonising the law with European legislation, redefining some basic terms and creating opportunities to reduce the bureaucracy of the R&D&I system as a whole. The RDI Council reached consensus on the main reasons for and key goals of the relevant legislative changes. The CAS played an active role in preparation of the amendment starting in summer 2019 through its representatives in the corresponding working group.

Update of the National RIS3 Strategy

In 2019, work continued on the National RIS3 Strategy update. The CAS was involved and devoted particular attention to this task. The CAS submitted comments to the document "A Complex Analysis of Barriers to Applied and Oriented Research,

> The CAS took note of the submitted state budget funding proposal for 2020–2022, but objected in regard to the persistent underfinancing of the CAS due to the decline in 2010–2016 and the current capacity of the state budget.

Experimental Development and Innovation in the Czech Republic and a Proposal for Implementation of Measures Set for the Programming Period of 2021–2027 for the National RIS3 Strategy 2021+". The CAS was thus recognised as an important partner in the formulation of key strategic documents for the Czech Republic. Final editing of the document is planned for 2020.

Development of the Czech state budget for 2020–2022

At its 345th session on 26 April 2019, the Research, Development and Innovation Council (RDI Council) approved, after negotiations with providers, proposed R&D funding from the state budget of the Czech Republic for 2020 with an outlook to 2021 and 2022. A total of CZK 6.511 billion was proposed for the CAS for 2020, CZK 6.585 billion for 2021 and CZK 6.585 billion for 2022. These figures include CZK 210 million for financing of ELI Beamlines, CZK 10 million for ERC-CZ/AV project support and CZK 283 million for the National Sustainability Programme I (NPU I) in 2020, CZK 349 million in 2021 and CZK 349 million in 2022.

The RDI Council's proposal for CAS funding from the state budget was adopted through Czech Government Resolution No. 352 on 20 May 2019.

During the subsequent Czech state budget preparation process, the Ministry of Finance of the CR submitted to the government a preliminary income and expenditures proposal for the sections of the state budget of the Czech Republic for 2020–2022, which was adopted through Czech Government Resolution No. 447 on 24 June 2019. This proposal listed the following amounts for the CAS budget:

- 2020: CZK 6.512 billion from the state budget and CZK 1.3 million from EU budget funding,
- mid-term outlook for 2021 and 2022: CZK 6.586 billion.

State budget funding for CAS was raised from the prior RDI Council proposal by CZK 550,000 per year to cover the costs of an archaeological study at the Prague Castle as defined by Act No. 20/1987 Coll. (to date the study had been implemented over the course of the year through funding from budget section 301, Office of the President of the Czech Republic).

The CAS took note of the submitted state budget funding proposal for 2020–2022, but objected in regard to the persistent underfinancing of the CAS due to the decline in 2010–2016 and the current capacity of the state budget. In a letter dated 26 July 2019 (ref. no. KAV-2737/ŘKAV/2019), the CAS requested increased funding levels for the CAS of CZK 6.516 billion for 2020, CZK 6.962 billion for 2021 and CZK 7.146 billion for 2022, with respect to the Declaration on stabilisation of the R&D&I system in the Czech Republic, dated 30 May 2017. The CAS' objection rests primarily on the fact that only 1.1% year-on-year growth of institutional resources for the CAS was proposed for 2021 (an increase from CZK 6.512 billion in 2020 to CZK 6.586 billion in 2021) and no budget increase was proposed for 2022 (which actually equates to a real decrease due to inflation). According to a statement made by the Czech Prime Minister and Chairman of the RDI Council on 11 July 2018, support of science is a government priority and "the government will support gradual increasing of institutional science and research funding and a reasonable ratio of this funding to targeted funding with the aim of stabilising the Czech research environment."

After difficult budgetary negotiations, the Czech government adopted Resolution No. 652 on 16 September 2019, which listed state budget funding of CZK 6.512 billion for the CAS for 2020 along with CZK 1.3 million from EU budget funding, and CZK 6.586 billion in the mid-term outlook for 2021–2022. The law on the state budget of the Czech Republic for 2020 was approved by the Chamber of Deputies of the Parliament of the Czech Republic on 4 December 2019, effective as at 1 January 2020. The current 2020 CAS draft budget is thus based on this draft government law on the state budget of the Czech Republic for 2020.

Preparation of a memorandum regarding support of research, development and innovation in the Czech Republic

In mid-2019, the CAS initiated a Memorandum regarding support of research, development and innovation in the Czech Republic, which was followed by a discussion process that culminated in the signing of the Memorandum by all of the parties at the Office of the Government of the Czech Republic on 19 December 2019. This key document, which follows on the Declaration on stabilisation of the R&D&I system in the Czech Republic mentioned above, was signed by the Prime Minister and Chairman of the RDI Council Andrej Babiš, Minister of Education, Youth and Sports Robert Plaga, President of the CAS Eva Zažímalová and Chairman of the Czech Rectors Conference Petr Sklenička. In the Memorandum, the signatories declare, among other things, that in cooperation with the RDI Council and with respect to the possibilities afforded by the state budget, they will advocate for systematic increasing of state budget funding of at least 4% per year for institutional support enabling the long-term, conceptual development of research organisations. The long-term goal is to increase direct institutional support to the CAS and universities so that it eventually equals up to seventy percent of their total budgets. It is therefore a document of vital significance to the gradual consolidation and stabilisation of key actors in Czech science and research – namely, the CAS and universities.

[1] On 30 May 2017, a Declaration on stabilisation of the R&D&I system in the Czech Republic was signed, according to which the CAS management and university representatives, in agreement with the RDI Council, will advocate for systematic increasing of institutional support to CAS Institutes and public universities of at least 5% annually for 2019–2023 so that institutional support to CAS Institutes and public universities eventually equals seventy percent of R&D expenditures.

4

Organisational measures

Two regular sessions of the CAS' highest body – the Academy Assembly – took place in 2019. The spring LIV. session was convened on 16 April 2019 and the autumn LV. session on 10 December 2019. The autumn session was the fourth during the 8th term of office, which runs from 2018 to 2022. At this session the members of the Academy Assembly approved, among other things, the CAS financial report and the draft budget. Furthermore, due to the death of an internal CAS Science Council member, an election was held for a new member representing Research Area II. Life and Chemical Sciences for the remainder of the 2017–2021 term of office.

During the course of 2019, changes were made to the member composition and administrative staffing of Advisory Bodies to the CAS Academy Council, specifically to the following bodies: the CAS Editorial Council, Economic Council, Property Committee, Research Data Management Committee, Information Technology Committee, Major Research Equipment Council, Regional Cooperation Committee, Prospective Human Resources – Postdoctoral Fellows Support Programme Committee, CEFRES Platform Committee, International Affairs Council, Housing Committee, Academic Media and Public Relations Council, CAS Technology Transfer Council and the Expert Committee on Animal Testing Approval. Amendments to the statutes of these advisory bodies were also approved.

Due to mandate expiry or termination of employment, it was necessary to appoint new chairs and members to the supervisory committees of 24 CAS Institutes. Seminars about the work of supervisory committees were held for the chairs and secretaries of supervisory committees. A new regulation governing the work of supervisory committees is being developed; an informational workshop will be held for relevant employees after the regulation is approved.

The President of the CAS appointed three new CAS Institute directors in 2019 based on employee selection processes and proposals from the relevant CAS Institute boards. She also appointed a new CAS Head Office director on 1 January 2019 based on an employee selection process. The President of the CAS issued five addenda to founding documents of CAS Institutes. The President of the CAS and the Rector of Charles University jointly appointed two directors of joint research centres of Charles University and the CAS, namely the director of the Centre for Theoretical Study and the director of the Centre for Medieval Studies, which are joint research centres of the Institute of Philosophy of the CAS and the Faculty of Humanities of Charles University.

The CAS Academy Council consistently emphasises the importance of R&D collaboration between various institutions on the national and international levels. In 2019, this aim was fulfilled through initiation of cooperation with noteworthy partners both on a general level and in relation to specific projects.

In terms of cooperation with the state sector, the CAS concluded an agreement on cooperation with the Ministry of Health of the Czech Republic on 31 October 2019, which strives to utilise the potential of information sharing, discussions and joint research to increase the level of knowledge in the field of health care.

On 6 May 2019, the CAS concluded a memorandum on cooperation in defence and security research and development with the Military Technical Institute.

On 16 May 2019, a memorandum on cooperation in the development of a Prague AI superhub, which is intended to propel Prague into a leading position in AI research, was signed by the Czech Technical University in Prague, Charles University, the capital city of Prague and the CAS.

With the sustainability phase of the BIOCEV project scheduled to end in 2020, the Academy Council rigorously explored options for a new organisational and legal format for the project. A range of possible scenarios was elaborated in cooperation with the relevant CAS Institute directors and subsequently submitted for legal and economic feasibility analysis.

In compliance with grant provision requirements pursuant to Act No. 218/2000 Coll., on Budgetary Rules, the Academy Council evaluated submitted applications and awarded grants correspondingly. In 2019, the CAS held 23 calls for grant applications. Based on experience with grant administration in 2018, the CAS modified and simplified the grant administration procedure at the CAS and held informational seminars for relevant CAS Institute employees on this topic. The need for proper processing of approved grants also led to changes in the procedural rules of the Academy Council and Presidium. Given the taxing administrative nature of the grant process, the Academy Council strived to simplify it and continually increase familiarity with the process by providing informational workshops.

Over the course of the year, the Academy Council invited CAS Institute directors managing large projects with operational programme funding to its meetings to learn more about these programmes. The projects with the largest budgets include e.g. the Institute of Physics' Centre of Excellence (HiLASE infrastructure) and Advanced Research and Use of Photons and Particles Created Using High Intensity Lasers (ELI Infrastructure), and the Institute of Plasma Physics' COMPASS-U: Tokamak for Cutting-Edge Fusion Research. All of the projects strongly emphasise using the potential of collaboration between CAS Institutes.

In 2019, the Academy Council continued its committed efforts to support and recognise excellent scientific results and support researchers at CAS Institutes. In 2019, more than 20 internal regulations were approved and issued by the CAS, including the CAS Academy Council Directive on Awarding the Academy Premium – Praemium Academiae, the CAS Academy Council Directive on Awarding the Josef Dobrovský Fellowship, the CAS Academy Council Directive amending CAS Academy Council Directive No. 10/2018, Programme to Support Prospective Human Resources – Postdoctoral Fellows (on the Programme to Support Prospective Human Resources – Postdoctoral Fellows), the CAS Academy Council Directive on the Programme for International Cooperation of Early Career Researchers, the CAS Academy Council Directive on Awarding the Otto Wichterle Award, the CAS Academy Council Directive amending CAS Academy Council Directive No. 8/2018 on the Lumina Quaeruntur Research Fellowship for Prospective Researchers, the CAS Academy Council Directive on Support to Individuals with scientific degree Research Professor at the CAS, the CAS Academy Council Directive on Support of CEFRES Platform Research, the CAS Academy Council Directive annulling CAS Academy Council Directive No. 4/2016 on Support of Research Education Activities for Early Career Researchers Abroad, as amended, the CAS Academy Council Directive on Support of International Collaboration by CAS Institutes and the CAS Academy Council Directive amending CAS Academy Council Directive No. 5/2018 on Strategy AV21.

A major topic in 2019 was the preparation of an evaluation of CAS Institutes' research and professional activities for the period of 2015–2019, which will be carried out in 2020. In compliance with the approved evaluation methodology, the schedule milestones were met over the course of 2019: the CAS evaluation methodology, which encompasses evaluation of all levels, including specific research teams, (document "Methodology of evaluation of research and professional activities of the research institutes of the Czech Academy of Sciences for the period 2015–2019") was published on the CAS website, the statutes and the composition of the Evaluation Coordination Board were approved along with methodological guidelines and documents outlining the procedures for evaluating research institutes and infrastructure offices, evaluators were registered, the composition of subject area panels and evaluation committees was approved and an information system was developed. The Institutes were asked to submit evaluation applications.

The Academy Council was regularly informed about progress in the preparation of the evaluation of research institutes according to the national Methodology 2017+ and, in collaboration with the Office of the Czech Government, strived to keep the administrative burden on CAS Institutes to a minimum given the concurrence of evaluations according to these two methodologies. The first informational seminar about the evaluation for Institutes was held on 24 October 2019.

In 2019, the CAS management expended particular effort for the Open Access and European Open Access Cloud initiatives, which process information and activities to date relating to open access to scientific information both in the Czech Republic and the European environment, and created an Open Access monitoring and coordination working group.

The principal information technology issue that arose for the CAS management in 2019 was negotiations with Microsoft regarding the CAS' status in terms of billing for Microsoft services. The CAS management is advocating to maintain the CAS' status as an academic institution in regard to the number of students engaged at CAS Institutes.

Another important topic was the purchase of economic-information systems (EIS) for CAS Institutes. The CAS management continually assists Institutes and provides methodological guidance in the preparation of EIS tenders. The CAS Head Office provided regular expert consultations throughout the year to ensure that all Institutes would be capable of independently managing the EIS tender process by 1 January 2020.

The Academy Council, in compliance with the internal directive on the procedure for issuance of prior consent of the founder and other handling of property, issued prior consent as defined by the law on public research institutions, which included, primarily, consent with purchase of scientific instruments and equipment for the purpose of main activity performance at Research Area II Institutes, and permission to enter into lease agreements in particular. Additionally, several cases of real estate acquisition or sale were addressed, and several requests for consent with an institute's participation in a legal entity were approved, as were requests for establishment of easements pertaining to construction of public networks. The Academy Council discussed long-term projects, particularly the reconstruction of the Hybernská building and related legal and technical steps, and a change in legal ownership pertaining to the reconstruction of Arnold Villa, located adjacent to the property owned by the Institute of Geonics in Brno. A considerable part of the agenda concerned conclusion of implementation and service contracts to secure new financial management and information systems for various CAS Institutes.

In regard to archaeological heritage preservation, the Czech Academy of Sciences concluded eight archaeological research agreements in 2019 with organisations with authorisations pursuant to the state monument preservation law. In 2019, a new CAS Academy Council Directive on state monument preservation division procedures was issued that governs the procedure by which the CAS consents to issuance of permits for archaeological research pursuant to Act No. 20/1987 Coll., on State Monument Preservation, the procedure for concluding agreements on the scope and conditions of archaeological research, including amendments thereto, and the procedure for filing proposals to declare archaeological finds as cultural monuments.

In 2019, the CAS management continued to support International Advisory Boards (MPS) at CAS Institutes. In an aim to support the establishment of MPS, an Academy Council directive on MPS support was developed. The directive goal is to set forth conditions under which CAS funding may be obtained for the purpose of establishing a MPS. Support led to the establishment of new MPS at 11 CAS Institutes, namely the Institute of Biophysics, Institute of Ethnology, Institute of Philosophy, Institute of Geophysics, Oriental Institute, Institute of Sociology, Institute of Analytical Chemistry, Institute of Experimental Medicine, Institute of Computer Science, Institute of Chemical Process Fundamentals and Institute of Molecular Genetics.

In regard to the issuance of the General Data Protection Regulation (GDPR) and to significant changes to Act No. 110/2019 Coll., on Personal Data Processing, the Academy Council issued a guideline, which was subsequently updated, relating to processing of personal data by CAS Institutes. This guideline aims to address the areas of the GDPR that are problematic in relation to the CAS.

The Academy Council also concerned itself with the issue of technology transfer and asked for a redefinition of the Technology Transfer Office of the CAS (CeTTAV)'s role. A new vision for the CeTTAV is currently being developed. The Academy Council was also represented at technology transfer conferences and supported the idea of holding the TTO Circle (The European Technology Transfer Offices Circle) plenary session in Prague in June 2021. The Academy Council continually updates the overview of technology transfer at CAS Institutes.

The Academy Council supported a proposal to establish a specialised Research, Development and Innovation Analysis Centre at the Economics Institute. The Centre's focus is R&D&I empirical analysis and research with application potential. As of January 2020, the Centre's work succeeds Strategy AV21 IDEA, which is winding down.

In regard to inter-ministerial commenting proceedings, in 2019 the CAS assessed and took positions on more than 127 government documents from ministries or other state bodies. In 2019, in compliance with Act No. 106/1999 Coll., on Free Access to Information, as amended, the CAS processed a total of twelve requests for information. In eight cases the full scope of the requested information was provided and in four cases the requests were suspended because the applicants did not respond to the CAS' appeal for additional information by the deadline and failed to complete their applications in the requested manner.

The President of the CAS bestowed patronage on 21 science and research events in 2019.

The CAS addresses environmental protection issues in many disciplines of its scientific work. The Global Change Research Institute (CzechGlobe) is fully dedicated to climate change issues. The importance of this issue is also clearly demonstrated by the themes of Strategy AV21 research programmes (primarily Food for the Future, Diversity of Life and Health of Ecosystems, Natural Hazards, Efficient Energy Conversion and Storage, as well as others). The CAS also looks long-term at ways to increase its resource use efficiency and reduce its environmental footprint.

5

Selected results

All 54 research institutes of the CAS, which operate as public research institutions, contributed to the scientific results achieved in 2019. CAS Institutes are grouped into three main research areas: Research area I comprises Mathematics, Physics and Earth Sciences, Research area II covers Life and Chemical Sciences, and Research area III focuses on the Humanities and Social Sciences. CAS scientific research led to many positive results in 2019. Nine of the most fascinating results from the three research areas are featured on the following pages.

SELECTED RESULTS FROM RESEARCH AREA I. INSTITUTES

MACHINE LEARNING METHODS FOR EPILEPSY LOCALISATION

Institute of Scientific Instruments

Advanced machine-learning methods can help eliminate artifacts and determine pathological areas in deep brain structures. Scientists from the Institute of Scientific Instruments, in collaboration with the St. Anne's University Hospital in Brno and the Mayo Clinic in the USA, developed and tested machine-learning models capable of accurately identifying different types of electrical activity in the human brain and localising pathological sources, including epileptogenic zones. The scientists used extensive records from intracerebral electrodes, i.e. electrodes placed into the brain, as input data for the analysis. The model results were verified through long-term monitoring of post-surgery patients. The methods are targeted towards application in clinical neurology.

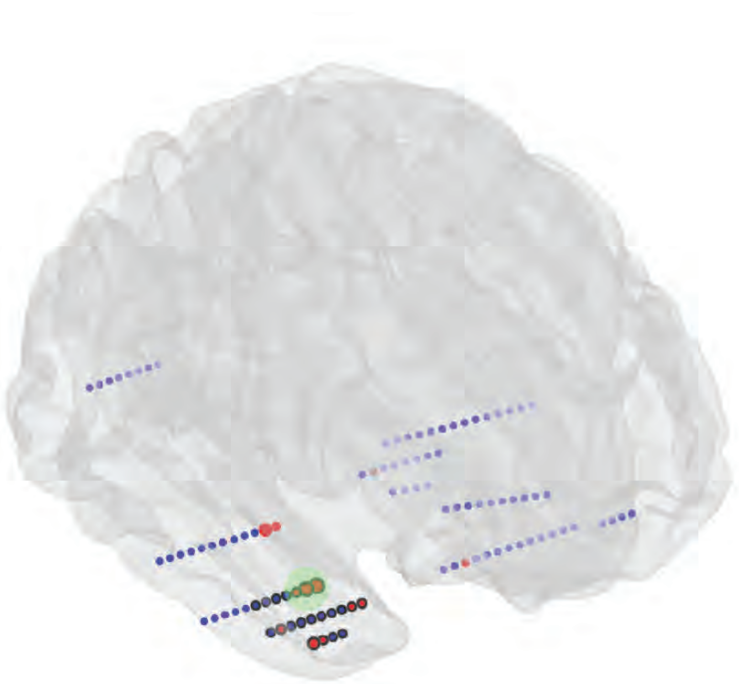
Bibliographic references:

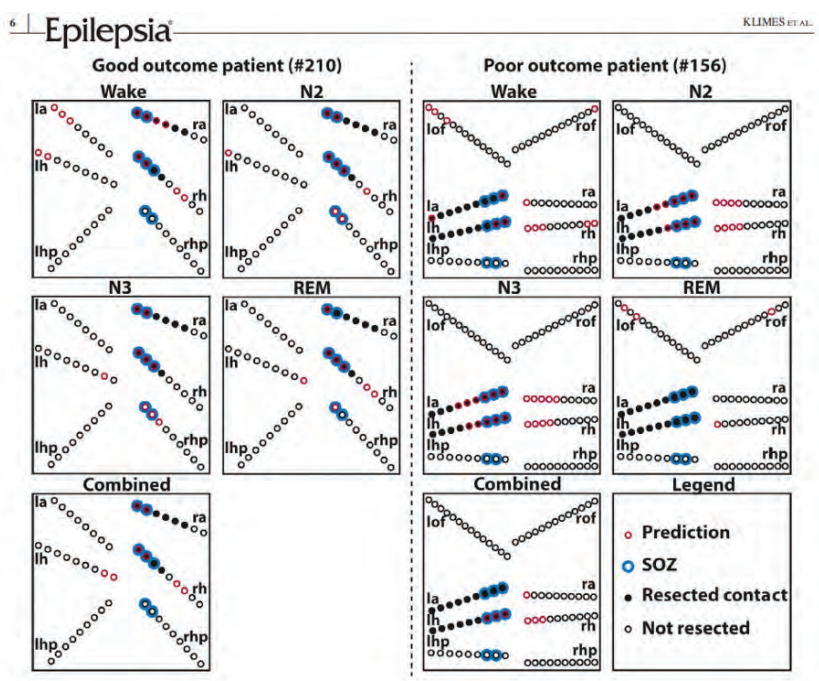
Nejedlý, P. et al. Intracerebral EEG Artifact Identification Using Convolutional Neural Networks. Neuroinformatics. 2019, 17(2), 225–234. ISSN 1539-2791 doi: 10.1007/s12021-018-9397-6

Nejedlý, P. et al. Deep-learning for seizure forecasting in canines with epilepsy. Journal of Neural Engineering. 2019, 16(3), 036031. ISSN 1741-2560 doi: 10.1088/1741-2552/ab172d

Nejedlý, P. et al. Exploiting Graphoelements and Convolutional Neural Networks with Long Short Term Memory for Classification of the Human Electroencephalogram. Scientific Reports. 2019, 9(AUG), 11383. ISSN 2045-2322 doi: 10.1038/s41598-019-47854-6

Cimbálník, J. et al. Multi-feature localization of epileptic foci from interictal, intracranial EEG. Clinical Neurophysiology. 2019, 130 (10), 1945–1953. ISSN 1388-2457 doi: 10.1016/j.clinph.2019.07.024





Localisation of epileptic areas in deep brain structures. *Left: Deep brain electrodes, identification of pathological areas (Cimbálník, J. et al. Clinical Neurophysiology, 2019). Right: Diagrams of intracerebral electrodes, example of localisation of areas affected by pathological activity in two patients (Klimeš, P. et al., Epilepsia, 2019, in print).*

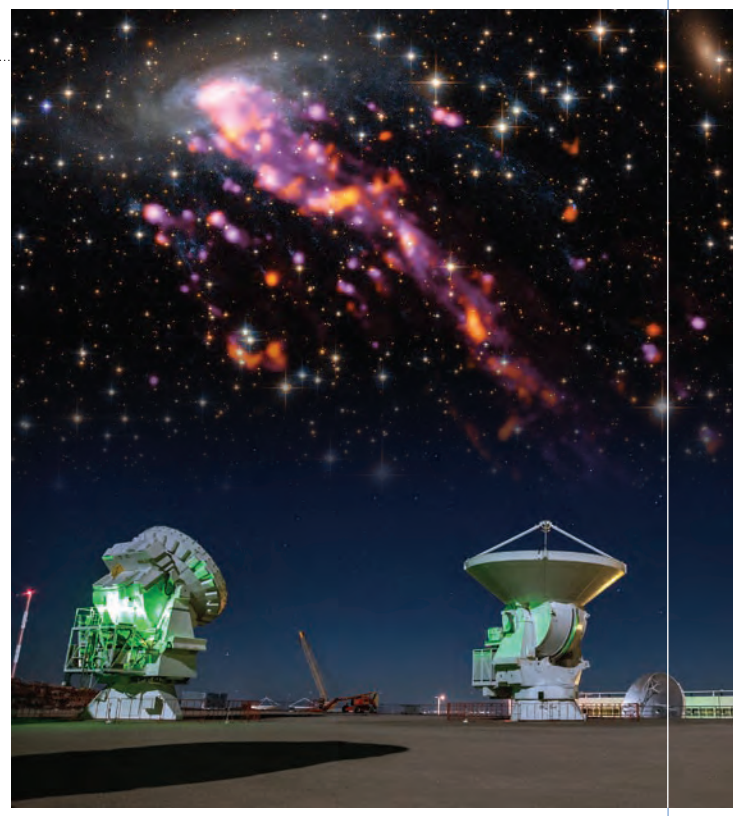
DISCOVERY OF MOLECULAR GAS IN THE TENTACLES OF A GALACTIC JELLYFISH

Astronomical Institute

ALMA, a huge astronomical interferometer, revealed a long tail of stripped molecular gas in a galaxy moving in the dense environment of the Norma cluster galaxy. New stars are formed from the gas, far from the galaxy itself. This discovery was made during the first mapping of cold molecular gas in a galaxy undergoing rapid evolution as it loses its interstellar gas due to the effects of external dynamical pressure in the dense environment of a galaxy cluster. In galaxy ESO 137-001, it forms a spectacular tail extending a great distance into inter-galactic space, which the astronomers call a galactic jellyfish due to its appearance. The research focused on the structure and kinematics of cold molecular gas, the physical processes associated with its formation outside of the galaxy, the relationship to star forming regions and the interrelationship with other gas components, which were also observed in ESO 137-001 by the Hubble Space Telescope, Chandra X-ray Telescope and VLT Optical Telescope. The structures of star forming regions were also modelled based on observations. This is the first observation made by Czech scientists with the ALMA millimetre interferometer. It is the largest contemporary ground-based astronomical instrument and consists of a system of 66 high-precision radio telescopes located in Chile at an altitude of 5,000 m. above sea level.

Bibliographic references:

Jáchym, P. et al. ALMA Unveils Widespread Molecular Gas Clumps in the Ram Pressure Stripped Tail of the Norma Jellyfish Galaxy, 2019, Astrophysical Journal, 883, 145 doi:10.3847/1538-4357/ab3ebc



ALMA examines a galactic jellyfish

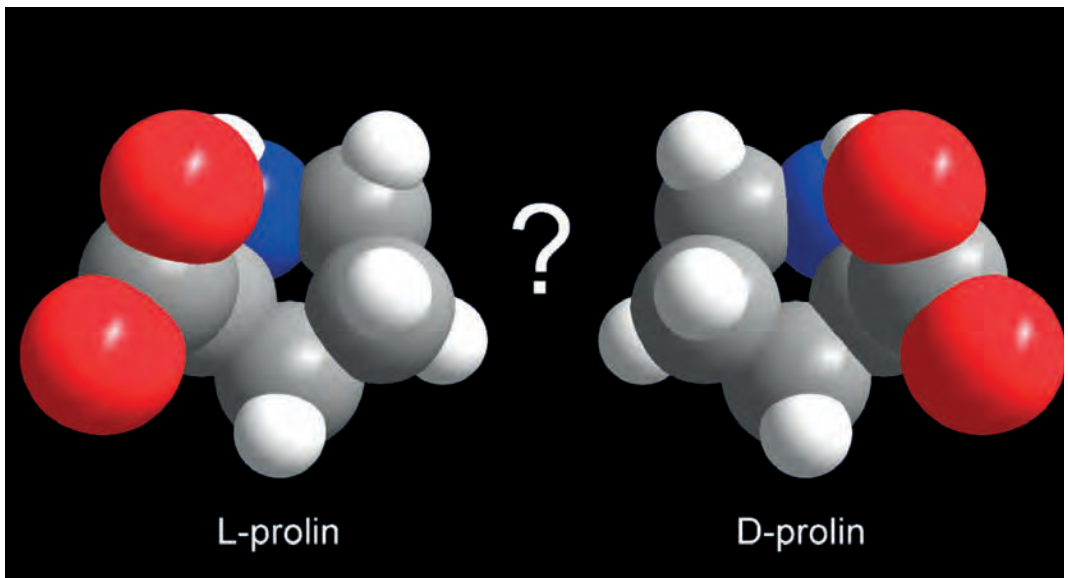
USE OF ELECTRON DIFFRACTION ENABLES LESS COSTLY AND FASTER DRUG DEVELOPMENT

Institute of Physics

Saccharides, proteins and DNA in living organisms are composed of chiral molecules. These molecules may appear in two absolute configurations which are mirror images of each other – like left and right hands. They are very similar, but not identical. If we were to replace a chiral molecule with its mirror molecule, it would not function properly in the living organism. Most contemporary pharmaceuticals are chiral molecules and there tends to be a significant difference between the effects of the two forms. While one has a therapeutic effect, the other may have a very minor or no therapeutic effect or may even be harmful. Determining the absolute configuration of organic molecules is thus crucial to the pharmaceutical industry and molecular biology research. Scientists from the Institute of Physics developed a new method that will help make development of new drugs simpler, faster and less costly. They demonstrated that the absolute configuration of organic molecules can be determined using electron diffraction on nanocrystalline material. *Ab initio* structure determination by electron diffraction has been limited thus far to compounds that maintain their crystallinity after a dose of one or more electrons per square angstrom.

Bibliographic references:

Brázda, P. et al. Electron diffraction determines molecular absolute configuration in a pharmaceutical nanocrystal. Science. 2019, 364(6441), 667–669. ISSN 0036-8075 doi: 10.1126/science.aaw2560



Molecular structure of L- and D-proline

Two different absolute configurations of proline molecules (labelled L- and D-proline) are mirror images of each other (chiral). Only L-proline is present in living organisms. Electron diffraction on nanocrystalline material was used to determine which of the molecules is found in a planned new medicine.

https://www.fzu.cz/novinky/rozptyl-elektronu-na-nanokrystalech-umozni-levnejsi-a-rychlejsi-vyvoj-leku

SELECTED RESULTS FROM RESEARCH AREA II. INSTITUTES

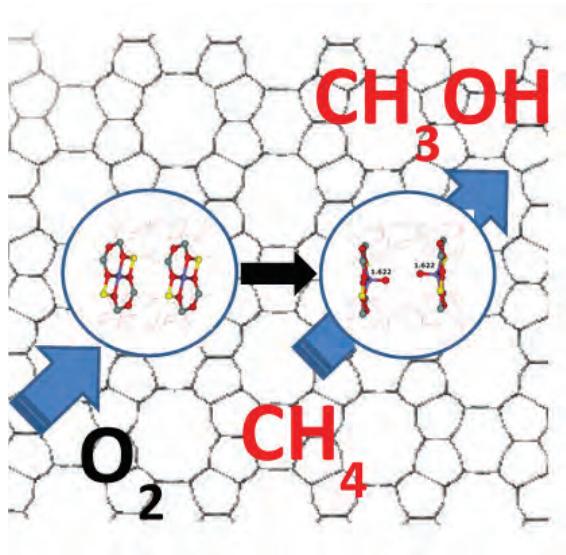
HIGHLY ACTIVE STRUCTURES FOR SELECTIVE OXIDATION OF METHANE TO METHANOL

J. Heyrovský Institute of Physical Chemistry

Physical chemists developed a unique new type of redox catalyst using a new type of catalytic centre stabilised in zeolite matrices. These binuclear cationic centers based on transition metal cations are capable of decomposing molecular oxygen or N_2O at room temperature to form highly active oxidic species. These oxidic species are subsequently capable of selectively oxidising methane to methanol at room temperature. The discovery of this system presents new possibilities in the utilisation of natural gas, which to date has served primarily as an energy source and for hydrogen production. The new procedure will enable efficient oxidation of methane to methanol, which acts as an energy carrier or as a base material for chemical production.

Bibliographic references:

Tabor, E. et al. Low-temperature selective oxidation of methane over distant binuclear cationic centers in zeolites. Communications Chemistry. 2019, 2 (JAN 2019), 71. E-ISSN 2399-3669 doi: 10.1038/s42004-019-0173-9



Binuclear cationic centres in a zeolite
Reduced binuclear centre stabilised in the zeolite ferrierite matrix and its oxidised form created through the decomposition of molecular oxygen.

GEOLOCATORS REVEAL NEW INSIGHTS INTO BIRD MIGRATION

Institute of Vertebrate Biology

Light geolocators are miniature devices, suitable even for small songbirds, that enable the study of these birds' migratory patterns, and – as confirmed by research – that have only a slight negative impact on the year-on-year survival of the studied animals. They enabled scientists to obtain interesting information about when small vertebrate types migrate and where they rest and winter. Geolocators record light intensity, which is used to determine the time of sunrise and sunset in various regions and day length at different times of year. These data are used to determine the approximate geographical location of the studied animal. Scientists at the Institute of Vertebrate Biology were able to study several species and obtain interesting results about the wintering location of the population. Thanks to an extensive network of collaborators in Europe, they also documented the continental differences in timing of autumn and spring bird migration between the western and eastern migration routes, and showed considerable variability in the timing and altitude of flight over the Sahara, one of the largest barriers on the journey to Africa.

Bibliographic references:

Briedis, M. et al. A full annual perspective on sex-biased migration timing in long-distance migratory birds. Proceedings of the Royal Society. B - Biological Sciences. 2019, 286 (1897), 20182821. ISSN 0962-8452 doi: 10.1098/rspb.2018.2821

Brlík, V. et al. Weak effects of geolocators on small birds: a meta-analysis controlled for phylogeny and publication bias. Weak effects of geolocators on small birds: a meta-analysis controlled for phylogeny and publication bias. Journal of Animal Ecology. 2019. ISSN 0021-8790 doi: 10.1111/1365–2656.12962

Jiguet, F. et al. Desert crossing strategies of migrant songbirds vary between and within species. Scientific Reports. 2019, 9 (1), 20248. ISSN 2045-2322 doi: 10.1038/s41598-019-56677-4

Briedis, M. et al. Broad-scale patterns of the Afro-Palearctic landbird migration. Global Ecology and Biogeography. 2019. Online ISSN:1466-8238. doi: 10.1111/geb.13063

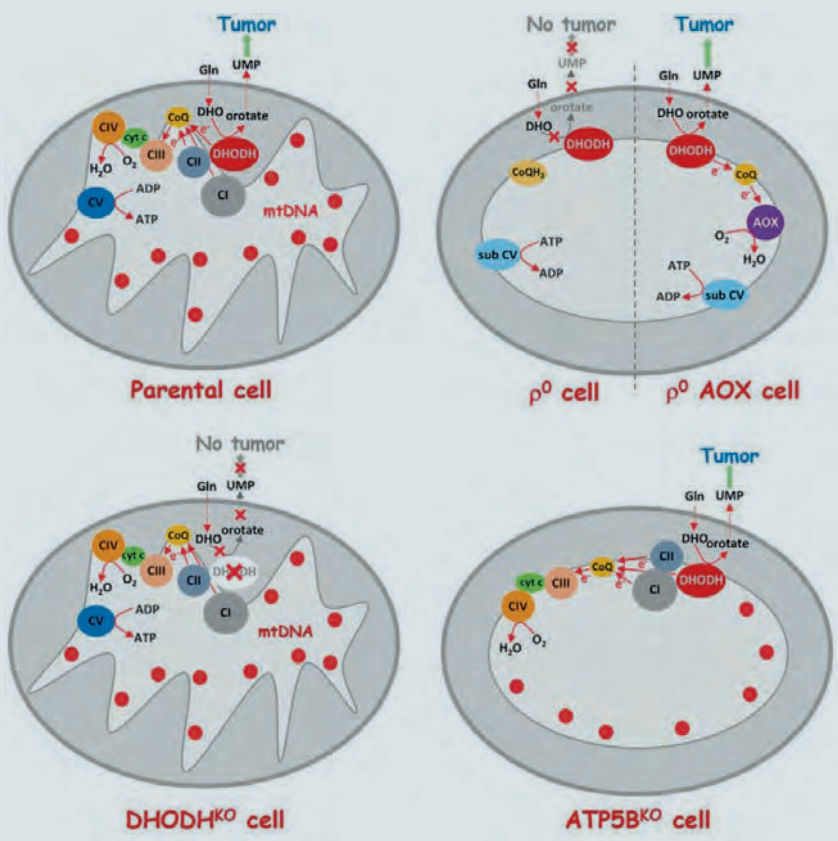
DETERMINATION OF CHEMICAL REACTION RESTORING TUMOUR GROWTH OF RESPIRATION--DEFICIENT CANCER CELLS

Institute of Biotechnology

Mitochondria, intracellular organelles with their own DNA (mtDNA), provide cells with energy that is essential to a number of processes, including cell growth. Energy production in mitochondria is dependent on mitochondrial respiration, which requires mtDNA. Institute of Biotechnology scientists had previously demonstrated that tumour cells with damaged mtDNA cannot respirate, and cannot therefore form tumours, but they can acquire functional mtDNA from surrounding host cells. They use these functional cells to restore their respiration, or more precisely, their oxidative phosphorylation, which is absolutely essential to restored tumour growth. Now scientists have clarified why respiration is so crucial to tumourigenesis. They discovered that new growth does not rest on renewed production of mitochondrial adenosintriphosphate (ATP), which plays a central role in cell energy metabolism, but rather on renewed pyrimidine biosynthesis. Pyrimidines are the building blocks of DNA essential for cell growth – and their synthesis is directly related to the respiration-dependent dihydroorotate dehydrogenase enzyme.

Bibliographic references:

Bajzikova, M. et al. Reactivation of Dihydroorotate Dehydrogenase-Driven Pyrimidine Biosynthesis Restores Tumor Growth of Respiration-Deficient Cancer Cells, Cell Metabolism, (2019), 29(2), 399-416. doi:10.1016/j.cmet.2018.10.014



Reactivation of dihydroorotate dehydrogenase-driven pyrimidine biosynthesis restores tumour growth of respiration-deficient cancer cells.

Tumour cells deficient in mitochondrial DNA do not form tumours unless they acquire mitochondria from host cells. Restored electron transport from mitochondria is key to pyrimidine biosynthesis using the dihydroorotate dehydrogenase enzyme (DHODH), which is critical for releasing cells back into the cell cycle. In this case restricted production of mitochondrial ATP (ATP5B KO cells) does not influence tumour growth.

The Eurasian reed warbler

(Acrocephalus scirpaceus) equipped with a light geolocator. (photo: Petr Procházka)

SELECTED RESULTS FROM RESEARCH AREA III. INSTITUTES

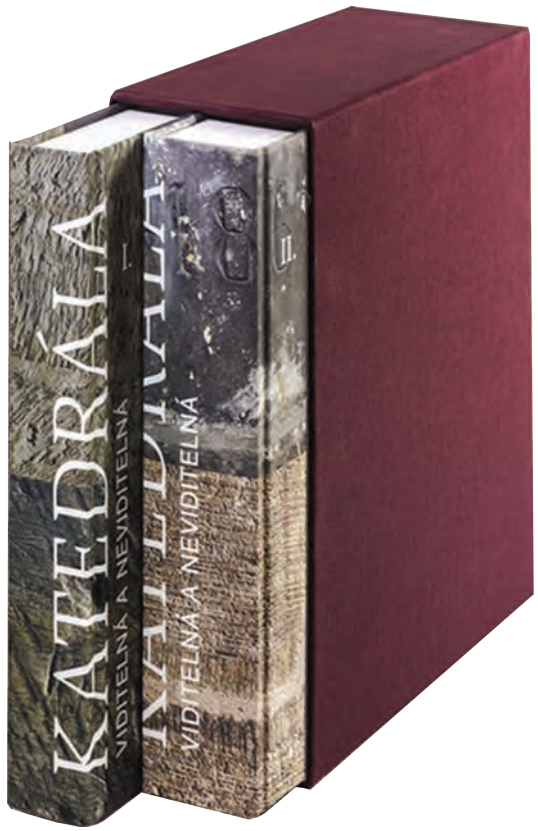
VISIBLE AND INVISIBLE CATHEDRAL

Institute of Archaeology, Prague

The two-volume publication *Visible and Invisible Cathedral: A Guide to the Millennial History of the Cathedral of St. Vitus, Wenceslas, Adalbert and the Virgin Mary at Prague Castle* presents a unique elaboration of the thousand-year history of this famous sacral structure. This monumental monography, which is a collaborative work of the Hilbertinum – Společnost Kamila Hilberta, z.s. and the Institute of Archaeology, Prague, engaged archaeologists, geologists, historians of architecture, art, liturgy and music in collecting the most up-to-date findings about the cathedral's earliest history, key individuals associated with the church and its construction history, architecture and artwork. The publication traces the cathedral's history farther back than the genesis of Charles IV's idea and construction by Mattias of Arras, which are sometimes the starting points in similar books, to the period before the promontory above the Moldau River was settled. The authors added chapters about music and liturgical rituals that took place in the cathedral over the centuries, important social milestones as well as the personal stories of the builders, stonemasons, canons and organists. The text is accompanied by a rich collection of images, including previously unpublished archival materials, photographs and new reconstructions and models. The notes, list of sources, cited literature and register of names also provide a wealth of information.

Bibliographic references:

Maříková-Kubková, J. ed. Visible and Invisible Cathedral: A Guide to the Millennial History of the Cathedral of St. Vitus, Wenceslas, Adalbert and the Virgin Mary at Prague Castle in Prague: Hilbertinum – Společnost Kamila Hilberta, z. s., 2019. ISBN 978-80-905659-0-6



Cover of *Visible and Invisible Cathedral: A Guide to the Millennial History of the Cathedral of St. Vitus, Wenceslas, Adalbert and the Virgin Mary at Prague Castle*

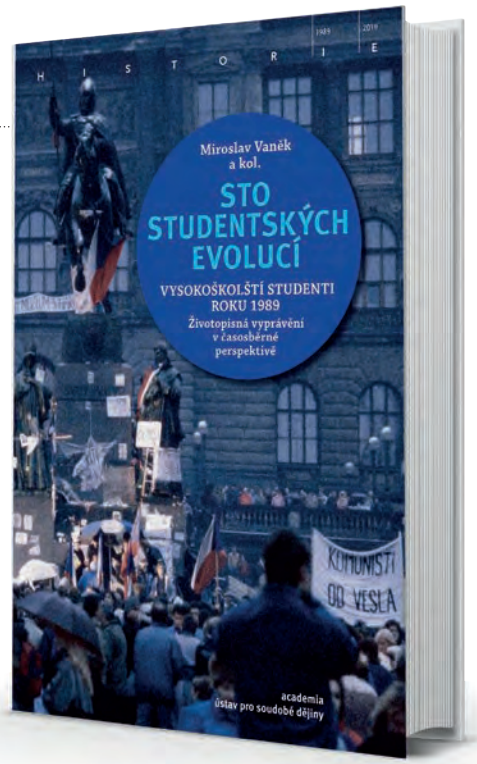
ONE HUNDRED STUDENT EVOLUTIONS: UNIVERSITY STUDENTS OF 1989

Institute of Contemporary History

The three-volume publication *One Hundred Student Evolutions: University Students of 1989, Biographical Statements in a Time-Lapse Perspective* focuses on student activists from the pivotal year of 1989. Using time-lapse oral history methods, it captures how the formative experience of the November revolution influenced the personal, professional and in some cases political dimensions of the students' subsequent journeys through life. In the first volume, the authors clarify their methodology and technical approach and capture the students' experiences with political and social developments in a set of interpretative chapters. The second and third volumes contain a collection of 91 edited interviews, a valuable source for studies of November 1989 as well as the period that followed. Although the lives and experiences of the students differ, the interviews confirm that the majority of them attribute great significance to their experiences during the Velvet Revolution. The Institute of Contemporary History also developed a related website, http://www.studenti89.usd.cas.cz/ *One Hundred Student Evolutions: University Students of 1989, Biographical Statements in a Time-Lapse Perspective*, where 90 former student activists respond to questions about what they recall when they hear the phrase November 1989, how they view today's young generation and what they consider their personal milestones in life.

Bibliographic references:

Vaněk, M. et al. One Hundred Student Evolutions: University Students of 1989, Biographical Statements in a Time-Lapse Perspective. Prague: Academia, Institute of Contemporary History of the CAS, 2019. 1600 s. ISBN 978-80-200-3027-6



Cover of *One Hundred Student Evolutions*

Home page of *the One Hundred Student (R)evolutions website*

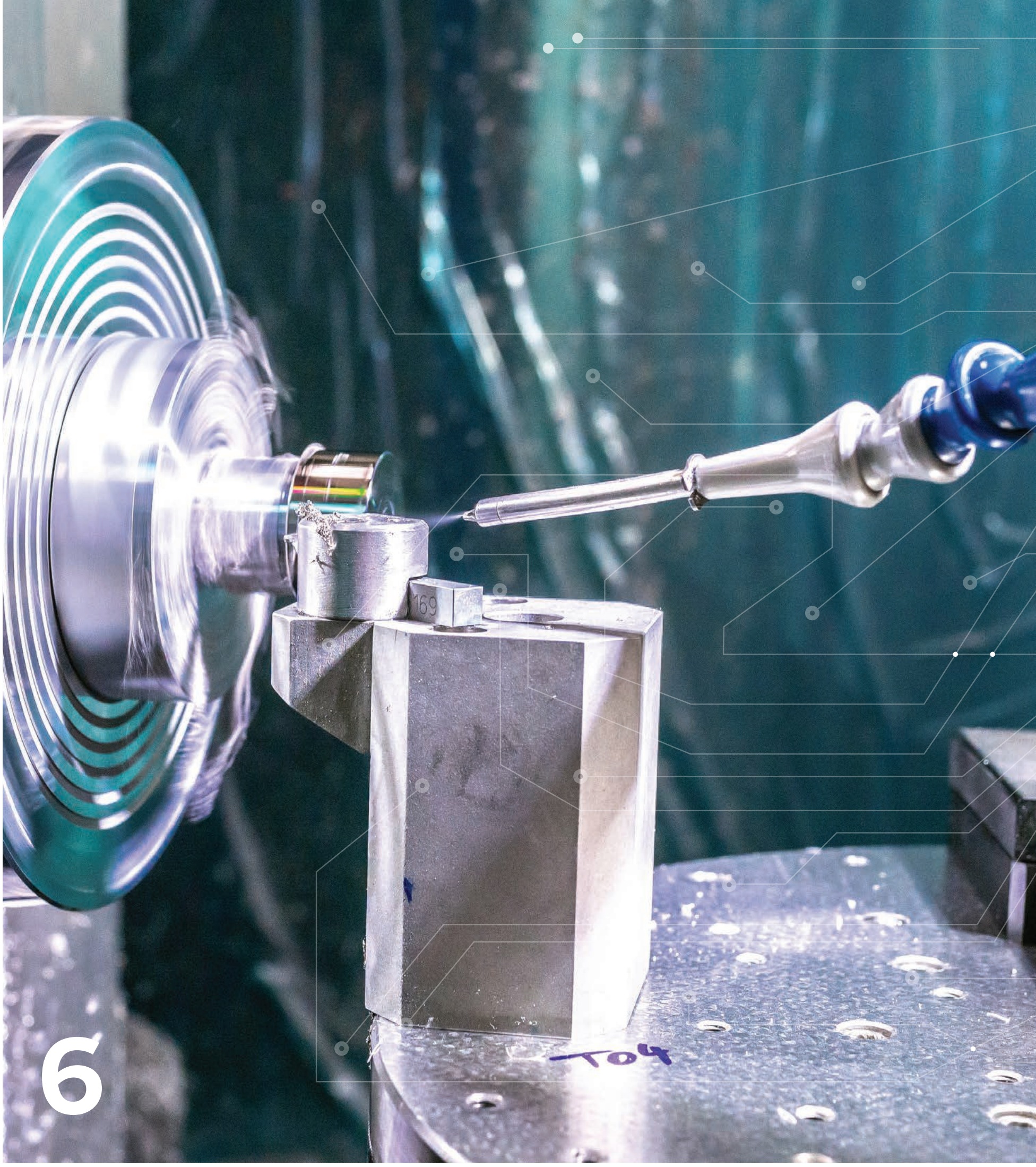
TOWARDS BETTER INCOME MEASUREMENT: POVERTY, PROGRAM EFFECTIVENESS AND HOLES IN THE SAFETY NET

Economics Institute

The authors connected survey and administrative data to improve income measurement to obtain more detailed and precise conclusions for poverty, program effectiveness and holes in the safety net. The resultant work describes the consequences of underreporting of social welfare transfer programmes in statistical surveys. It reveals that use of survey data understates the income of poor households, biases findings about anti-poverty programs and underrepresents their effects. Using combined survey and administrative data the poverty reducing effect of these programs is nearly doubled. The results of this study have sizeable potential to influence government social transfer programme policy.

Bibliographic references:

Meyer, B. D., Mittag, N. Using linked survey and administrative data to better measure income: implications for poverty, program effectiveness, and holes in the safety net. American Economic Journal-Applied Economics. 2019, 11(2), 176–204. ISSN 1945-7782 doi: 10.1257/app.20170478


169
T04

Strategy AV21

Top research in the public interest

Strategy AV21, approved at the CAS Academy Assembly in 2014, is the result of the CAS' ongoing efforts to help solve contemporary social problems, and is aptly characterised by the motto "Top research in the public interest". Strategy AV21 research programmes focus on current, socially important issues. These issues require broad-based, interdisciplinary research and inter-institutional synergy, both between CAS Institutes and with other relevant external partners. Strategy AV2 research programmes benefit from the wide range of research concentrated within the CAS, which gives them the possibility to create exceptional connections between findings from the natural, technical and social sciences and humanities. The engagement of all CAS Institutes in Strategy AV21, excepting two, as well as many external academic institutions, is further evidence of its success.

Given that the Strategy AV21 goals are aligned with the goals of the National Research and Innovation Strategy for Intelligent Specialisation of the Czech Republic (RIS3), representatives of Strategy AV21 participated in the RIS3 strategy update and specific thematic work for RIS3 national innovation platforms.

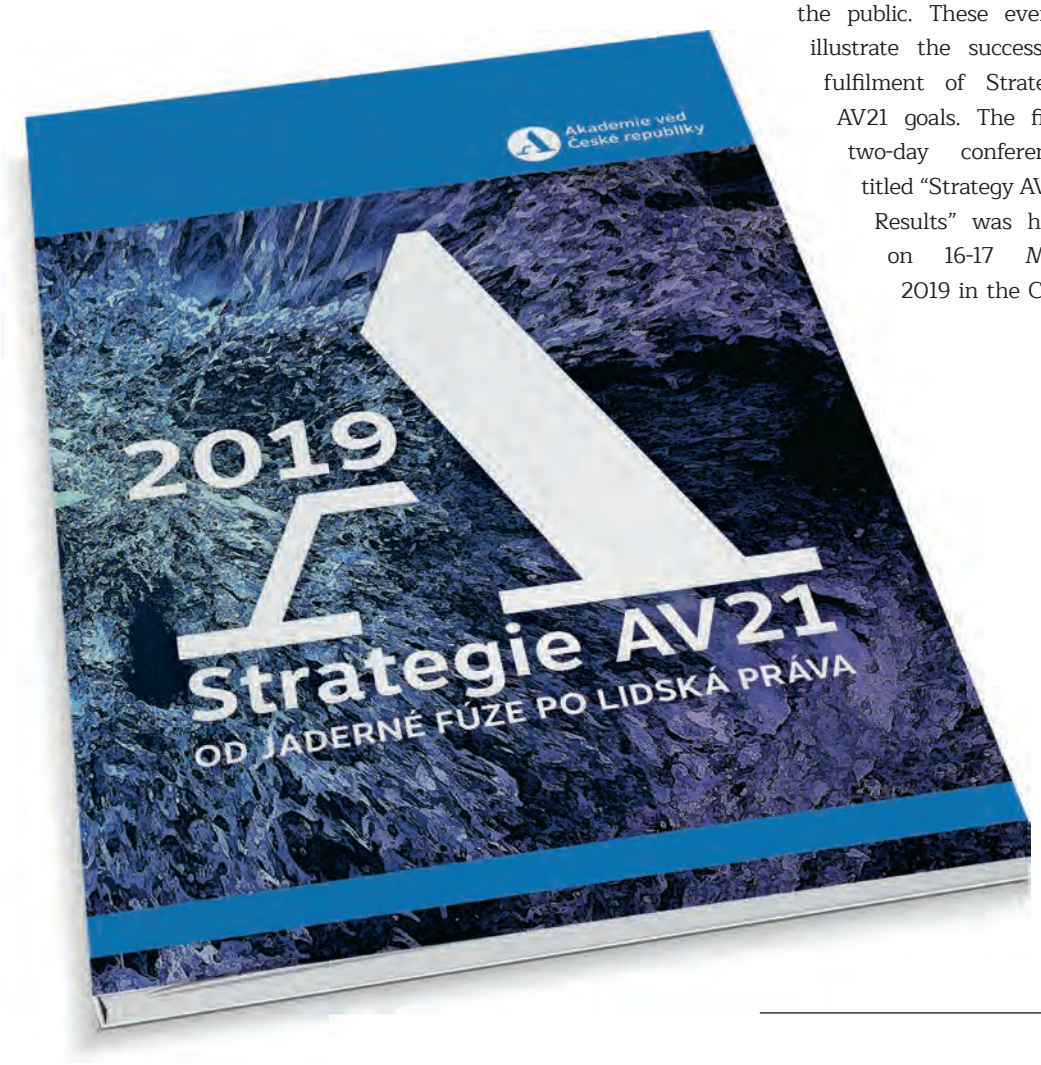
2019 was the fifth year of Strategy AV21 implementation and included 18 research programmes and two associated activities. Fourteen research programmes concluded their five-year efforts. Three of these programmes ended, nine were recommended for two-year extensions and two for one-year extensions. The Academy Council also approved five new research programmes: Foods for the Future, Water for Life, Landscape Preservation and Revitalisation, Society in Motion and The City as a Laboratory of Change and Safe Construction, all of which will commence work in 2020.

With these new additions, the total number of research programmes will rise from 18 to 20 in 2020, when all of the CAS Institutes will take part in fulfilling the Strategy AV21 goals. The associated IDEA Research Section for Research, Development and Innovation has academy-wide significance and was therefore transferred outside of Strategy AV21.

Two conferences and one exhibition presenting selected results from the research programmes were held in 2019 for legislators, members of the scientific community and the public. These events illustrate the successful fulfilment of Strategy AV21 goals. The first two-day conference titled "Strategy AV21 Results" was held on 16-17 May 2019 in the CAS building on Národní třída and presented results from all 18 research programmes. The second, one-day conference, titled "Top research in the public interest" was held on 4 November 2019 in the Chamber of Deputies of the Parliament of the Czech Republic under the patronage of the Committee for Science, Education, Culture, Youth and Sports. Results from eight selected research programmes representing all three CAS research areas were presented. An eponymous exhibition in the Chamber of Deputies of the Parliament accompanied a conference which ran from 29 October through 8 November 2019, and provided more detailed information about some Strategy AV21 results, including selected publications.

Information about the research programmes and associated activities, results and upcoming events were regularly published on both the Czech and English versions of the Strategy AV21 website (http://www.avcr.cz/en/strategy/).

Research programme reports presenting the results of specific activities are published by the Strategy AV21 Editorial Board and the Academia Publishing House provides editing and printing services. Information about report content and availability may be found at the website http://www.avcr.cz/en/strategy/documents/.



Cover
Strategy AV21: From nuclear fusion to human rights

> An important part of Strategy AV21 is the CAS Application Laboratories project, which is a practical embodiment of the motto "Top research in the public interest". The aims of this project are to expand direct contacts between CAS Institutes and industrial partners and support specific collaborative projects between the academic and application sectors.

A number of books and brochures featuring the results of different research programmes were published in 2019, along with other analyses of the state of research developed through the IDEA section associated activity.

Expert opinions for legislative bodies, called AVexes, are another important output of Strategy AV21. The aim is to provide lawmakers with expert advice to inform their legislative decision-making. Four AVex expert opinions were elaborated in 2019 *(Large Data, the Current Problem of Drought in the Czech Republic, Genetically Modified Crops, Drinking Water – Is There Enough and Will There Be?)*.

In compliance with the updated directive, in 2019 the Strategy AV21 Council expended great effort on a complex evaluation of the research programmes according to eleven qualitative criteria and three additional criteria for associated activities. In October, results achieved in 2019 were evaluated. Based of the evaluation, the research programmes were classified into two success categories, which had a subsequent impact on recommendations for improvement and funding.

Strategy AV21 Research Programmes

AND COORDINATORS

01 **Hopes and Risks of the Digital Era**
doc. RNDr. Barbara Zitová, Ph.D.

02 **Systems for the Nuclear Power Industry**
doc. RNDr. Radomír Pánek, Ph.D.

03 **Efficient Energy Conversion and Storage**
Ing. Jiří Plešek, CSc.

04 **Natural Hazards**
RNDr. Josef Stemberk, CSc.

05 **New Materials Based on Metals, Ceramics and Composites**
prof. RNDr. Ludvík Kunz, CSc., dr. h. c.

06 **Diagnostic Methods and Techniques**
Ing. Ilona Müllerová, DrSc.

07 **Wellbeing in Health and Disease**
doc. MUDr. Jakub Otáhal, Ph.D.

08 **Foods for the Future**
prof. Ing. Jaroslav Doležel, DrSc.

09 **Diversity of Life and Health of Ecosystems**
prof. Ing. Josef Špak, DrSc.

10 **Molecules and Materials for Life**
Ing. Jiří Brus, Dr.

11 **Europe and the State: Between Barbarism and Civilisation**
prof. PhDr. Petr Sommer, CSc., DSc.

12 **Memory in the Digital Age**
PhDr. Luboš Velek, Ph.D.

13 **Effective Public Policies and Contemporary Society**
doc. Ing. Daniel Münich, Ph.D.

14 **Forms and Functions of Communication**
prof. PhDr. Petr Koťátko, CSc.

15 **Global Conflicts and Local Interactions: Cultural and Societal Challenges**
doc. PhDr. Marek Hrubec, Ph.D.

16 **Space for Mankind**
RNDr. Jiří Svoboda, Ph.D.

17 **Light at the Service of Society**
Ing. Tomáš Mocek, Ph.D.

18 **Preclinical Testing of Potential Pharmaceuticals**
MUDr. Jan Kopecký, DrSc.


HS Hi-R NEO

Projects from operational programmes

of EU Structural Funds

In 2019, CAS Institutes were involved in 160 research projects falling under EU Structural Funds operational programmes. CAS Institutes served as coordinators or beneficiaries of 122 projects, of which 13 were launched in 2019, 77 were ongoing, and 32 were completed during the course of the year. A summary of CAS Institutes' participation in the projects, categorised by operational programme, is provided in Table No 1. More detailed information about projects launched in 2019, including one-year projects, is presented in Table No 2. The total amount of approved support for the entire duration of the specified projects is CZK 163,849,000.

Table No. 1: Participation of CAS Institutes in operational programme projects in 2019

Operational programme	Projects launched	Projects ongoing	Projects completed	TOTAL
Integrated Regional Operational Programme	1	0	0	1
OP Enterprise and Innovation for Competitiveness	0	1	5	6
OP Prague - Growth Pole of the Czech Republic	3	1	1	5
OP Research, Development and Education	8	69	20	97
OP Employment	0	2	0	2
OP Environment	0	0	2	2
Interregional Cooperation OP Interreg Europe	0	1	0	1
Transnational Cooperation OP Interreg Central Europe	0	2	0	2
Cross-border Cooperation OP	1	1	2	4
Interreg Austria – Czech Republic	1	1	2	4
Cross-border Cooperation OP Free State of Bavaria – Czech Republic	0	0	1	1
Cross-border Cooperation OP Free State of Saxony – Czech Republic	0	0	1	1
TOTAL	**13**	**77**	**32**	**122**

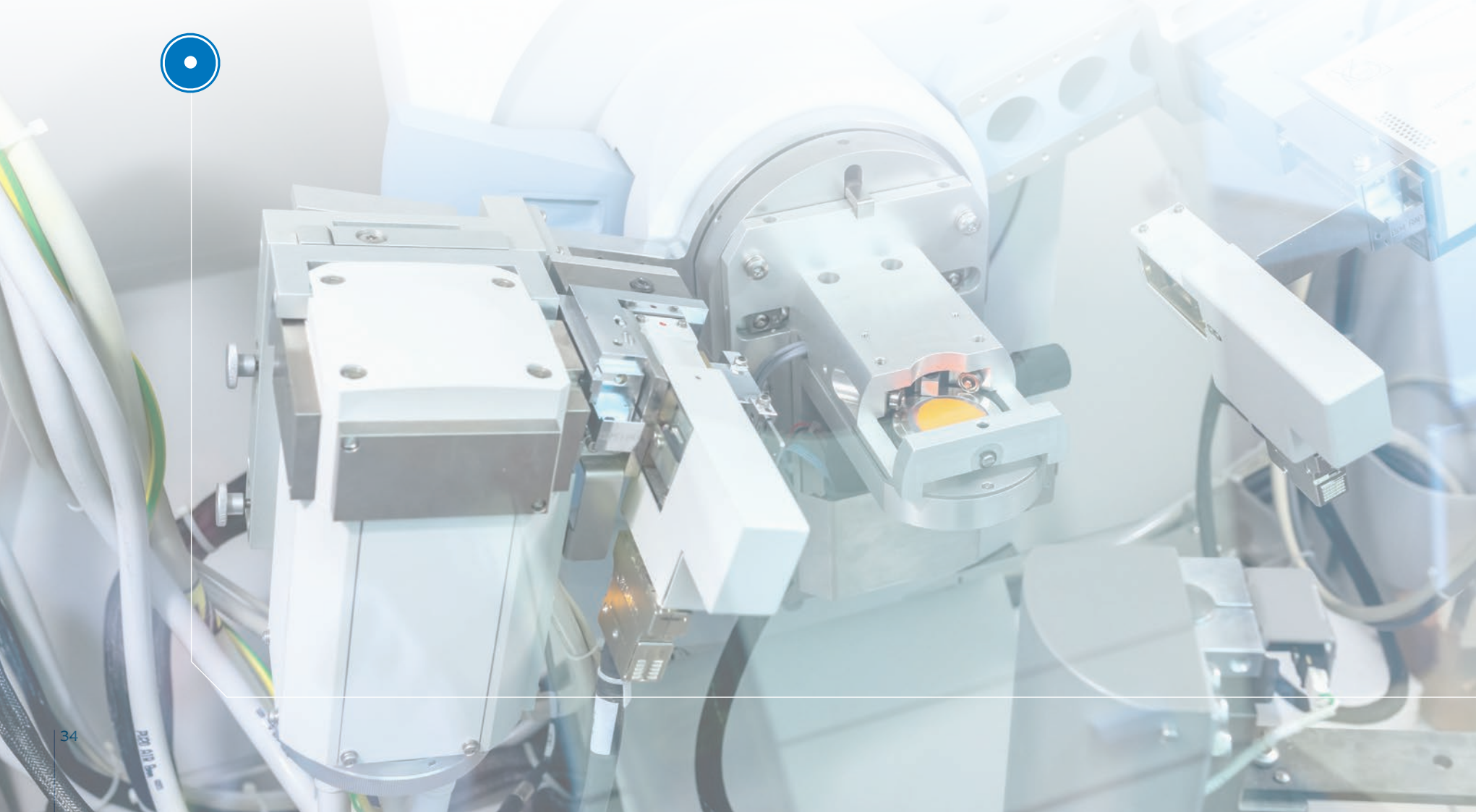


Table No. 2: Operational programme projects launched in 2019

Beneficiary coordinator	Project	Total approved support for the project in thousands of CZK
	Integrated Regional Operational Programme	
BÚ	Increasing protection and unification of Průhonice Park	**8,997**
	OP Prague - Growth Pole of the Czech Republic	
FZÚ	Non-destructive monument testing methods	**17,741**
FZÚ	Advanced food safety technology	**11,622**
SSČ	Expansion of capacity and transformation of the Lvíček class	**2,045**
	OP Research, Development and Education	
BC	H2020 – LeishOmics and Invaweb European Fellowships	**5,805**
BC	Expanded view of organism energy balance: neural integration between insulin signalisation and the adipokinetic hormone	**3,103**
BÚ	Integration of root system architecture model into terrestrial modelling to specify forecasting of soil moisture and transpiration in the future climate	**3,103**
BÚ	R.S.A.T.M.- Integration of root system architecture model into terrestrial modelling to specify forecasting of soil moisture and transpiration in the future climate	**457**
FGÚ	Career advancement support	**7,749**
FLÚ	Knowledge in the tangible world	**4,158**
ÚFCH JH	Theoretical modelling of redox properties and their influence on reactivity of polynuclear centres in non-heme metalloenzyme and biomimetic complexes	**3,266**
	OP Environment	
ÚCHP	Expert measurement of ultra fine air particles: monitoring station and calibration laboratory	**3,545**
ÚFA	Heat source exchange - Kopisty	**214**
	Cross-border Cooperation OP Interreg Austria – Czech Republic	
SSČ	Region of renaissance against the flow of time: Northern gate of the Vysočina Geopark	**4,505**

Practical application of research

The mission of the Czech Academy of Sciences encompasses an emphasis both on excellence in science and on the socio-economic relevance of the research conducted by its institutes. Relevance is understood in this context in the broadest sense, i.e. in terms of increasing the competitiveness of the national economy as well as the benefits and applicability of research results to non-commercial uses. This undoubtedly includes e.g. the application of research results from biological fields to environmental protection and the use of social scientists' expertise in the state administration.

Application collaborations and knowledge transfer

In 2019, the CAS participated in the implementation of the National Innovation Strategy titled "Czech Republic: The Country for the Future". Collaboration between the academic and application sectors, and knowledge transfer and technology, relates primarily to initiatives to support spin-offs and start-ups.

With support from the Ministry of Industry and Trade and CzechInvest, a working group was established and charged with providing methodological guidance, eliminating obstacles and taking steps to develop an ecosystem to nurture the founding of technology spin-offs and start-ups that will translate research results into practice. Academy Council member Josef Lazar is part of the working group, where he is responsible for coordination of knowledge and technology transfer to the application sector, and coordination and conceptual oversight of intellectual property use. Professor Martin Fusek is also a member and concurrently CEO of IOCB Tech, a company focused on transfer of Institute of Organic Chemistry and Biochemistry technology; his wealth of experience is an invaluable asset. In 2019, the working group completed a methodology document that aims to increase the legal confidence of institutes and individuals developing spin-offs.

Inspiration gleaned from other countries is very important to CAS' efforts to support the establishment of spin-offs and start-ups. The CAS is a member of the TTO Circle, part of the Joint Research Center (JRC), which brings together individuals and technology transfer offices of major European public research organisations. Support for establishment of spin-offs and start-ups is discussed extensively at TTO Circle meetings and considered the main direction of transfer efforts. This is due to the fact that contractual or collaborative research projects are typically negotiated by researchers on an individual basis and licencing of patents and technologies directly into the corporate sphere is restricted to a fairly narrow segment of the biomedicine, pharmaceutical and, to some degree, chemical research sectors and industries. Traditional industrial sectors such as mechanical and electrical engineering, etc., tend to be more conservative in accepting research results.

Inspiration gleaned from other countries is very important to CAS' efforts to support the establishment of spin-offs and start-ups. The CAS is a member of the TTO Circle, part of the Joint Research Center (JRC), which brings together individuals and technology transfer offices of major European public research organisations.

Technology transfer through establishment of spin-offs (and in some cases subsequent sale of spin-offs) can be a form of commercialisation that confirms the market applicability of results. These experiences are very useful and important in directing knowledge and technology transfer efforts and avoiding dead ends.

Thanks to personal ties from the TTO Circle, the Technology Transfer Centre (CETTAV) of the CAS was able to invite experienced transfer specialists from the German Fraunhofer-Gesellschaft research organisation and its Dutch equivalent, TNO (Netherlands Organisation for Applied Scientific Research) to hold a series of seminars for interested CAS Institute researchers about technology transfer through support of spin-off and start-up efforts. This series was part of the Academic TTO project, which supports sharing of academic institutes' transfer knowledge and competences.

A key goal of the Centre in its collaborative efforts with the application sector is eliminating obstacles, primarily those of an administrative nature. In the Czech Republic, rules governing state

support are still strongly perceived as resulting in a framework delineating the commercialisation activities of research organizations and the role of those activities in market deformation. It is becoming apparent that this problem is common to all EU13 countries, where these rules are used by controlling authorities as a control mechanism and are often interpreted restrictively. This often creates the impression in the academic community that any collaboration with the application sector is strictly regulated, which fosters an atmosphere of legal uncertainty. The CAS representative brought up this fact at the TTO Circle, which spurred the establishment of a working group at the JRC that is preparing explanatory material for EU13 countries. The CAS representative played a key role in consultations about and commenting of this document, which is to be released in 2020.

The issue of state support is also duly addressed in the Czech Republic. The Research, Development and Innovation Council initiated the establishment of a working group and the CAS is a member. The main work on the explanatory material took place in 2019 and should be completed in 2020.

It is also becoming clear that a significant issue on the European level is exercising intellectual property rights in science and research. Research organisations and individual researchers are required to follow many rules and recommendations, such as “Open Access”, “Open Science”, “Responsible Research and Innovations” as well as European intellectual property rights recommendations. Unification or at least harmonisation of all these concepts would greatly alleviate the situation for the Czech academic community and others. A number of these rules and recommendations inevitably conflict with one another. At the JRC this issue was clearly identified and the authorised CAS representative, the relevant member of the Academy Council charged with coordination of knowledge and technology transfer to the application sector, coordination and conceptual oversight of use of intellectual property, took part in these meetings.

In 2019, documents and rules governing evaluation of teams and CAS Institutes were completed. Collaboration with the application sector was reflected in the socio-economic relevance criteria, which are now on the same level as scientific excellence. The output evaluation scale has been unified and reflects the fact that research results can be, and often are, important not only in terms of scientific excellence but also in regard to their socio-economic significance. This concept was proposed at the CAS Technology Transfer Council and then incorporated into the evaluation principles. The institute evaluation criteria now also include assessment of how well the intellectual property management system and knowledge and technology transfer work at each institute.

In regard to systemisation of knowledge and technology transfer at the CAS, the CETTAV is part of the Centre of Administration and Operations. In 2019, a key element was the continuation of the project Academic TTO and dissemination of information and awareness-raising about intellectual property rights and transfers at CAS Institutes. CETTAV staff provided numerous consultations and helped resolve some of the many transfer issues that arose.

Lastly, it should be noted that the CAS management maintained its good relations with the highest level of Czech industry, represented by the Union of Industry and Transport, in 2019. Informal meetings of CAS and Union representatives are a key ingredient in developing collaborative efforts between specific companies and CAS Institutes and teams. This type of smooth cooperation is essential to the support of innovation and the Czech economy’s competitiveness and the country’s prosperity, and is in the interest of both the academic and business sectors and the Czech population as a whole. It is the best possible fulfilment of the National Innovation Strategy titled “Czech Republic: The Country for the Future”.

Selected examples

of practical research application

Biology Centre of the CAS

Scientists verified technology for production of entomopathogenic fungus *Isaria fumosorosea* strain CCM 8367 blastospores using various cultivation media. The technology includes the procedure, original cultivation media recipe and the blastospore yield. The technology can be used for small lot production of bio-pesticides, auxiliary products and suppressive substrates.

Biotechnology Institute of the CAS

A patent was filed for the synthesis and biological effects of new mitochondrially targeted iron chelators based on 3.5-bis(phenyl)-1H-heteroaryl. These new substances show selective effects on tumour cells and are capable of reducing tumour growth and division at very low concentrations and also inducing tumour death. They can serve as new elements of cancer therapy.

Institute of Physics of the CAS

In collaboration with Rigaku Innovative Technologies Europe s.r.o., a three-colour compact x-ray source prototype was developed and tested. The source can emit x-rays in three different wavelengths without requiring any resetting of the source.

Institute of Physiology of the CAS

A patent was granted for synthetic peptides derived from natural peptide hylanine and their use in treating infectious diseases caused by various pathogenic bacteria and Candida genus fungi, in particular topical infections, such as poorly healing wounds and skin problems, mucosal infections, as well as infections in catheters, joint replacements and implanted materials, which are very often caused by microbial biofilms.

Geology Institute of the CAS

In collaboration with Severočeské doly a.s., the paleomagnetic properties of rock from bore HK930 were measured, which helped clarify the local stratigraphy of upper-layer clays in the Most basin, an important factor in economically efficient mining of the deposit.

Microbiology Institute of the CAS

The Institute developed and optimised pilot cultivation and DSP recombinant intracellular oxido-reductase in microbial production for industrial use, which will serve to protect food from oxidation, for Cambrex IEP GmBH, Weisbaden.

Economics Institute of the CAS

In collaboration with OGResearch, s.r.o., macroeconomic models for forecasting and currency policy analysis in developing countries were created. A "Macro Risk" for 70 countries is also regularly processed. Macro Risk is a statistical model interpreted using a set of macroeconomic imbalance indicators.

Institute of Chemical Process Fundamentals of the CAS

In collaboration with TARPO spol. s r.o., operation of a processing line for material transformation of dry sewage sludge stabilised through anaerobic fermentation was developed, constructed and tested, with simultaneous use of energy from the organic component of the sludge. The processing line was implemented in a container version while the pyrolyser was tested in a specific area. Biochar may be used as a highly porous fertiliser and also as a high quality component for cultivating and fertilising soil.

Institute of Experimental Botany of the CAS

Non-exclusive commercial licensing agreements were concluded for propagation and sale of the apple varieties Biogolden, Goldstar, Lotos, Rajka, Rubinola and Topaz, which cover propagation, cultivation, use, sale and procurement of trees of these varieties and are valid in a number of countries.

Institute of Plasma Physics of the CAS

The Institute developed protective coatings made of ceramics, i.e. mainly corundum, for key glass furnace components such as molybdenum stirrer shafts. The protective ceramic coatings will be produced by KAVALIERGLASS, a.s.

J. Heyrovský Institute of Physical Chemistry of the CAS

A method of producing a porous diamond layer and a thick porous diamond layer reinforced by nanofibres was patented. This method includes a step in which diamond nanoparticles are injected into nanofibres of any material capable of withstanding plasma-enhanced deposition. The diamond layers are used for industrial applications and high surface area electrodes, e.g. for water purification or supercapacitors.

Institute of Geonics of the CAS

A mathematical model of associated thermo-hydro-mechanical processes in bentonite sealing barriers of deep storage areas for spent nuclear fuel was proposed, implemented and tested as part of the international DECOVALEX 2019 project. Testing took place using data from the FEBEX experiment implemented at the Grimsel laboratory in Switzerland. The modelling will serve for preparation of deep storage areas for spent nuclear fuel in the Czech Republic.

Institute of Computer Science of the CAS

Data analyses were conducted for ŠKODA AUTO a.s. examining the dependence of orders on sales representatives' motivational factors, weather, holidays and days of the week and the geographical dependence of spare parts sales. The analyses will help optimise management of warehouse stock and sales support.

Institute of Macromolecular Chemistry of the CAS

In collaboration with MemBrain s.r.o., Stráž pod Ralskem, and MEGA a.s., Prague, a functional heterogeneous ion-exchange membrane with a new binder was developed. The binder's processing and mechanical properties make it possible to develop a thinner membrane that will have lower resistance to the passing ions.

Institute of Molecular Genetics of the CAS

A patent was granted for a pharmaceutical product containing diphenyleneiodonium for treatment of diseases caused by parasites of the family *Trypanosomatidae*. The subject of the invention is the use of diphenyleneiodonium or its pharmaceutically acceptable salt for diseases caused by parasites of the genuses *Leishmania* and *Trypanosoma*. The product can be applied in both human and veterinary medicine. Medical treatment is understood in this context as both prophylaxis and curative treatment.

Institute of Organic Chemistry and Biochemistry of the CAS

A patent was granted for a group of substituted thienopyrrolopyrimidine ribonucleosides which exhibit potent cytostatic and cytotoxic activity against cancer cell lines of a wide range of diseases, including tumours of various histogenetic origins. The compounds may be useful in the treatment of cancer.

Institute of Scientific Instruments of the CAS

In collaboration with CARDION s.r.o., a HF-BSM monitor was developed for measuring, recording and analysing time-varying electrical potential caused by cardiac activity on the chest surface with an orthogonal electrode placement system, which is designed for detailed measurement and visualisation of electrical cardiac activity (HF-BSM - High Frequency Body Surface Mapping). The results are displayed on image maps generated for different time intervals to provide detailed information about the evolution of the heart's electrical activity on the depicted area of the chest during the entire phase of the cardiac cycle.

Institute of Rock Structure and Mechanics of the CAS

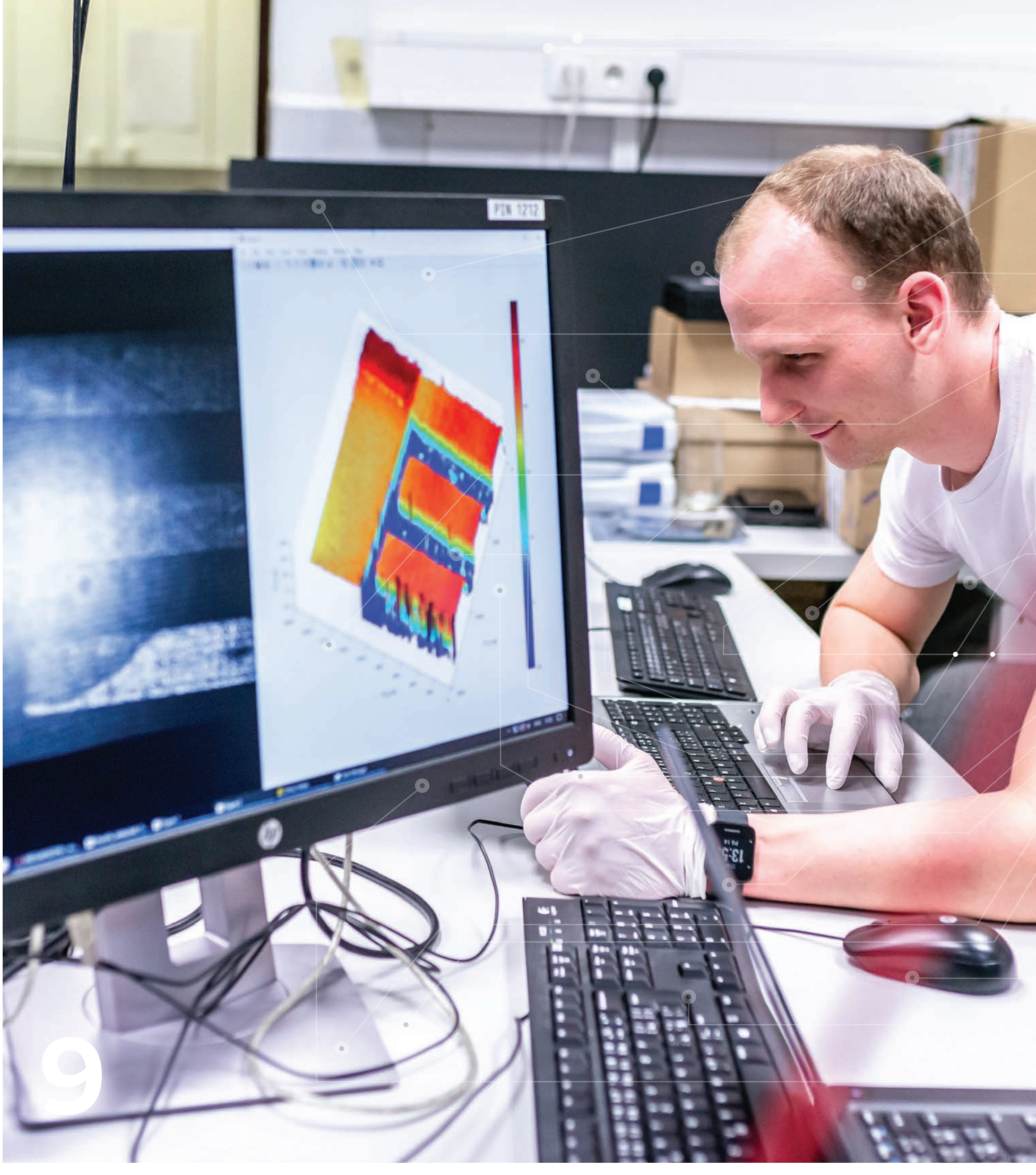
A patent was granted for the melting area of a continuous glass melting furnace and a melting method for the given area. The solution describes the melting area of a continuous glass furnace heated by heating electrodes and a method of melting glass in this melting area to make maximum use of the melting area for melting processes. An important parameter is the correct energy distribution in the longitudinal axis of the melting area with relatively low energy consumption. The solution will increase the performance of glass melting furnaces, reduce energy consumption in glass melting and increase the quality of molten glass.

Institute of State and Law of the CAS

A legal opinion was prepared on the legal nature of warnings and methodologies issued by the National Office for Cyber Security under the Cyber Security Act in relation to application of the Office for the Protection of Competition's oversight of acts issued by public authorities in terms of protection against unfair competition.

Institute of Thermomechanics of the CAS

A patent was granted for conversion of an electrical input signal to a controlled output gas flow that operates without mechanical components. Ionized gas ions, which are acted upon by the Lorentz force in the fluid amplifier interaction cavity, are used as charge carriers. The gas flow is then flipped between the two outlets. Laboratory testing demonstrated that this signal conversion responds more quickly than known electro-fluid converters by two decimal places. It is anticipated that the conversion will be used in the keenly developing field of fluidics, where collaborative efforts with electronics has encountered slow-moving transducers with moving parts.


PTN 1212

Employees and salaries

The total number of CAS employees (listed as the average number of employees calculated in Full Time Equivalent – FTE) increased year-on-year from 9,390 in 2018 to 9,751 in 2019. A total of 4,843 employees are paid through extra-budgetary allocations (which equalled 49.67% in 2019 compared to 46% in 2018). The number of research institute employees with university degrees who have passed arduous attestations pursuant to the Career regulations of CAS employees with university degrees and have been classified in the relevant qualification levels grew year-on-year from 5,660 to 5,940.

The Czech Academy of Sciences and its institutes expended a total of CZK 5,181,148,000 on salaries and wages and CZK 170,777,000 for other payments for work (OON). The total average monthly salary at the CAS was CZK 44,278 with year-on-year growth of 5.6% from 2018.

Chart No. 1: Number of employees and average monthly salary at the CAS

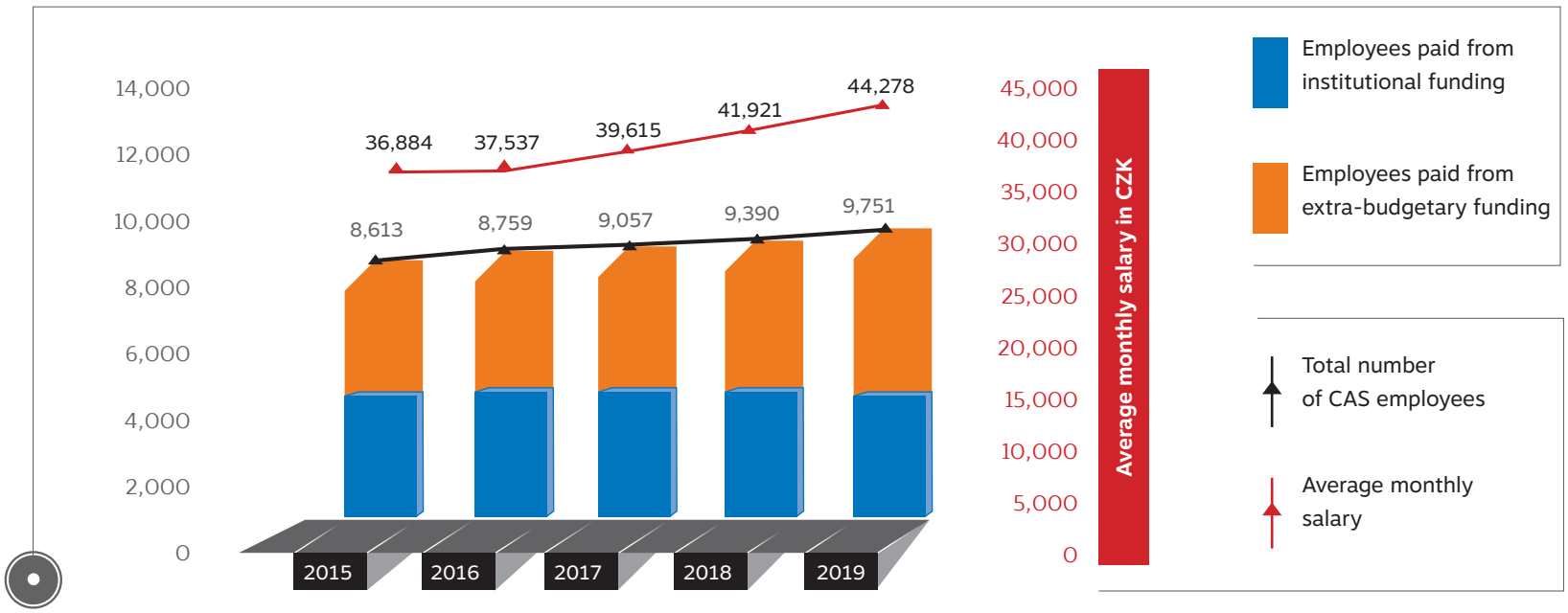


Table No. 3 provides a more detailed look at the number of CAS employees categorised into employees of the CAS Head Office and employees of all CAS research institutes.

Table No. 3: Number of CAS employees

Year	2015	2016	2017	2018	2019
In CAS public research institutions	8,539	8,685	8,983	9,314	9,672
CAS Head Office	74	74	74	75	79
CAS TOTAL	**8,613**	**8,759**	**9,057**	**9,390**	**9,751**

At the CAS Head Office, CZK 51,181,473 was expended for salaries and CZK 1,250,691 for other payments for work performed for 78.58 employees (recalculated as average FTE). Deferred liabilities totalling CZK 26,614 for salaries and CZK 197 for other payments for work performed were carried over. The average monthly salary of CAS Head Office employees, excluding CAS elected officials, was CZK 48,757 in 2019.

Elected officials of the CAS (CAS Academy Council chairman, deputy chairs and members) are also remunerated at the Czech Academy of Sciences pursuant to Government Regulation No. 341/2017 Coll., on the Salaries of Employees in Public Services and Administration. For this reason, elected officials are counted among CAS Head Office employees, and therefore the total average salary in the state organisational unit - CAS was CZK 54,277. The average salary rose by 0.06% from 2018.

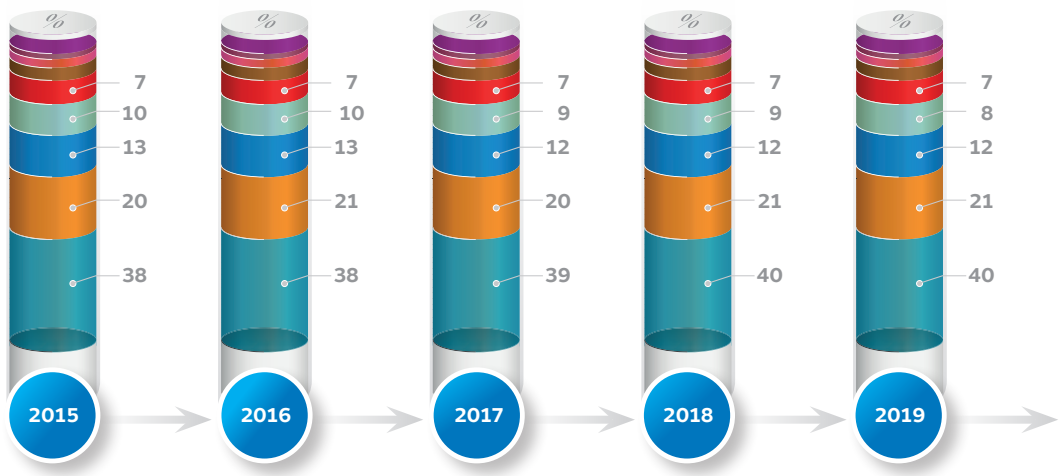
The total spent across all CAS Institutes (public research institutions) in 2019 for 9,672 CAS employees was CZK 5,129,966,000 for salaries and CZK 169,526,000 for other work performed. The average monthly salary equalled CZK 44,196 with year-on-year growth of 5.7% from 2018.

The table below provides a detailed overview of average monthly salaries at public research institutions (including all funding sources – institutional and extra-budgetary) by employee categories.

Table No. 4: Number of employees and average monthly salary per category for 2019

Category	Average recalculated number of employees	Average monthly salary in CZK
Researchers	3,926	56,612
Other research institute employees with university degrees	2,014	34,495
Expert employees with university degrees	715	42,718
Expert employees with secondary school or training college degrees	798	31,541
Expert R&D employees with secondary school or training college degrees	208	33,748
Technical staff	1,206	43,328
Manual labourers	479	26,406
Operations staff	326	24,837
TOTAL	**9,672**	**44,196**

Chart No. 2: CAS research institute employee categories



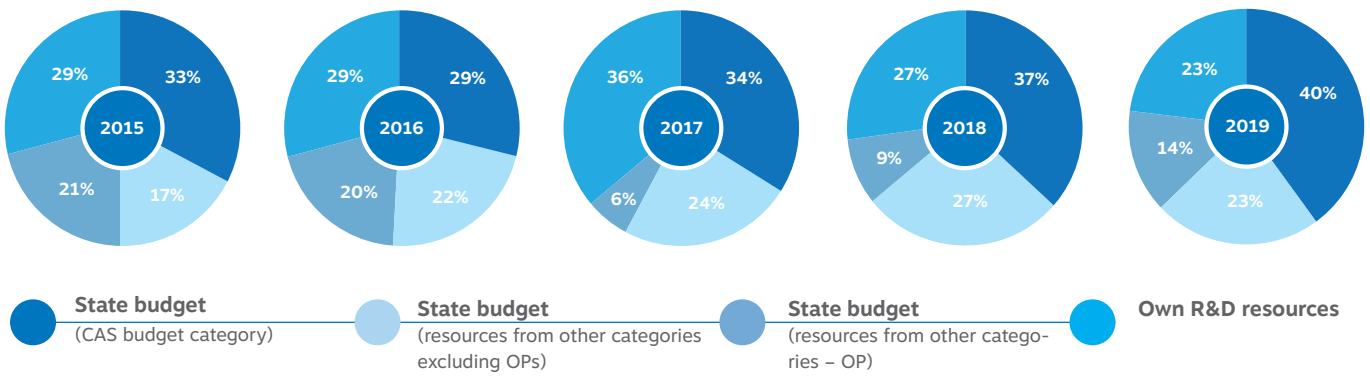
Expert employees with secondary school or training college degrees
Operations staff
Manual labourers
Expert employees with university degrees
Employees with secondary school or training college degrees
Technical staff
Other research institute employees with university degrees
Researchers

Financial resources

and their use

In 2019, the Czech Academy of Sciences managed a total of CZK 15,461.74 million, of which CZK 6,093.41 million came from the CAS category in the state budget (SB). This state budget funding equalled 40% of the CAS' total financial resources in 2019. The 3% year-on-year increase in the share of state budget funding was primarily caused by the decrease in public research institution resources (a decrease in revenues from Institute of Organic Chemistry and Biochemistry licenses) and a drop in funding from other categories (excluding operational programmes).

Chart No. 3: CAS Financial resources (in %)



Financial resources (for the entire CAS) originating from the CAS budget category, subsidies from other budget categories and the CAS' own resources are summarised in the following table.

Table No 5: Structure of financial resources (actual) in millions of CZK

Financial resource	Non-investment resources	Investment resources	TOTAL
Resources from the CAS budget category	**4,804.17**	**1,289.24**	**6,093.41**
Subsidies from other budget categories	**4,579.98**	**1,089.14**	**5,669.12**
GA CR grants	1,774.78	24.73	
TA CR projects	331.19	189.46	
Projects of other ministries, including operational programmes	2,474.01	874.96	
Own R&D&I resources	**3,699.22**		**3,699.22**
Commissions relating to main activity	251.78		
Publication sales	106.52		
Rent	95.80		
Licenses	2,008.12		
Sale of goods and services	180.75		
Conference fees	24.64		
Interest, exchange rate profit	210.24		
Sale of material and securities	9.93		
Foreign grants and gifts	418.51		
Resources from CAS funds	231.38		
Other	161.53		
Total resources	**13,083.36**	**2,378.38**	**15,461.74**

CAS Institutes used CZK 11,734.25 million of the total non-investment resources of CZK 13,083.36 million to cover their own expenses.

> In comparison to 2018, the total expenditures of CAS Institutes (public research institutions) increased by CZK 1,023.63 million.

Given that CAS Institutes are managed as public research institutions in the system of non-governmental organisations and they therefore do not need to close their accounts until 30 June of the following year and that the institutes' financial statements must be verified by an auditor, the following expenditures statement should be taken as preliminary.

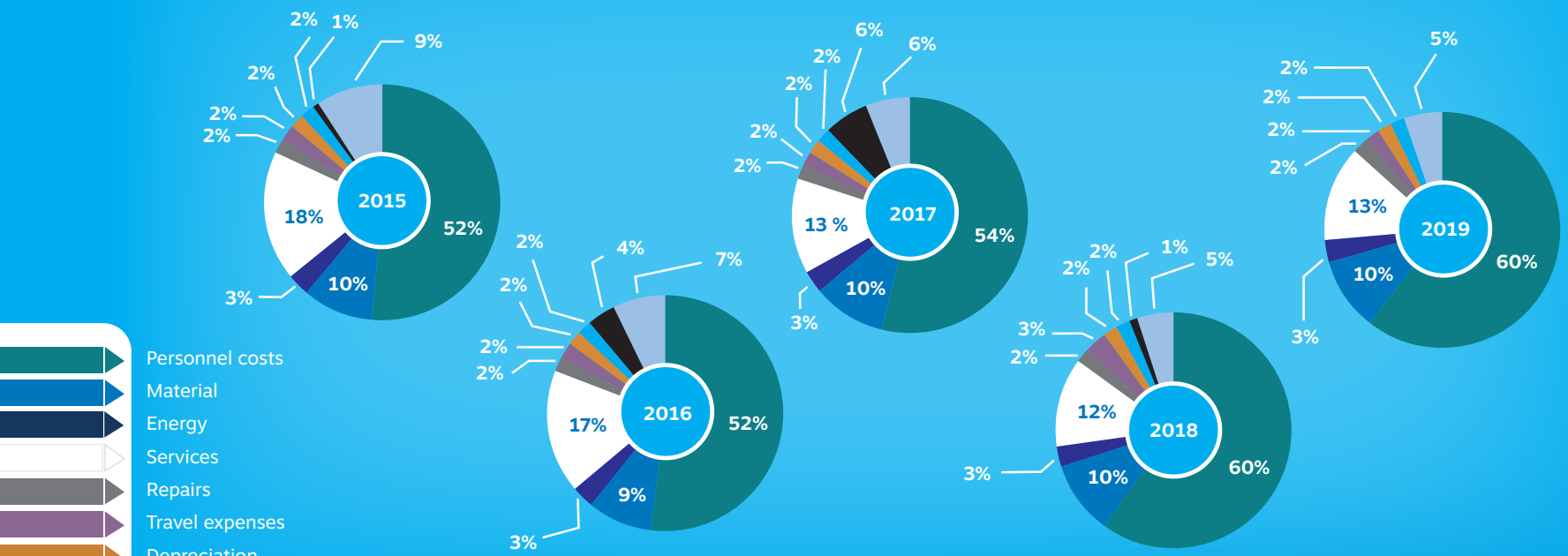
In comparison to 2018, the total expenditures of CAS Institutes (public research institutions) increased by CZK 1,023.63 million. A detailed breakdown of the expenditures is provided in the following table.

Table No. 6: Structure of non-investment expenditures of CAS Institutes (in mil. CZK)

Type of expenditure	2018	2019	Difference
Personnel costs (wages, mandatory insurance paid by the employer, sickness insurance benefit reimbursements)	6,449	7,057	608
Materials (e.g. books, journals, small tangible assets, consumable supplies, protective gear)	1,095	1,204	109
Energy, water, fuel	289	333	44
Services (postal services, small tangible assets, rent, conference fees, other services)	1,321	1,526	205
Repairs and maintenance	219	287	68
Travel expenses	283	292	9
Creation of targeted funds in total	207	183	-24
Transfer to social funds and other social expenses	225	247	22
Taxes and fees	212	308	96
Depreciation of fixed assets	213	209	-4
Exchange rate losses	33	48	15
Securities and shares (sale of)	121	0	-121
Other expenses (accident insurance, fines, damages)	127	132	5
Inventory changes of own activity	-14	-12	2
Activation of material, goods, services and property	-69	-81	12
TOTAL	10,711	11,734	1,023

A significant cost item consists of depreciation of assets acquired with subsidies amounting to CZK 1,897.82 thousand, which is not included in this table.

Chart No. 4: Use of non-investment resources (in %)



The comparison of non-investment resources expended by CAS Institutes during the monitored period of 2015 to 2019 shows that the ratios of the main categories have changed only minimally.

The main sources of investment resources are institutional and targeted subsidies from the state budget and foreign grants. They serve primarily for the acquisition or improvement of buildings and equipment, and secondarily for maintenance and repair of buildings and equipment.

Table No. 7: Investment resources of CAS Institutes (in mil. CZK)

Financial resource	2018	2019	Difference
Resources from the CAS category of the state budget	1,113.6	1,289.2	175.6
Resources from other ministries, including operational programmes	1,107.6	1,089.1	-18.5
Depreciation	238.2	218.0	-20.2
Transfer of additional profits	57.8	48.5	-9.3
Foreign grants and gifts	106.3	55.5	-50.8
Revenue from sale of fixed assets	69.1	63.8	-5.3
Aggregation of funds to acquire fixed assets	10.4	13.2	2.8
TOTAL	**2,703.0**	**2,777.3**	**74.3**

Table No. 8: Use of investment resources by CAS Institutes (in mil. CZK)

Type of expenditure	2018	2019	Difference
Financing of buildings	331.0	460.1	129.1
Acquisition of instruments and equipment	1,980.8	1,754.5	-226.3
Maintenance and repairs	81.4	61.6	-19.8
Other	205.9	232.8	26.9
TOTAL	**2,599.1**	**2,509.0**	**-90.1**

In 2019, CAS Institutes used CZK 2,509 million from the total investment resources of CZK 2,777.3 million. The asset reproduction fund was increased by CZK 268.3 million.

Controlling

The CAS controlling system is based on requirements associated with the decision-making and management processes of CAS bodies and fulfils the purpose of state administrative controlling. Controlling at CAS and CAS Institutes is provided by the Division of General Control of the CAS Head Office, which reports directly to the President of the CAS.

Controls are performed pursuant to the approved annual plan in compliance with the thematic focus of specific controlling events. The Division of General Control controlling ensures that requirements stemming from the financial control act and other regulations governing state administration controlling are met. This secures the content and practical implementation of the requirement to verify management of state budget funding, which the CAS disburses as the administrator for the science and research budget category.

As in previous years, auditing of controlled entities focused mainly on relations to state budgets, with verification of fulfilment of legal conditions during utilisation of budget funding, due record-keeping and reporting. Aside from addressing labour relations, particularly fulfilment of conditions stipulated by the labour code, including employee liability for loss events at work, and aside from the standardly audited functionality and efficiency of the internal controlling systems at CAS Institutes, in 2019 the Division of General Control again focused on verification of controlled entities' management of intangible assets acquired with state funding.

The Division of General Control paid particular attention to controlled entities' contractual relations in relation to exercising property rights for intangible assets and to optimisal use of tangible assets and supplier-customer relations with respect to fulfilling conditions of both economic and non-economic activity pursuant to the EU directive.

The Division of General Control also examined compliance with procedures for the preparation, implementation and financing of capital investments as stipulated by valid legal regulations and internal rules and with legal tendering regulations, including due diligence in property management. Throughout 2019, the Division of General Control examined, as standard practice, adherence to conditions set forth by budgeting rules, due consideration of all operations in accounting, due asset record-keeping and adherence to the principles of economy, effectiveness and efficiency in management of the controlled entities' financial resources and assets.

Heightened attention was also paid to verifying compliance with basic requirements concerning financial management and management of institute assets stipulated by the CAS Statutes, decisions made by CAS bodies and the internal regulations of the CAS and CAS Institutes.

Cases of incompliance with legal regulations that were identified during controls were described in control reports and the findings were discussed at length with the management and responsible employees of the controlled entities. The identified problems were subsequently analysed in greater detail to create, after appropriate generalisation and processing, a basis for methodology for the financial management departments of CAS Institutes. The conclusions and analyses of control findings are used in the Division of General Control's methodology work to prevent reoccurrence of identified discrepancies. In all cases, control reports and conclusions were submitted to the President of the

CAS and other members of the Academy Council Presidium to inform their discussion of state administration controlling results at CAS Academy Council sessions.

In regard to the fact that controls at two entities (the Main Library and CAS Head Office) planned and begun in late 2018 were not completed until May 2019, and in regard to very complicated communication and difficulties in cooperation with the Economics Institute, where state administration control planned for 2019 was carried out, the controlling plan for 2019 was not fully implemented. Nonetheless, the CAS' legal obligation as a provider of state budget funding to control at least 5% of the total volume of provided funding was clearly met. State administration controls of CAS Institutes planned for, but not initiated in, 2019 were transferred to the 2020 controlling plan.

Eight controls were conducted in 2019, including the Main Library and CAS Head Office, where controls begun in late 2018 were implemented and completed. Furthermore, in compliance with the 2019 controlling plan, state administration controls were conducted at the following institutes:

- Centre of Administration and Operations
- Economics Institute
- Institute of Photonics and Electronics
- Institute of Plasma Physics
- Global Change Research Institute
- Biology Centre

Four follow-up controls to verify fulfilment of measures designed to eliminate problems identified in 2018 financial management controls, were conducted at the following institutes:

- Institute of State and Law
- Institute of Philosophy
- Institute of Scientific Instruments
- Institute of Vertebrate Biology

In regard to the fact that the management of the Institute of State and Law had to deal with a very difficult financial management personnel situation in 2019, fulfilment of several measures to eliminate problems identified in 2018 was delayed. This institute therefore remains under the Division of General Control monitoring and the follow-up control will be completed in 2020.

Persisting short-comings identified in 2018 follow-up controls were fully rectified at the following institutes:

- Institute of Psychology
- Institute of Geology
- Institute of Ethnology
- Institute of Contemporary History

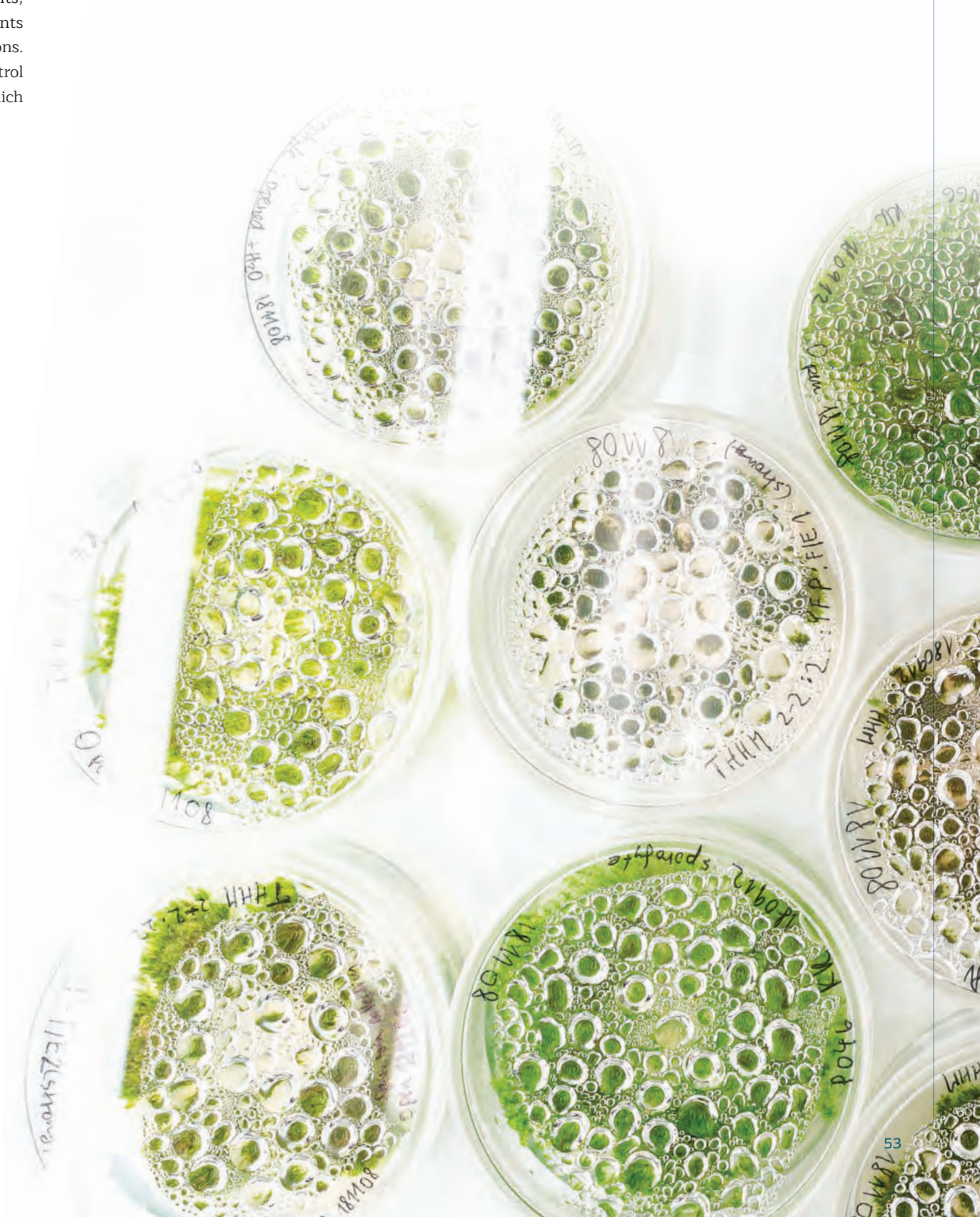
The Division for General Control also conducted controls at ten scientific societies, with detailed audits of use of 17 project grants, i.e. 8.2% of the total volume of funding provided to the given entities in 2019 through the CAS state budget category.

The following societies under the Council of Scientific Societies of the Czech Republic were controlled:

- Czech Archaeological Society
- Czech Bioclimatological Society
- Czech Society for Parasitology
- Czech Society for Histo- and Cytochemistry
- Czech Society for Cell Biology
- Czech Algological Society
- Czech Sociological Society
- Czech Musicological Society
- Czech Demographic Society
- Czech Environmental Law Society

The Division of General Control's standard tasks also includes processing complaints and suggestions sent to the Academy bodies and the CAS Head Office. In addition to cases sent directly to the Division of General Control, the Division maintains records of other complaints, intermittently monitors settlement of complaints and in some cases takes part in finding solutions. In 2019, the Division of General Control addressed or recorded 16 complaints, of which 10 were deemed unsubstantiated.

Audits of accounting in EU framework programme projects were conducted. The volume of audited funding in 2019 equalled CZK 30,227,000.



11

Support of excellence

The science policy of the Czech Academy of Sciences includes support of excellent research at its Institutes. The CAS implements this support in a number of ways. One well-known avenue is the Academic Premium (Praemium Academiae), which serves to support scientists working on excellent research in all scientific fields. Another means of support is the Otto Wichterle Award for prospective young researchers.

The Czech Academy of Sciences supports prominent foreign scientists who are invited to collaborate with the CAS through a new financial aid tool called the Lumina Quaeruntur Research Fellowship, as well as the Jan Evangelista Purkyně Fellowship. The Czech Academy of Sciences also supports early career scientists through three further programmes: the Programme to Support Prospective Human Resources, the Programme for Research and Mobility Support of Early Career Researchers and the Josef Dobrovský Fellowship Programme. Successful scientists are annually rewarded for their outstanding scientific results through the prestigious the Czech Academy of Sciences Prizes.

PRAEMIUM ACADEMIAE – ACADEMIC PREMIUM

The Academic Premium is the most significant means of support of scientific excellence at the Czech Academy of Sciences. It is awarded to outstanding scientists who excel in their fields and provides them with financial and moral support for further scientific work on a globally comparable scale. The Academic Premium award money of up to CZK 5 million per year helps recipients cover their research costs for a period of six years and, in the longer term, to develop it both by building their own scientific teams and by acquiring needed new instruments or laboratory materials. The Academic Premium is comparable with European Research Council (ERC) grants in terms of its significance and prestige as well as the amount of financial support awarded.

THE 2019 ACADEMIC PREMIUM AWARD-WINNERS INCLUDE:

Michal Ernée, Martin Kalbáč, President of the CAS Eva Zažímalová and Milan Paluš

Mgr. Michal Ernée, Ph.D., DSc.

Institute of Archaeology, Prague

Dr. Ernée is a prominent archaeologist and prehistorian who focuses primarily on research of the Early Bronze Age in Europe and application of scientific methods in archaeology. He has worked at the Institute of Archaeology since 2002. He has systematically applied himself to field research, analysis and interpretation of prehistoric field stratigraphy.

He published a monograph on this topic which is entitled *Prehistoric cultural formation as an archaeological source* (2008). He currently focuses on interdisciplinary analysis of burial sites from the Late Eneolithic Period and Early Bronze Age as well as issues related to research of ancient DNA.

In 2009, Michal Ernée was awarded the prestigious Alexander von Humboldt Foundation scholarship. With the scholarship he worked on interdisciplinary research of Early Bronze Age burial sites at the Martin Luther University in Halle/Saale, where he also lectured and prepared work for publication. In recent years, Michal Ernée has collaborated particularly closely with the Max Planck Society for the Advancement of Science in Jena, and with a number of world-renowned experts, ERC grant recipients who publish in esteemed journals including Nature and Science.

Dr. Ernée will use the Academic Premium for his research of the Late Eneolithic Period and Early Bronze Age in Europe, which is associated with e.g. the spread of Indo-European languages. He plans to employ a number of methods including analysis of DNA and strontium, oxygen, nitrogen and carbon isotopes, and radiocarbon dating. On a global scale, the Early Bronze Age is among the intensively examined periods of the European prehistoric period and the territory of today's Czech Republic was one of the three most progressive centres of development on the entire European continent. The project anticipates use of a broad array of scientific analyses on samples of prehistoric skeletal remains from the third and second centuries B.C.

RNDr. Ing. Martin Kalbáč, Ph.D.

J. Heyrovský Institute of Physical Chemistry

Dr. Kalbáč is an exceptional physical chemist. He has extensive international experience; he has been a fellow at the Massachusetts Institute of Technology in the USA, the Leibniz Institute of Solid State and Materials Research in Germany and the Institute of Microtechnology at the University of Neuchatel in Switzerland. At the J. Heyrovský Institute of Physical Chemistry he leads the Low-dimensional Systems Department and is a deputy director.

Dr. Kalbáč's research focuses primarily on two-dimensional materials (2DM), the discovery of which caused a revolution in nanotechnologies. Two-dimensional materials have one significantly limited dimension, which leads to new properties that cannot be observed in macroscopic materials. Essentially, they are self-supporting surfaces accessible from two sides that can be modified and whose properties are very sensitive to the immediate surroundings. Scientific teams around the world are now trying to utilise the unique properties of these materials in a number of fields, from sensors to applications in nanoelectronics, optoelectronics, quantum technology and artificial intelligence. In his project Dr. Kalbáč will attempt to create functional hybrids of two-dimensional materials that will be stable even in real-world environments.

This is a complex issue that requires synchronisation of chemical, physical and physical-chemical methodologies, which is an enormous challenge because, among other things, these methodologies are not entirely compatible. The aim of Dr. Kalbáč's concept is to develop two-dimensional hybrids whose electronic structure will be controlled through electrochemical stimuli and their reactivity using physical fields. In his research Dr. Kalbáč can rely on international contacts (he is a member of foreign consortia) as well as an excellently equipped laboratory.

RNDr. Milan Paluš, DrSc.
Institute of Computer Science

Dr. Paluš is a world-renowned expert in complex systems research. This new, very contemporary research field combines methods from computer science, mathematics and statistical physics and tries to develop unconventional mathematical models and methods that enable understanding and forecasting of complex phenomena related to e.g. the Earth's atmosphere and climate, financial markets and the human brain. The work of Dr. Paluš, who received a two-year scholarship to the US National Institutes of Health in the 1990s for research at an untraditional interdisciplinary research institute in Sante Fe, has already been applied to physics, meteorology, climatology, air pollution, neurology and psychiatry.

In his research Dr. Paluš has demonstrated, in collaboration with University of Milwaukee researchers, that e.g. the amplitude of the annual temperature cycle in Central Europe varies in a 1°C range and the average winter temperature in a 4°C range, depending on the climatic cycle phase, with a periodicity of roughly 7 to 8 years. They published these results in the leading journals *Physical Review Letters and Geophysical Research Letters*. Dr. Paluš' methods for inferring causality in multi-dimensional data have been applied in climatology as well. Dr. Paluš' work on non-linear electroencephalograms (EEG), which he continued in the European project BrainSync, has met with global success. His discoveries have been applied particularly to research into epileptic seizure genesis, on which he collaborates with the Charles University Second Faculty of Medicine, the Motol Hospital and the CAS Institute of Physiology, and which has resulted in publications in the journal *Nature Neuroscience*.

Dr. Paluš plans on using the Academic Premium to develop algorithms which could predict the character of the winter season in Central Europe (mild or cold winter, extreme freezing, etc), El Niño events and other extreme climate events, or the intensity of monsoon rains in Southeast Asia. He will also continue researching the complex system of the human brain with the partners mentioned above and the National Institute of Mental Health in Klecany.

LUMINA QUAERUNTUR **FELLOWSHIP**

In 2018, the Czech Academy of Sciences initiated a generous grant programme for successful early- and mid-career scientists with international experience. The Lumina Quaeruntur Fellowship provides financial aid to prospective researchers enabling them to compose their own research teams and fund their work for up to five years. There are two key conditions of the fellowship: the fellow must submit a project proposal to the European Research Council (ERC) or a similar foreign grant agency during the fellowship, and the length of the fellow's scientific practice since receiving a doctorate must not exceed 10 years. Both Czech and foreign researchers are eligible for the fellowship.

IN 2019, SIX SCIENTISTS FROM DIVERSE CAS INSTITUTES BECAME LUMINA QUAERUNTUR FELLOWS:

RNDr. Lukáš Ondič, Ph.D.
Institute of Physics

Dr. Ondič's scientific team will focus on studying new diamond-based nanophotonic platforms suitable for quantum photonic and sensorics.

Mgr. Zdeněk Kameník, Ph.D.
Institute of Microbiology

The basis of his research is a new field titled metabolomics, which is important for understanding cell functions and focuses on complex analysis of specific metabolisms.

RNDr. Jana Kamanová, Ph.D.
Institute of Microbiology

Her research focuses on the as yet unclarified mechanisms of toxicity in pathogenic bacteria from the *Bordetella* genus.

JUDr. Hana Müllerová, Ph.D.
Institute of State and Law

Her new research team will examine one of the key topics in environmental law: climate protection rights.

Mgr. Ladislav Varadzin, Ph.D.
Institute of Archaeology, Prague

His new scientific team will specialise in environmental archaeology projects in northern Africa.

M. A. Geoffrey Dierckxsens, Ph.D.
Institute of Philosophy

A new interdisciplinary bioethics research laboratory will be established at the Institute of Philosophy that will collaborate with other research groups within the institute and externally as well. It will take part in collaborative efforts with foreign scientists and systematically establish innovative applied ethics research in the Czech Republic.

J. E. PURKYNĚ **FELLOWSHIP**

The aim of this fellowship is to bring outstanding scientists from other countries to CAS Institutes, including scientists of Czech origin who have been working abroad long-term as well as leading foreign scientists, generally younger than 40 years old, and to provide them with adequate funding at CAS Institutes for a period of up to five years. These scientists are expected to become leaders of creative teams in their respective institutes. In 2019, the CAS funded 24 J. E. Purkyně fellows with total funding of CZK 22,650,000. New proposals have not been accepted since 2018. Funding for projects that have already been approved will continue until 2023.

OTTO WICHTERLE **AWARD**

This award is intended for extraordinarily talented, prospective CAS scientists up to 35 years of age. The award bears the name of Professor Otto Wichterle, an outstanding Czech chemist on a global scale, who became President of the Czechoslovak Academy of Sciences after November 1989. The aim of the Otto Wichterle Award is to encourage young CAS scientists whose excellent results contribute to the development of their relevant scientific disciplines. In 2019, President of the CAS Eva Zažímalová bestowed the Otto Wichterle Award to the following 23 young scientists:

I. MATHEMATICS, PHYSICS AND EARTH SCIENCES

Ing. Anna Artemenko, Ph.D.
Institute of Physics
Ing. Jaroslav Čapek, Ph.D.
Institute of Physics
RNDr. Kateřina Kůsová, Ph.D.
Institute of Physics
Renann Lipinski Jusinskas, Ph.D.
Institute of Physics
Mgr. Oleg Lunov, Ph.D.
Institute of Physics
Mgr. Jan Geletič, Ph.D.
Institute of Computer Science
Ing. Ondřej Tichý, Ph.D.
Institute of Information Theory and Automation
Michael Warsitzka, Ph.D.
Institute of Geophysics
Mgr. Filip Tomek, Ph.D.
Institute of Geology
RNDr. David Píša, Ph.D.
Institute of Atmospheric Physics

II. LIFE AND CHEMICAL SCIENCES

RNDr. Viliam Kolivoška, Ph.D., MBA
J. Heyrovský Institute of Physical Chemistry
Ing. Petr Kovaříček, Ph.D.
J. Heyrovský Institute of Physical Chemistry
Mgr. Ing. Eva Krupičková Pluhařová, Ph.D.
J. Heyrovský Institute of Physical Chemistry
RNDr. Naděžda Zíková, Ph.D.
Institute of Chemical Process Fundamentals
RNDr. Miroslav Krepl, Ph.D.
Institute of Biophysics
Mgr. Lenka Marková, Ph.D.
Institute of Biophysics
Mgr. Tomáš Větrovský, Ph.D.
Institute of Microbiology
RNDr. Petr Blabolil, Ph.D.
Biology Centre
Mgr. Jan Perner, Ph.D.
Biology Centre
RNDr. Jan Altman, Ph.D.
Institute of Botany

III. HUMANITIES AND SOCIAL SCIENCES

Mgr. Filip Děchtěrenko, Ph.D.
Institute of Psychology
RNDr. Martin Šimon, Ph.D.
Institute of Sociology
PhDr. Martin Klečacký, Ph.D.
Masaryk Institute and Archives

ERC-CZ/AV PROGRAMME

This is a programme to support research projects which have received who have received an A in the second round of the European Research Council expert panel evaluation (meaning not supported due to lack of funding resources) or a B. A projects are five years in duration, and B projects two years. In 2019, the CAS supported three projects with total funding of CZK 22,846,000. The project investigators are:

Mgr. Iva Mozgová, Ph.D.
Biology Centre
RNDr. Karel Žídek, Ph.D.
Institute of Plasma Physics
doc. PhDr. Michal Bauer, Ph.D.
Economics Institute

Support for Early Career Scientists

The Academy Council dedicates systematic and long-term support to prospective human resources and the establishment of international cooperation with young scientists. In 2019, the successful CAS support programmes for early career scientists continued.

Prospective Human Resources – Postdoctoral Fellows Support Programme – Payroll support for postdoctoral students at CAS Institutes (the PPLZ programme) is intended for starting post-graduate students (within two years of the defence of their PhD thesis or equivalent, or four years in the case of long-term study abroad or parental leave).

In 2019, through two PPLZ Programme calls, 38 candidates were supported in the 13th call and 40 candidates in the 14th call (with funding commencing on 1 January 2019 or 1 July 2019).

The Josef Dobrovský Fellowship Programme helps young foreign researchers who need to study the historical, cultural, artistic, linguistic, geographical or natural context in the Czech Republic for their scientific work. In 2019, total funding of CZK 214,000 was provided for six study visits at four CAS Institutes. The following researchers received support:

Anna Bischof, M.A.
Masaryk Institute and Archives
Dr. Norman Domeier
Masaryk Institute and Archives
Anna Jozefacka, Ph.D.
Institute of Art History
Luise Mahler, M.A.
Institute of Art History
Dr. Eva Schäfler
Institute of Contemporary History
Helena Sabel Bermúdez, M.A.
Institute of Czech Literature

CZECH ACADEMY OF SCIENCES PRIZES

The Czech Academy of Sciences annually bestows these awards to outstanding researchers for exceptional research results focused on social priorities which have strengthened the competitiveness of Czech science on an international scale, and which were first published or implemented within the last five years. In 2019, the Czech Academy of Sciences Prizes for outstanding results of great scientific significance were bestowed by CAS President Eva Zažímalová to the following:

INSTITUTE OF HISTORY TEAM COMPOSED OF:

PhDr. Jindřich Dejmek, DSc. (CAS Institute of History)
PhDr. Ľudovít Hallon, DrSc. (Institute of History of the Slovak Academy of Sciences)
prof. PhDr. Drahomír Jančík, CSc. (Charles University, Faculty of Arts)
PhDr. Dušan Kováč, DrSc. (Institute of History of the Slovak Academy of Sciences)
PhDr. Miroslav Londák, DrSc. (Institute of History of the Slovak Academy of Sciences)
PhDr. Elena Londáková, CSc. (Institute of History of the Slovak Academy of Sciences)
doc. PhDr. Jan Němeček, DrSc. (CAS Institute of History)
prof. JUDr. Jan Kuklík, DrSc. (Charles University, Faculty of Law)
PhDr. Petr Prokš, CSc. (CAS Institute of History)
doc. Mgr. Jaroslav Šebek, Ph.D. (CAS Institute of History)

for the scientific work *Czechoslovakia. History of the State*

MASARYK INSTITUTE AND ARCHIVES TEAM COMPOSED OF:

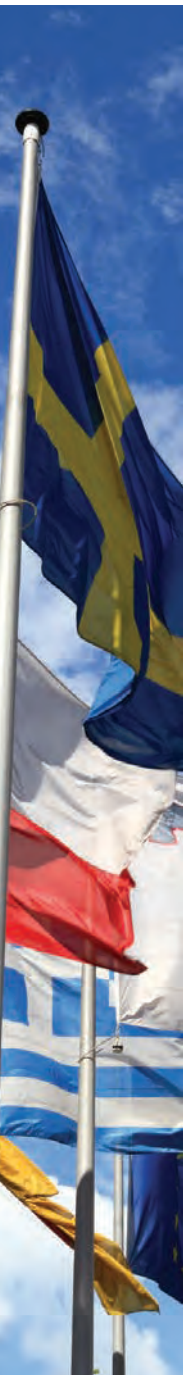
PhDr. Dagmar Hájková, Ph.D.
PhDr. Mgr. Pavel Horák, Ph.D.
doc. PhDr. Martin Jemelka, Ph.D.
PhDr. Martin Klečacký, Ph.D.
doc. Dr. phil. Rudolf Kučera, Ph.D.
doc. PhDr. Ota Konrád, Ph.D. (Charles University, Faculty of Social Sciences)
Mgr. Lucie Merhautová, Ph.D.
doc. PhDr. JUDr. Jakub Rákosník, Ph.D. (Charles University, Faculty of Law)
PhDr. Josef Tomeš, Ph.D.
Mgr. Richard Vašek, Ph.D.
PhDr. Luboš Velek, Ph.D.

for the scientific work *Czechoslovak Republic 1918–1939*

International cooperation

In alignment with the Concept of Support of International Cooperation approved in November 2014, the CAS continued to further international relations in 2019. It did so by engaging in research organisation networks on the European and global levels, presenting abroad and systematically supporting its institutes in their involvement in international research efforts. The CAS supports its institutes in taking an international view, developing new partnerships and increasing participation in international research efforts, not only through international bilateral or multilateral collaboration, but also, for example, through Strategy AV21 programmes.

> By taking part in international projects, CAS Institutes carry out high-level research and gain access to unique scientific infrastructures, instruments, platforms and scientific information sources and data.



Similarly to previous years, the CAS took part in the activities of international non-governmental organisations, which strive to create a global scientific strategy, devise a joint approach to pressing scientific and social challenges and address pan-European and global research and development problems. International organisations and platforms also afforded the CAS opportunities to share insights and experience from both the scientific and political realms. The CAS is a member of prominent international organisations including the European Academies Science Advisory Council – EASAC, All European Academies – ALLEA, International Science Council – ISC, Inter Academy Partnership – IAP and others. The CAS nominated six experts to emerging EASAC and IAP working groups. CAS representatives from previous periods played an active role in panels, working groups and committees of various organisations and also helped prepare expert reports and articles.

One of the CAS' traditional partnerships is with the academies of the V4 countries. This group's 2019 meeting was hosted by the Slovakian Academy of Sciences and was held, unconventionally, in the Austrian Academy of Sciences building. The meeting took place in November 2019, was attended by representatives of the Austrian and Slovenian Academies of Sciences and as in previous years, encompassed an award ceremony for young scientists, this time for quantum physicists. The Austrian Academy of Sciences followed on the meetings with an event titled Joint Academy Day, during which scientists representing the participating Academies took part in six panel discussions on various topics. In October, in cooperation with the European Academy of Sciences and Arts (EASA) and under the patronage of the Ministry of Foreign Affairs of the CR, the CAS held an international conference in Prague titled the Danube Academies Conference. More than 80 participants from 17 countries and 14 embassies in the Czech Republic took part. The two-day conference focused on issues relating to scientific diplomacy and research infrastructure.

In regard to the Hungarian government's persisting interventions into the academic structure and funding mechanisms of R&D, the President of the CAS sent a letter to the Hungarian Minister for Innovation and Technology, László Palkovics, in February containing the Academy Council's declaration of support for the Hungarian Academy of Sciences. This was followed in July by a joint letter from the presidents of the CAS and Learned Society of the Czech Republic to the Hungarian President János Ánder. Another joint letter, from the CAS and ALLEA, was also sent in July to the Minister of Foreign Affairs of the CR and the Chairman of the Committee for Education, Science, Culture and Human Rights and a petition to the Senate of the Czech Parliament about the adverse situation of the Hungarian Academy of Sciences. The CAS also engaged in academic freedom and human rights issues through the International Human Rights Network of Academies and Scholarly Societies (IHRNASS); in response to the IHRNASS' request, the CAS declared its support for several persecuted scientists in countries such as China, Turkey, Greece and Sudan. In the case of the Sudanese scientist, the IHRNASS later informed the CAS that he had been released after the supportive letter had been sent.

In 2019, CAS Institutes also received numerous foreign delegations, 64 of which visited institutes at the request of state administration offices (e.g. the Office of the Government and ministries), or offices of foreign representatives located in Prague. The CAS management received more than twenty foreign delegations and foreign representatives in Prague. In late May the CAS held its traditional reception, Academic Prague, to which the President of the CAS invites representatives of Czech universities and embassies in Prague.

ERA Cooperation

One of the CAS' key long-term priorities is deepening its integration into the European Research Area (ERA). By taking part in international projects, CAS Institutes have the opportunity to participate in initiatives with far-reaching social impacts and to gain access to unique research infrastructures, instruments and scientific data. The CAS takes advantage of opportunities offered by the EU Horizont 2020 framework programme for research and innovation. Aside from direct involvement in research, CAS researchers also provide expert advisory services to European institutions.

In 2019, CAS Institutes participated in research in 120 Horizon 2020 programme projects with funding totalling EUR 8.18 million. There were also two projects funded by the 7th EU Framework Programme for Research and Technological Development with a total budget of EUR 3,967,000. The CAS regularly applies for European Research Council (ERC) grants, which are intended for support of outstanding scholarly research directed beyond the bounds of knowledge in a given field. In 2019, two

CAS projects received this support: one in ERC Consolidator Grants (approx. EUR 2 mil) and one in Synergy Grants (approx. EUR 2.5 mil.).

The HR Excellence in Research Award confirms the high quality of CAS Institutes. In 2019, five CAS institutes received this award, which is bestowed by the European Commission to institutions with a progressive human resource management approach. Another important milestone in CAS' integration into European structures is the Global Change Research Institute's accession into the European Institute of Innovation - Technology Climate Knowledge and Innovation Community (EIT Climate KIC).
The long-term ties between the CAS and the European Commission's Joint Research Centre (JRC) were sealed in 2019 with the signing of a memorandum of understanding. This framework cooperation agreement identifies 11 pilot areas in which the potential for cooperation between the two organisations appears most promising, ranging from climate change to artificial intelligence and nuclear research.

Bilateral and Multilateral Cooperation

In 2019, the CAS continued to update contractual documents with existing partner organisations and entered into several new contractual partnerships, e.g. with a prominent American partner, the U.S. Department of Energy. In 2019, the CAS implemented bilateral international cooperation programmes with 27 partner organisations from 23 countries. Within these programmes, there were 115 projects supporting researcher mobility (80 ongoing projects and 35 new projects), whose funding exceeded CZK 6 million.

Extraordinary funding from the Office of the Government of the Czech Republic state budget category intended for development of cooperation with leading research institutes in East and Southeast Asian countries was provided for the second year. In 2019, cooperation was extended beyond Taiwan to Japan, South Korea and Singapore; 57 short-term activities were implemented with subsidy funding exceeding CZK 3 million as well as three long-term residencies at the Taiwan Industrial Technology Research Institute (ITRI). The programme for international cooperation of early career researchers also continued in 2019 with support to 40 projects exceeding CZK 13.5 million.

In an effort to support and deepen international cooperation, the CAS arranged visits by representatives of foreign research institutions to CAS Institutes and held several events to give Czech and foreign researchers opportunities to establish contacts. Representatives of the Italian Istituto Nazionale di Fisica Nucleare (INFN), Taiwan Industrial Technology Research Institute (ITRI) and U.S. National Science Foundation (NSF) visited the CAS and its institutes, for instance. In December, the CAS and the German Embassy in Prague jointly held a Czech-German roundtable focused on "Management of bilateral and multilateral cooperation support in science & research". The roundtable was attended by representatives of the CAS and the German Embassy as well as the Ministry of Education, Youth and Sports, RDI Council, Czech Grant Agency, Czech Technology Agency and the German Federal Ministry of Education (BMBF), Fraunhofer Gesellschaft, Helmholtz Gemeinschaft, Max Planck Gesellschaft and the grant agencies DFG, DLR and DAAD.

CAS representatives also made several foreign trips to present research results and establish new partnerships, e.g. to the USA, Japan, Germany, Switzerland, Oman and Mongolia. On the basis of a memorandum of understanding with the Israeli Academy of Sciences (IASH), an expert Czech-Israeli workshop about Plant Genomics took place in Jerusalem in March, which was attended by a CAS delegation led by the CAS President. Cooperation between the CAS and the IASH will continue with another expert workshop in Prague in spring 2021.

The CAS continued to develop multilateral cooperation by engaging in joint research programmes founded on the broad-based initiative of member states supported by the European Commission. In 2019, a subsidy of CZK 2.76 mil. was granted for the DAISIE project implemented within the NORFACE partnership by the Institute of Sociology. In 2019, a tender for projects under the Governance umbrella theme. Governance was held. The CAS provided funding of CZK 593,000 for the VICTOR-E project, part of the HERA partnership and researched by the Institute of Contemporary History. In 2019, the CAS also joined the 6th call for joint multilateral projects in the EIG Japan platform, in which two projects with CAS team participation were awarded support. The CAS also negotiated renewal of cooperation between European countries and Korea through the EU-KOR Community, which follows on previous EIG Korea activities. In 2019, the CAS also initiated cooperation with Southeast Asian countries through the SEA-Europe JFS platform.

The CAS' successful cooperation with the French National Centre for Scientific Research (CNRS), Charles University and the French Embassy in the Czech Republic within the framework of the CEFRES Platform also continued. In autumn 2019, an addendum extending the contract duration for another five years was signed. The success of the cooperation to date was reflected in the awarding of a prestigious ERC grant for follow-up research by the Czech project team under the TANDEM platform of CEFRES (the ERC Consolidator Grant mentioned above). An international selection committee choose the team of Michèle Baussant from the CNRS, the research director at the Institut des sciences sociales du politique and Johana Wyss from the Institute of Ethnology for another two-year period.

Regional cooperation

The Czech Academy of Sciences helps Czech regions and microregions improve local quality of life through jointly funded research projects and their application. This work is rooted in agreements concluded successively with the Association of the Municipalities of Orlicko (2003), South Moravian Region (2008), City of Brno (2008), Prague 1 Municipal District (2009), Pardubice Region (2013), Hradec Králové Region (2013), Vysočina Region (2014), Zlín Region (2015), Ústí nad Labem Region (2015), Central Bohemian Region (2016), Karlovy Vary Region (2016), Olomouc Region (2017), South Bohemian Region (2018), Pilsen Region (2019) and Šumava National Park Administration (2019). In 2019, these agreements were implemented through 21 joint projects which were financed according to the agreements between the CAS Institutes and their regional partners.

> The Czech Academy of Sciences Institutes help Czech regions and microregions improve local quality of life through jointly funded regional cooperation projects.

Searching for the historic adit in the Komorní hůrka volcano in the Karlovy Vary region
The first section of Goethe's Adit was opened in 2019.

In 2019, the 270th anniversary of European art and science master Johann Wolfgang Goethe's birth, the first section of Goethe's Adit in Komorní hůrka was opened in a gala ceremony.

Goethe's Adit is one of the outcomes of the Tor ins Erde/Gateway to the Interior of the Earth CAS – Karlovy Vary Regional Cooperation Programme, operated since 2018 as an international project of the European Regional Development Fund. This is one of the specific ways that the CAS is helping the regions and micro-regions of the Czech Republic improve local quality of life through jointly funded research projects and their application.

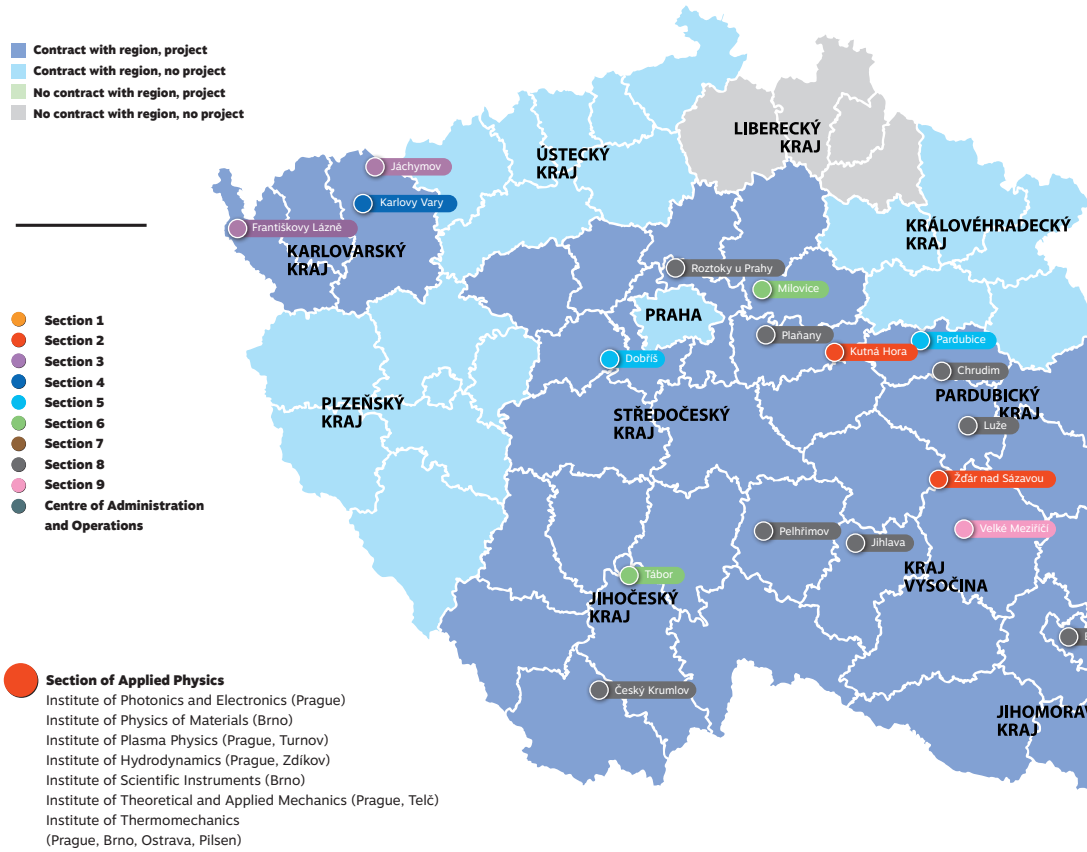
In 2019, CAS Institutes from the sections of Applied Physics, Earth Sciences, Chemical Sciences, Biological and Medical Sciences, Biological-Ecological Sciences, Historical Sciences and Humanities and Philology were engaged in regional cooperation. Projects focused on the following topics: research into landscape formation history (volcanological and seismological history of an area, analysis of underground mines), health-economics issues (risk of lung cancer in relation to solid fuel combustion, the impact of plant species on wastewater treatment plan efficiency) and research relating to archaeological sites and cultural monuments in regions (preservation and presentation of archaeological heritage, research into medieval sculpture and painting).

These joint projects include regular annual meetings, which are held alternately in Prague and Brno and attended by representatives of the CAS and regions of the Czech Republic. These meetings serve as informational, inspirational and discussion platforms for researchers and representatives of regional and local self-governments. The CAS Regional Cooperation Committee chose 5 out of the 21 joint projects

to be presented and evaluated in Prague on 30 April 2020 to illustrate the results of the regional cooperation subsidies provided in 2019.

1. **Impact of plant species on the efficiency of small constructed wetland wastewater treatment plants,** Institute of Experimental Botany, Upper Secondary School of Chemistry Pardubice and Upper Secondary School of Electrical Engineering Pardubice;
2. **Study of ionospheric plasma using sudden ionospheric disturbance monitors (SID),** J. Heyrovský Institute of Physical Chemistry, Observatory and Radioclub of Spa City of Carlsbad;
3. **Reduction of the biomass of unsuitable fish species to reduce the negative effects of eutrophication in the Jordan Reservoir,** Biology Centre, City of Tábor;
4. **Current philosophy: Humans and the environment,** Institute of Philosophy, Vysočina Region and JUPITER Club;
5. **Research into medieval sculpture and painting in the Pardubice region. Architect František Schmoranz Sr. and Neo-Gothic remodelling of of buildings and their interior furnishings in the region,** Institute of Art History, Chrudim Regional Museum.

Map depicting the distribution of projects of the Programme for Regional Cooperation between CAS Institutes and Regions in 2019



Section of Applied Physics
Institute of Photonics and Electronics (Prague)
Institute of Physics of Materials (Brno)
Institute of Plasma Physics (Prague, Turnov)
Institute of Hydrodynamics (Prague, Zdíkov)
Institute of Scientific Instruments (Brno)
Institute of Theoretical and Applied Mechanics (Prague, Telč)
Institute of Thermomechanics
(Prague, Brno, Ostrava, Pilsen)

Section of Earth Sciences
Institute of Geophysics
(Prague, Budkov, Kašperské hory, Příbram)
Institute of Geology (Prague, Průhonice)
Institute of Atmospheric Physics
(Prague, Dlouhá louka, Kopisty)
Institute of Geonics (Ostrava, Brno)
Institute of Rock Structure and Mechanics (Prague)

Section of Biological and Medical Sciences
Institute of Biophysics (Brno)
Institute of Biotechnology (Prague, Vestec)
Institute of Physiology (Prague)
Institute of Microbiology
(Prague, Nový hrádek, Třeboň, Vestec)
Institute of Experimental Botany (Prague, Olomouc)
Institute of Experimental Medicine (Prague)
Institute of Molecular Genetics (Prague, Koleč)
Institute of Animal Physiology and Genetics
(Liběchov, Brno, Prague)

Section of Chemical Sciences
Institute of Analytical Chemistry (Brno, Prague)
Institute of Inorganic Chemistry (Řež, Prague)
J. Heyrovský Institute of Physical Chemistry (Prague)
Institute of Chemical Process Fundamentals (Prague)
Institute of Macromolecular Chemistry
(Prague, Pardubice, Vestec)
Institute of Organic Chemistry and Biochemistry (Prague)

Section of Biological-Ecological Sciences
Biology Centre
(České Budějovice, Papua New Guinea)
Institute of Botany
(Průhonice, Brno, Třeboň)
Global Change Research Institute
(Brno; České Budějovice; Drásov)
Institute of Vertebrate Biology
(Brno; Studenec; Valtice)

Centre of Administration and Operations

Section of Historical Sciences
Institute of Archaeology, Brno (Brno,
Dolní Dunajovice, Dolní Věstonice, Mikulčice, Opava)
Institute of Archaeology, Prague
(Prague, Kutná Hora, Kvilice, Závist)
Institute of History
(Prague, Brno, České Budějovice, Rome)
Masaryk Institute and Archives (Prague)
Institute of Art History (Prague)
Institute of Contemporary History (Prague, Brno)

Section of Humanities and Philology
Institute of Ethnology (Prague, Brno)
Institute of Philosophy (Prague)
Oriental Institute (Prague)
Institute of Slavonic Studies (Prague)
Institute of Czech Literature (Prague, Brno)
Institute of the Czech Language (Prague, Brno)

Educational activities

A crucial part of the CAS mission and an integral part of CAS' work is helping to educate young scientists and to improve the quality of the national education system at all levels. CAS' educational activities centre around cooperation with universities, particularly in doctoral programmes. CAS employees are also directly involved in teaching and supervising university students, while also taking part in a variety of educational and training programmes for secondary school students and teachers.

COOPERATION WITH UNIVERSITIES

The amendment to Act No. 111/1998 Coll., on Higher Education Institutions requires that doctoral programmes implemented by institutes in cooperation with universities be accredited by the National Accreditation Bureau. A mandatory part of the accreditation application is a cooperation agreement between the Czech Academy of Sciences and the relevant university in the implementation of doctoral programmes. The Academy Council has drawn up a model agreement and works individually with the management of each relevant university on the specific wording of each given agreement, including points such as representation of CAS Institutes in subject area boards of specific study programmes and listing affiliations on papers published by students. Agreements have already been signed with sixteen universities and negotiations with others are continuing in an atmosphere of mutual trust and due procedure. In 2019, memorandums on cooperation were signed between the CAS and the VSB - Technical University of Ostrava and between the CAS and the University of Žilina. In November 2019, negotiations took place between the CAS management and the INSA Lyon University in France and preparation of a draft memorandum is underway. Negotiations about potential cooperation continued with the Leipzig University and Leibniz Association. In conjunction with the Division for Administration of the CAS Head Office, several model "partial" agreements were also prepared and CAS Institutes are gradually entering into such agreements with university faculties which are applying for accreditation of a study programme.

> In 2019, employees of CAS Institutes trained 2,672 doctoral students and also participated in the supervision of bachelor and master programme students.

Relations between the CAS and universities are monitored and coordinated by the Council for Higher Education and Researcher's Training Cooperation, which is an advisory body to the CAS management. The Council met for its annual session on 2 December 2019. The session was also attended by the external member, Prof. Tatiana Molková of the Praesidium of the Council of Higher Education Institutions. Long-standing good relations between the Council of Higher Education Institutions and the Council for Higher Education and Researcher's Training Cooperation is also demonstrated by the fact that, conversely, the Chair of the Council for Higher Education and Researcher's Training Cooperation Pavel Krejčí is a regularly invited guest at meetings of both the Praesidium and the Assembly of the Council of Higher Education Institutions.

CAS Institutes and employees participate extensively in student education at both public and private universities. In 2019, CAS employees provided more than 6,915 semestral series of lectures, practicals or seminars with a total scope of more than 70,000 hours. CAS Institutes contribute significantly to student education and supervision of students' qualification work. In 2019, employees of CAS Institutes trained 2,672 doctoral students and also participated in the supervision of bachelor and master programme students. 316 doctoral students trained at CAS Institutes successfully completed their studies.

The CAS has supported the general education of doctoral students for many years through its successful and sought-after week-long course on the basics of scientific work, which is intended for doctoral students in various fields and aims to cultivate the skills students need to succeed in the fiercely competitive international environment. Courses are held regularly in Prague and in Brno; in 2019 they were attended by 120 students in Prague and 189 students in Brno. The lecturers are renowned and experienced experts, mainly CAS employees, and lecture topics are chosen so as to be useful for doctoral students across all disciplines. In 2019, the main subjects included scientific methodology, research integrity principles and bioethics, evaluation of scientific work, scientific communication and its written genres, presentation of scientific results, editorial practice for publishing in journals, scientific writing techniques, rhetoric and the culture of the spoken word, lecturing skills, information resources for science, research and education, research funding, targeted funding, project development, intellectual property and its commercialisation, technology and knowledge transfer, writing in English, and more. The import and significance of these courses is evidenced by student feedback received by the CAS.

Table No 9: Overview of the most significant forms of cooperation with universities

	2013	2014	2015	2016	2017	2018	2019
Doctoral students trained at CAS institutes	2,063	2,030	2,091	2,019	2,175	1,995	1,972
Newly accepted doctoral students	397	315	376	348	323	376	384
Number of doctoral dissertations completed	224	268	264	263	260	264	316
Number of semestral series of lectures, seminars and practicals	4,025	4,046	4,246	5,547	4,949	5,247	6,915
Number of hours lectured	74,198	75,342	76,348	75,978	76,423	71,335	72,862

PROJECT OPEN SCIENCE

The CAS offers students of secondary, higher vocational and higher education institutions the opportunity to participate in scientific work through one-year internships at a CAS Institute under the guidance of experienced teachers. Open Science student internships have been running since 2005 and are fully funded by the Czech Academy of Sciences. The internships are twelve months in length, with a minimum of eight hours per month. Travel costs are also covered for students who commute. Some internships are available in English. In addition to natural sciences and technical disciplines, since 2016 the humanities and social sciences have also been incorporated. On 21-22 November 2019, 140 Czech Academy of Sciences intern met for a two-day Student Science Conference at the Institute of Molecular Genetics, where they presented their project results in three sections according to their scientific disciplines. The first section included biology, chemistry, medical sciences, biochemistry and ecology; the second astronomy, biophysics, physics, geography, geology, mathematics and technology; and the third concerned the humanities and social sciences, particularly philology, art history, sociology, literature, history and anthropology. The jury presented awards for first through third place in each discipline and also gave a special award for outstanding creative work. For 2020, 106 topics have been announced covering a wide range of scientific fields and disciplines in all areas represented at the Czech Academy of Sciences.

ENGAGEMENT AT SECONDARY AND PRIMARY SCHOOLS

CAS' engagement in secondary and primary school education centres around teaching and a broad array of lectures. The CAS also offers summer science camps for secondary and primary school science teachers through the Open Science project. In regard to the humanities, the eighth annual School of Czech language and literature for teachers was held in October 2019.

School of Czech language and literature for teachers

Media communication

and promotion

The Czech Academy of Sciences has always dedicated great effort to communicating with the public, particularly through the media. Distinctive CAS scientific results have the potential to leave an indelible imprint on the Czech media landscape and beyond. For instance, in 2019 CAS Institutes were already preparing to present at the EXPO 2020 international exhibition. Another inherent part of the Academy's work is continuous, regular and systematic popularisation of scientific and research results through all available communication channels. CAS employees strive to spark the public's interest in scientific work. They endeavour to bring science closer to non-scientists, capture their interest in research findings across disciplines and present research institutes and staff at work on specific research projects.

THE CZECH ACADEMY OF SCIENCES AS A MEDIA PARTNER

The Czech Academy of Sciences has always dedicated great effort to communicating with the public, particularly through the media. In 2019, 21,489 media outputs pertaining to the CAS were recorded in monitored media

The Czech Academy of Sciences has always dedicated great effort to communicating with the public, particularly through the media. One of the key elements of the CAS communication strategy is working with public service media. Czech Television (CT), Czech Radio (CR) and the Czech Press Agency are natural partners of the CAS. These media take note of research results from CAS Institutes, CAS popular science events like the CAS Science Fair, Science Festival and CAS Science and Technology Week as well as special CAS lectures and award ceremonies. News programmes regularly cover presentation of the Otto Wichterle award to talented young CAS scientists, Academy prizes and the Academy Premium and Lumina Quaeruntur Fellowship. The results of the Strategy AV21 academic conference were also reported in the media, including the two-day conference at the Czech Academy of Sciences in May as well as seminars held in the Chamber of Deputies of the Parliament of the CR in November.

In 2019, there was a total of 21,489 media outputs mentioning the CAS and other selected keywords and topics associated with the CAS in monitored print, internet and other media, which is comparable to 2018, i.e. an average of 1,790 mentions per month. The keyword AV ČR and its variations (AV, ČAV, ČSAV, ČAVU) appeared more than 7,227 times, the name of the President of the CAS, Eva Zažímalová, was mentioned on 584 occasions and Strategy AV21 was referred to 243 times.

The media took note that the Czech Academy of Sciences launched AVexes, i.e. expert opinions issued by the CAS about pressing social issues, for the needs of both chambers of the Czech Parliament. The media provided extensive information about another new CAS initiative, namely the strengthening of cooperation with ministries through joint memoranda, including cooperation with the Ministry of Finance and Ministry of Health. The media also informed the public about the Memorandum on support of R&D&I in the Czech Republic, which was initiated by the CAS and signed on 19 December 2019.

The CAS Science Fair, Science Festival and – more than ever before – the CAS Science and Technology Week attracted extraordinary media attention. The opening of CAS Science and Technology Week on 11 November was particularly well covered, along with videomapping on the Czech Academy of Sciences building on Národní třída on 16 November to commemorate the 30th anniversary of the November 1989 Velvet Revolution. Another November event was the CAS commemoration of the 60th anniversary of the awarding of the Nobel Prize for Chemistry to Prof. Jaroslav Heyrovský, which was likewise broadly reported in the media.

The *"Frontiers of Quantum and Mesoscopic Thermodynamics (FQMT)"* academic conference held by the Institute of Physics in July and attended by five Nobel Prize winners also elicited significant media coverage. The *Name Exo Worlds* project of the International Astronomical Union, implemented in cooperation with the Astronomical Institute and the Centre of Administration and Operations, was hugely popular with the public and journalists. The new two-volume book *Cathedral Visible and Invisible* from the Prague Institute of Archaeology also attracted media attention. The news spotlight also shone on two ERC grant recipients, Josef Komenda of the Institute of Microbiology, who was awarded an ERC Synergy Grant, and Luděk Brož of the Institute of Ethnology, who was awarded an ERC Consolidator grant.

The series *Česká věda zblízka (Czech Science Up Close)*, launched in the magazine *Týden* in 2018, continued throughout 2019. The series presents outstanding Czech research through interviews with directors of CAS Institutes. In 2019, Týden introduced the Institute of Computer Science, Institute of Geology, Institute of Information Theory and Automation, Institute of State and Law, Institute of Physics, Institute of Archaeology, Brno, Institute of Physics of Materials and the Institute of Ethnology.

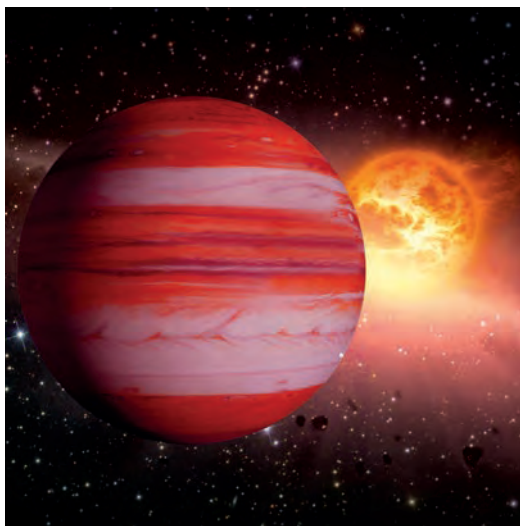
In the autumn, the Czech Television 24 (CT24) dedicated four Friday evenings to the Strategy AV21 research programme in a show titled *Natural Hazards*. In the show, Václav Moravec introduced viewers to scientists' work and new findings in research into landslides, earthquakes, the climate and cosmic weather. The show also included discussions with experts.

CAS Institutes intensified their cooperation with media throughout the year, as radio show hosts, public service TV and private TV stations asked scientists for interviews or to take part in media programs. Journalists are aware that they can call on scientists whenever they need knowledgeable statements on issues pertaining to science, research and current affairs in the Czech Republic and abroad. Scientists responded to questions about basic and applied research, commented on funding and evaluation of science and research, expressed opinions about the sustainability of scientific centres and milestones in Czech history, provided information about Strategy AV21 results and the condition of the environment and presented their own scientific achievements. These data demonstrate that the work of the Academy across all scientific disciplines held a central position in the media environment in 2019. The scope of popularisation activities and media outputs pertaining to specific researchers, their work, achievements, awards and CAS Institutes is so extensive that only a few brief examples can be shared in the following text.

RESEARCH AREA I. – MATHEMATICS, PHYSICS AND EARTH SCIENCES

The **Astronomical Institute** is a long-standing leader in the popularisation of science. Light pollution was one of the issues reported in the media, in particular by Pavel Suchan. His rigorous science popularisation efforts are evidenced by more than 550 media mentions. News about the 100th birthday of Luboš Perek, a prominent astronomist and former director of the institute, in the summer of 2019 received roughly 163 media outputs. Astronomy websites as well as standard daily newspapers reported that a team of scientists from various countries, led by Petr Kabáth of the Astronomical Institute, had in all likelihood discovered traces of sodium on two known exoplanets. Vladimír Karas, director of the Astronomical Institute, spoke on *CT24's* Studio programme about Czechs' role in space research.

The *Name Exo Worlds* campaign, a collaborative effort of the International Astronomical Union, the **Astronomical Institute** and the **Centre of Administration and Operations**, was a media success. More than 1,700 people sent in name suggestions for a planet and stars outside of our solar system and approximately 4,500 people participated in the final voting. The International Astronomical Union announced the winning name in December 2019 and presented it at a press conference in the CAS building; the planet's name is Makropulos and the star that orbits around the planet was named Absolutno. The campaign included an art and writing contest for primary and secondary school students.



The **Institute of Physics** was frequently mentioned in the media. The development of a new microwave material with unique properties by Stanislav Kamba's research team, in collaboration with American and German scientists, attracted attention. In October, news about a new nanocomposite that could decompose dangerous chemical warfare agents such as novichok and sarin much more effectively was widely reported *(e.g Czech Television 1 News, TV Nova, Deník N, CR)*. It was developed by Štěpán Stehlík of the **Institute of Physics** and Jiří Henych of the **Institute of Inorganic Chemistry**, along with scientists from other Czech institutions and the Uppsala University.

The **Institute of Physics** received the HR Excellence in Research Award, the fourth CAS Institute to do so. On this occasion the media noted that about 470 scientific or university institutes in Europe have been recognised with this award with only a handful from the Czech Republic, including the **J. Heyrovský Institute of Physical Chemistry**, **Biology Centre** and the **Institute of Physiology**.

The **Nuclear Physics Institute** made news in 2019, as Vladimír Wagner indefatigably responded to the student climate change movement with his knowledgable articles, as evidenced by over 200 media mentions in a broad array of printed media and servers. Vladimír Wagner commented on other issues as well, e.g. he explained uranium enrichment methods in regard to the Iran nuclear programme on *CT1's Studio 6*.

In 2019, the **Institute of Photonics and Electronics** commemorated the 40th anniversary

of the discovery of optic fibres. Erich Spitz, the 88-year-old scientist who was behind the discovery, spoke about it on *CT1 News* and Pavel Honzátko, deputy director of the Institute of Photonics and Electronics, commented. The history of optic fibre technology research was outlined through a number of articles, interviews and appearances. Director of the Institute of Photonics and Electronics Jiří Homola was quoted 26 times in the media.

More than 1,200 articles about microplastics were published in 2019. Martin Pivokonský, director of the **Institute of Hydrodynamics** and author of the world's first study on microplastics and expert guarantor of the Avex expert opinion Drinking Water – Is there Any and Will There Be? (no. 2/2019), sparked boisterous media debate. He was quoted almost 100 times in relation to this topic *(e.g. CT, CR, MF Dnes, iHNed.cz)*.

Another frequently quoted institute in 2019 was the **Institute of Geophysics** with a total of 106 media outputs, including TV (24), CR (16), printed periodicals (66) and the internet (138).

RESEARCH AREA II. – LIFE AND CHEMICAL SCIENCES

New cancer treatment and drugs are always a point of interest for Czech mass media. For example, in March 2019, CT1's *168 Hours* show reported on a new substance called DON that works against various types of cancer. Pavel Majer's team at the **Institute of Organic Chemistry and Biochemistry** collaborated on the research with John Hopkins University in Baltimore, Maryland, USA. The media also noted that in May 2019 the Institute signed a licence agreement with US-based SHINE Medical Technologies concerning use of completely new methods to separate rare earth elements. American scientists intend to use the new method to produce lutetium-177. In an article published in the prominent journal *Chemical Science*, scientists from the Institute of Organic Chemistry and Biochemistry and **Institute of Microbiology** described a method for artificially turning a specific segment of DNA on or off. If they are able to successfully apply the method to living organisms, they will open up new possibilities for treatment of diseases related to DNA mutations.

The awarding of the annual National Government Prize for science, known as the "Czech Head", is a popular media event every year. In 2019, public attention focused on Daniel Bím of the Institute of Organic Chemistry and Biochemistry, who also works with the **J. Heyrovský Institute of Physical Chemistry**. He was awarded the Czech Head prize for research into activation of carbon-hydrogen bonds in organic compounds. The media also reported on the J. Heyrovský Institute of Physical Chemistry in relation to the 60th anniversary of professor Jaroslav Heyrovský's Nobel Prize for Chemistry.

There were over 60 articles published in the media about the MitoTam anti-cancer agent, which was developed in the BIOCEV Centre at the **Institute of Biotechnology**. Another 30 articles about MitoTam reported on Jiří Neužil, who began working on MitoTam several years ago at Griffith University in Australia. MitoTam is now being tested by oncologists at the General University Hospital in Prague.

The **Institute of Physiology's** contribution to public discourse about the alternation of winter and summer time were publicized, with over 70 mentions of Alena Sumová's opinions across various media. Přemysl Jiruška and his epilepsy research were similarly popular, with more than 60 mentions; he spoke about his research in the CT 24 *Hyde Park Civilizace* series. The media also reported on the unique centre linking epilepsy research with clinical practice that opened at the University Hospital in Motol. Scientists from the Second Faculty of Medicine at Charles University and the Institute of Physiology work alongside physicians in multi-disciplinary teams at the new centre.

The most frequently cited scientist from the **Institute of Experimental Botany** was Jaroslav Doležel, coordinator of the Strategy AV21 Foods for the Future programme. In almost 130

Jaroslav Doležel

media outputs, he spoke primarily about wheat cultivation. Jaroslav Doležel's team also attracted media attention when scientists from the Institute of Experimental Botany mapped the sequence for a genome similar to contemporary wheat - *Aegilops biuncialis*. As a result, it will be possible to enrich wheat with the rare genes of this wild relative to increase its resilience. The media also reported on a discovery made by an international team of scientists who deciphered a reference pea genome in a six-year project. Scientists from the Olomouc laboratory of the Institute of Experimental Botany and from the South Bohemian **Biology Centre** played an important role in the research.

There were 300 mentions of the work of the **Institute of Experimental Medicine** in the media in 2019. Genetist Radim Šrám, awarded the De scientia et humanitate optime meritis medal of honour, was cited 100 times as the Chair of the CAS Environmental Committee commenting on the impact of environmental pollution on human health, the construction of the Danube-Odra-Elbe canal, the amendment to

the forestry act, etc. Josef Syka was mentioned almost 60 times in the media in relation to e.g. Brain Week and the health impacts of noise.

Researchers from the **Institute of Molecular Genetics** were present in the media in 2019. Václav Hořejší was mentioned more than 150 times in relation to applied and basic research, the scientist Antonín Holý, the Nobel Prizes for physiology and medicine as well as political events. Markéta Černohorská of the same institute told Czech Television 24 viewers about research in which she and a colleague discovered how lashes and flagella form on cells. Zdeněk Trachtulec commented on findings explaining why Czech male mice are fertile even though they lack a gene that influences one of the important characteristics of germ cell development. Keith Caldecott's team identified two hitherto undescribed genetic mutations and proved that they cause microcephaly, i.e. abnormally small skull volume. The discovery, which was covered by the Czech media but primarily by the journal *Neurology Genetics*, could make a significant contribution to treatment of neurodegenerative and development brain disorders.

In September 2019, the headline "Huntington's disease gene therapy clinical trial proposed" appeared in the media. Czech scientists from the PIGMOD Research Center at the **Institute of Animal Physiology and Genetics**, headed by director Jan Motlík, took part in development of a new gene therapy for the hitherto incurable Huntington's disease which entered the clinical trial phase in the USA. There were almost 70 mentions in the media.

The **Biology Centre** was cited in almost 250 media outputs including, for example, reporting of the Centre's receipt of the HR Excellence in Research Award. One of the most frequently cited researchers was the Centre's director Libor Grubhoffer (over 90 citations). He commented on a groundbreaking discovery relating to the transmittal of Lime's disease from ticks to humans. Milan Janda and his team from the Biology Centre, which discovered new species of ants on Papua New Guinea, also made news *(Lidové noviny, MF Dnes, Týden, Studio CT 24)*.

Milan Janda

Scientists from the Institute of Parasitology of the Biology Centre and the **Institute of Vertebrate Biology**, in collaboration with the University of Minnosota in the USA, sparked media discussion about the significance of the intestinal microbiome for human health. There were almost 50 press mentions of Julius Lukeš, director of the Institute of Parasitology, e.g. pertaining to his being the first Czech scientist to be named a fellow of the American Association for the Advancement of Science. The Institute of Vertebrate Biology was cited in the media with reports that newts make clicking sounds underwater. The media also reported on the return of large ungulates and spring herbs to the reserve in Milovice and the dramatic decrease in owls.

Scientists from the **Global Change Research Institute** had almost 300 media outputs. One of the heavily publicised reports pertained to a finding by a group of European scientists, including two Czech researchers from the Global Change Research Institute, that wheat in Europe is not resistant to climate change. Institute director Michal V. Marek was particularly oft-quoted in the media (named over 70 times, appeared on the CT1 show *Václav Moravec's Questions*, interviewed in *Hospodářske noviny*), along with Alexander Ač (about 110 citations).

RESEARCH AREA III. – HUMANITIES AND SOCIAL SCIENCES

The **Economics Institute** attracted considerable media attention, with roughly 300 citations on various topics, along with CERGE-EI, the joint research center of the CAS and Charles University (almost 450 times), and its researcher Daniel Münich (approx. 250 times), who repeatedly commented on education in the Czech Republic, school-leaving exams and teachers' salaries, the government Innovation Strategy for the Czech Republic, evaluation of science and research, the lack of equilibrium between pensions and funding of pensions, etc.

The **Institute of Sociology** Public Opinion Research Centre evidenced about 3,000 media outputs in 2019. One of the many topics that Centre director Paulína Tabery commented on for Czech Television and Czech Radio was the 30th anniversary of the November 1989 events. In a research study for Czech Radio called *"Divided by Freedom"*, which was subsequently published in a number of other Czech media, sociologists attempted to describe the class structure of Czech society 30 years after the Velvet Revolution. Institute of Sociology scientists also attracted media attention with their calculations of what salary would be required to sustain a dignified life.

The **Institute of Contemporary History** made news (more than 150 citations) in regard to the commemoration of November 1989 events. The media dedicated particular attention to institute director Miroslav Vaňek, who had participated directed in these events as a student.

Media attention also turned to both **Institutes of Archaeology** and noted the 100th anniversary of the founding of their predecessor, the State Archaeological Institute. Director of the Prague Institute of Archaeology Jan Mařík spoke in Czech Television 24's *Historie.cs* series about three-dimensional visualisation in archaeology from prehistory to the Middle Ages and modern times. The beautiful two-volume book *Visible and Invisible Cathedral*, published by Hibertinum and the Institute of Archaeology, Prague, elicited extraordinary media attention (62 outputs). Scientists from the Institute of Archaeology, Prague and the Nuclear Physics Institute who proved that the oldest cave drawing in the Czech Republic was created 6,200 years ago in the Moravian Karst also made news.

Researchers from the **Oriental Institute** commented on Czech Television 24 and in other media on various issues such as the Islam Sharia law punishments in Brunei, the African climate summit, the situation in north Syria and the 20th anniversary of persecution of Faun Gong by the Chinese government. Lumina Quaeruntur Fellow Ondřej Klimeš was mentioned almost 120 times in the media.

A discovery made by Petr Plecháč of the **Institute of Czech Literature** was reported by Czech media (*Právo*, *Hospodářské noviny*, *Respekt*, *Czech Television Art*, *Czech Radio*) as well as CNN. Using a computer algorithm, Petr Plecháč demonstrated that William Shakespeare wrote *Henry VIII* in collaboration with at least one other author, John Fletcher, from his theatre company. The study also indicates a possible third, as yet unknown co-author, as Petr Plecháč told the journal *MIT Technology Review*.

Over the entire year, staff from the **Institute for the Czech Language** informed readers of *Lidové noviny* about troublesome aspects of the Czech language through the well-established column *Language Window*. Director of the Institute Martin Prošek regularly entertained questions from the moderator of the Czech Radio show *Language Corner*. Markéta Pravdová, member of the CAS Academy Council and deputy director of the Institute, often commented on Czech language issues in the media, e.g. inflection of female surnames and words of the year.

SCIENCE POPULARISATION

through the CAS Centre of Administration and Operations

The Centre of Administration and Operations (Středisko společných činností – SSČ), as a CAS service office, played a key role in systematic popularisation of scientific results. In 2019, through the Division of External Relations, the Centre implemented activities that covered current scientific events and drew attention to events with broad social impact. The keyword SSČ was cited in the media 181 times.

> The Czech Academy of Science considers popularisation of research results and dissemination of scientific findings to the broad public as a core part of its mission

In 2019, the Czech Academy of Sciences kicked off the new year with its traditional **new year's performance** at the National Theatre. The opera performance *Aida*, held under the auspices of the CAS and the National Theatre, took place on 23 January and was attended by CAS representatives and many foreign guests, high government officials and members of the government cabinet, ambassadors of foreign countries, rectors of public universities, representatives of partner organisations, sponsors and many other prominent figures.

During the year, the CAS organised two **gala lectures** as part of its ongoing series "Czech Academy of Sciences – Top research in the public interest". The seventh lecture in the series took place on 25 March in the Žofín Palace in Prague. The lecture, given by Institute for Hydrodynamics director Martin Pivokonský, was titled "*Drinking water treatment – current research and reality*". On 21 October, lecture no. eight was held at the same venue; the lecture was titled "*November 1989 – Between symbols and history*" and was given by Miroslav Vaněk, founder of Czech oral history and director of the Institute for Contemporary History. Prominent guests from the scientific and political sectors attended both lectures.

Brain Week is a festival about the latest discoveries and trends in brain research and neuroscience held under the patronage of the Czech Academy of Sciences. The main goals of Brain Week are to present new discoveries in theoretical and clinical neuroscience, raise public awareness about this scientific discipline and inform the public about research conducted at the CAS. The main organisers of Brain Week are the Institute of Experimental Medicine, the Czech Neuroscience Society and the Centre of Administration and Operations. The 21st annual Brain Week was held from 11 to 17 March 2019. More than 103 media outputs, in the main daily newspapers and shows on Czech Television and Czech Radio, informed the public about the event.

From 4 to 15 April, the Czech Academy of Sciences held a **lecture tour featuring American geophysicist Andrew Feustel**, one of the most prominent American astronauts at NASA. Feustel, who led the 56th expedition to the International Space Station and entered space three times during his career, shared his story during lectures and gatherings in four Czech cities (Prague, Brno, Ostrava and Olomouc), where he also met with representatives of local government and universities. The director of the Terezín monument presented Andrew Feustel and his wife Indira Feustel with a reproduction of Petr Ginz's drawing "Moonscape". Andrew Feustel had taken a copy of the Jewish boy's drawing form the Terezín concentration camp to the International Space Station in 2018. Andrew Feustel's visit was noted by 273 media

Martin Šálek, Institute of Vertebrate Biology of the CAS - Jarda the Farmer with an owl
Winning photo in the Photogenic Science competition

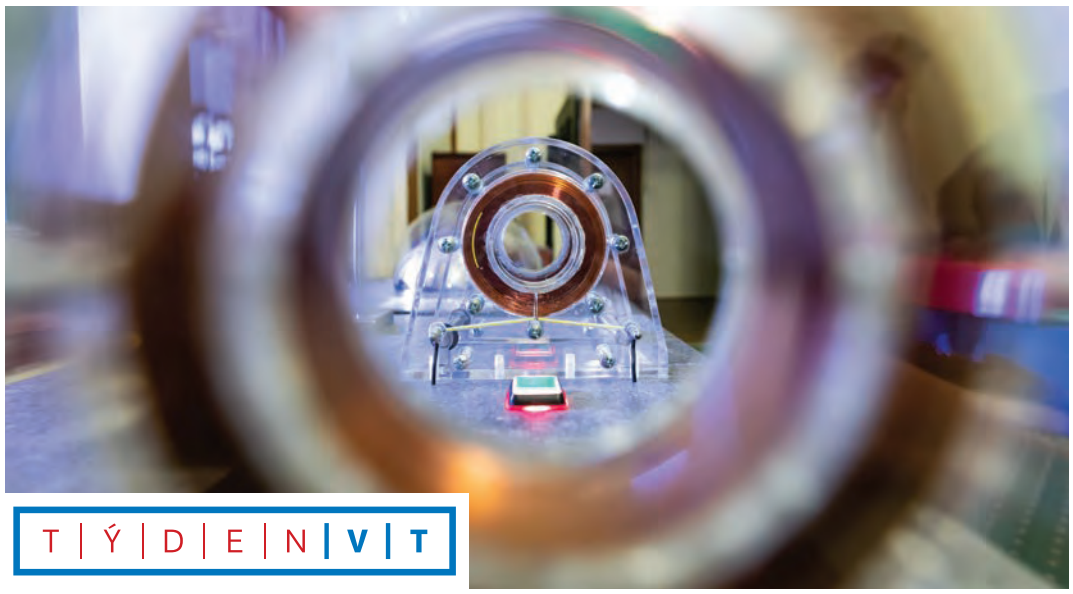
outputs. 70 regional dailies published the photo of the week of Andrew Feustal and the President of the CAS Eva Zažímalová (6/4/2019) along with the article *"We'll go back to the moon and fly to Mars"*.

The **Photogenic Science** competition for CAS Institute employees was held from 1 May to 30 June 2019. The winning photos were presented on 10 October at an exhibition in the American Centre in Prague attended by President of the CAS Eva Zažímalová. A record 350 photos were submitted by 98 employees from 33 institutes in 2019. The winning photos were featured in the CAS calendar and a traveling exhibition.

The fifth annual **Science Fair**, held from 6 to 8 June 2019 in Prague-Letňany, included over 100 exhibitors in 8000 m² of exhibition space, CAS Institutes, universities and dozens of innovation firms and more than 30,000 visitors. It was exceptional in every respect: it attracted a record number of visitors, had the largest floor space and most of the 54 CAS Institutes were represented. CAS Institutes presented interactive exhibitions, experiments, lectures, workshops, carefully selected exhibits and a science show. Panel discussions and lectures accompanied the exhibits.

In 2019, another **Night of Scientists** event was held in the Czech Republic, specifically on 27 September. The 2019 motto was "Planet Friendly". A host of educational and popularisation activities awaited visitors in the CAS building on Národní třída. Visitors had a chance e.g. to talk with beekeepers, taste and learn to distinguish different types of honey, learn more about bats and bat protection, and pet and feed bats. Other CAS Institutes, including the Institute of Physics, Astronomical Institute, Institute of Organic Chemistry and Biochemistry, Institute of Experimental Botany and Biology Centre, and the Main Library of the CAS also participated.

From 11 to 17 November 2019, the 19th annual **CAS Week of Science and Technology** took place across the entire Czech Republic. The 2019 event focused on global threats and the 30th anniversary of the Velvet Revolution. There were



OTEVŘENÁ VĚDA
AKADEMIE VĚD ČR

over 600 events: open door days, excursions, lectures, science shows, panel discussions, a unique game, exhibitions, videomapping and more. Almost 50,000 visitors attended festival events. The festival spot on YouTube had 103,000 views and the Czech Television spot almost two million viewers.

In 2019, the **Open Science** project once again enabled secondary school students from across the country to take part in science internships. The themes spanned all three of the CAS research areas and students could choose from 111 topics. A total of 1,171 applications were submitted by 513 students. Lecturers could choose one to three students for each internship. Altogether 177 interns were selected for 2019, who took part in 100 internships under the guidance of 90 lecturers from 34 CAS Institutes.

Thirty secondary and primary school teachers from across the Czech Republic took part in the **Summer Science Camp**, which was held in Jindřiš near Jindřichův Hradec from 12 to 24 August 2019. The camp was divided into three separate three-day sections: chemistry and biology, mathematics and physics, and science for primary school teachers. The goals of the course were to share teaching methods that include immediate practical illustration of the material and to develop an understanding of how to use these methods in practice. Lecturers included scientists from CAS Institutes, university education experts and teachers who shared their own classroom experiences.

The **Undistorted Science** educational video series has long been popular. In 2019, the number of views reached almost 4.5 million and another series was added based on Strategy AV21 research programmes. Shows focus on topics such as water, smart materials, lifestyle diseases, the internet and electron microscopes. There are also shows with themes from the humanities and social sciences such as *"Barbarians"* and *"Don't Be Afraid of Economics"*.

In 2019, four issues of the magazine **A / Science and Research** were published. The main theme of the March issue was water (A 1/2019), the June issue focused on the human microbiome, the September issue, which included an insert about the 30th anniversary of the Velvet Revolution, focused on flying (A 3/2019) and the December issue theme was time (A 4/2019). There were two issues of the popular science magazine **AΩ / Science for Everyone**, which received the 2019 Grand Prix for content in the 17th Zlaty Středník communications competition. Both magazines also received awards in the G2C category of the Zlaty Středník communications competition, taking silver and bronze. In 2019, there were also 10 issues of the internal electronic newsletter **AB / Academic Bulletin.**

Currents events at the CAS and its institutes are promoted through the CAS website and **social networks.** Facebook, Twitter and Instagram activity, reach (number of followers, likes) and the quantity of outputs continue to increase. The most visited social network in 2019 was once again Facebook with 28,000 fans (compared to 16,000 in 2018), followed by Instagram (8,900 followers compared to 3,400 in 2018) and Twitter (3,600 in 2019 compared to 2,200 in 2018).

The Czech Academy of Sciences also helped popularise science through its **audiovisual works**. Alongside the traditional show *Czech Science*, which viewers watched on four television channels and social networks, there was also a new YouTube show called *Scout*. YouTuber Vojtěch Klinger presents current topics in contemporary science for audiences aged 18 to 30. CAS documentary films were also very successful. *Magion* won the Czechoslovak competition at the International Festival of Popular Science Films at Academia Film Olomouc (AFO) 2019. Prior to the film festival, *Magion* was featured in a special edition of Czech Television 24's *Hyde Park Civilization* show. Czech Television 24 also promoted the *Silent Threats* documentary

series through a special TV series in September and October hosted by Václav Moravec, which included a screening of the documentary and a subsequent discussion with experts. Czech Television 24 ran the series again later. *Magion* and *Silent Threats* are available for viewing online at the CT 24 website and have been viewed by 500,000 people. There were over one million views of CAS YouTube material in 2019 and the *Czech Science* channel on Facebook recorded similar viewing statistics.

Each year the CAS also organises exhibitions featuring scientific projects and achievements. The **Gallery of Science and Art** is the main venue for CAS exhibitions. Four exhibitions were held there in 2019. The exhibition season was kicked off with the *NATURE – FUTURE: Plants of the Future* exhibition, which highlighted discoveries in agricultural crop genetics and was prepared by the Centre of Administration and Operations in collaboration with the Institute of Experimental Botany and the Research Institute of Crop Production (8 February – 12 April). The exhibition *Divine Wisdom, Divine Nature: The Message of the Rosicrucian Manifestoes in the Visual Language of the Seventeenth Century* made accessible rare, richly illustrated editions and manuscripts. This exhibition was developed in collaboration with the Institute of Philosophy, The Embassy of the Free Mind in Amsterdam and the Rosicrucian Foundation (14 May – 30 June). To commemorate the 600th anniversary of the death of Wenceslas IV, the Institute of Art History curated an exhibition titled *Imago/Imagines. The Czech State under Wenceslas IV: The Testimony of Art* (4 September – 26 October). The fourth exhibition, *November 1989: Journey to Democracy*, captured the historical framework and memories of the Velvet Revolution from the student demonstrations on 17 November to the student strike, founding of the Civic Forum and election of Václav Havel as president (11 November –14 December).


New Moskow
The Wastes
Johannesburg
New Sydney
31:03
CORRECT


filosofia
Michal Přibáň
a kolektiv
Miloslav Šimek
a kol.
František Mareš
Jan Sedláček

Publications

The Czech Academy of Sciences supports the publication of selected scientific and popular science works from all scientific disciplines, both through the Academia Publishing House, which is part of the Centre of Administration and Operations, and other CAS Institutes. Book by CAS scientists are also published by other Czech publishers as well as prestigious international publishing houses. In 2019, CAS scientists authored or co-authored a total of 30 books published abroad.

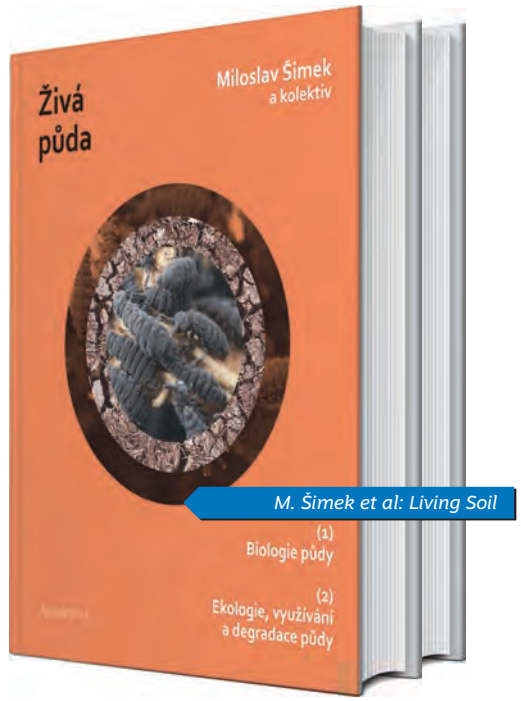
> The Czech Academy of Sciences supports the publication of high quality, publicly accessible scientific and popular science works to help disseminate scientific research results and develop new knowledge.

In 2019, the new Directive No. 13/2018 on Support of Publishing Activity came into force. The Czech Academy of Sciences continues to support proposals for publication of original scientific work, critiques of important sources and significant monuments, translations of important scientific or popular science works, and popular science work encompassing original research results as a major component.

Through the Publishing Support Programme, the Czech Academy of Sciences supported, based on recommendations from the CAS Editorial Board, publishing at the following 16 CAS Institutes: the Institute of Archaeology, Brno, Institute of Archaeology, Prague, Astronomical Institute, Institute of Ethnology, Institute of Philosophy (Filosofia Publishing House and Oikoymenh Publishing House), Institute of History, Masaryk Institute and Archives, Institute of Psychology, Institute of Art History (Artefactum Publishing House), Institute of Experimental Botany, Institute of Chemical Process Fundamentals, Institute of Czech Literature, Institute of Contemporary History, Institute of State and Law, Slavonic Institute and Centre of Administration and Operations (Academia Publishing House).

This support of almost CZK 15 million enabled the publication of 83 books, of which 39 were published by the Academia Publishing House and 44 were published at CAS Institutes. Support also extends to another forthcoming 47 books.

Some of the noteworthy works that were published with Publishing Support Programme funding in 2019 include the following original scientific works: an extensive two-volume publication by M. Šimek et al. titled *Living Soil* (Academia), an expanded edition of *Key to the Flora of the Czech Republic* by Z. Kaplan et al. (Academia), *Jáchymov. Mineralogical Pearls of the Ore Mountains*, a richly illustrated book by P. Škácha, J. Plášil and V. Horák (Academia), the 1,750-page *Dvůr Králové and Zelená Hora Manuscripts in Culture and Art* by D. Dobiáš et al. (Academia) and O. Klimeš' remarkable work, *Cultural Diplomacy of China and its Regional Variations* (Academia).

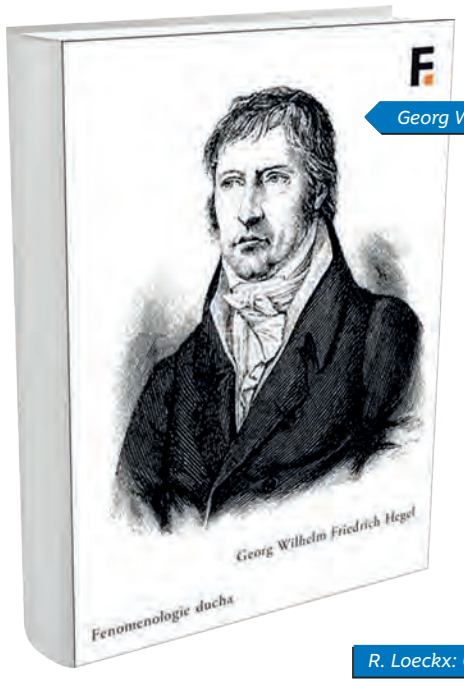


M. Šimek et al: Living Soil

Z. Kaplan (ed.): Key to the Flora of the Czech Republic

P. Škácha, J. Plášil, V. Horák: Jáchymov. Mineralogical Pearls of the Ore Mountains

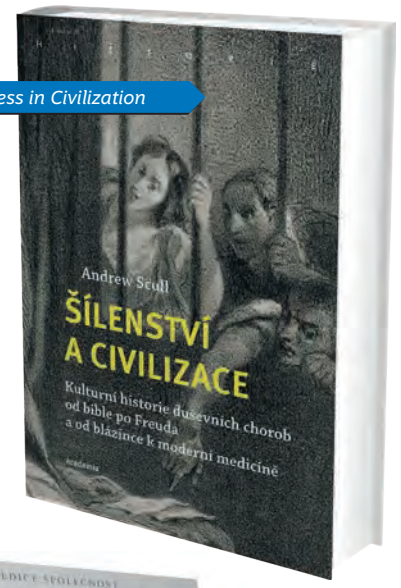
Notable translations supported by the CAS Editorial Council include e.g. G. W. F. Hegel's extensive work *The Phenomenology of Spirit* (Filosofia, translated by J. Kuneš and M. Sobotka), Andrew Scull's richly illustrated book *Madness in Civilization* (Academia, translated by J. Veis) and the alluring *Cold War Triangle: How Scientists in East and West Tamed HIV* by R. Loeckx (Academia, translated by J. Kurfürst).



Georg Wilhelm Friedrich Hegel: The Phenomenology of Spirit

R. Loeckx: Cold War Triangle: How Scientists in East and West Tamed HIV

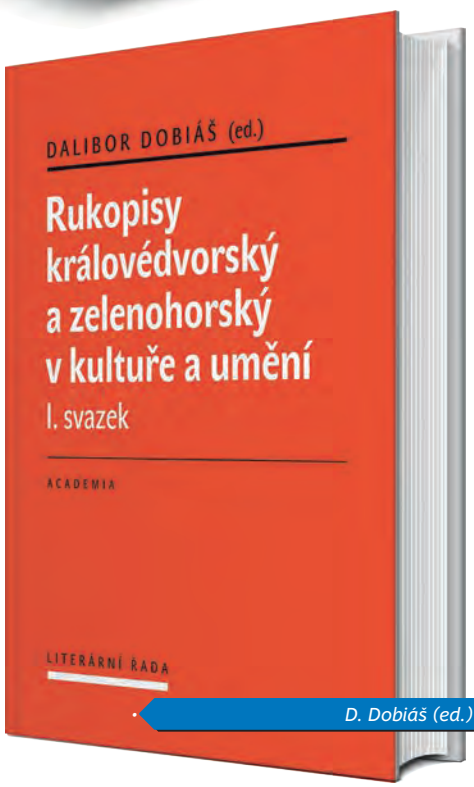
O. Klimeš et al: Cultural Diplomacy of China and its Regional Variations



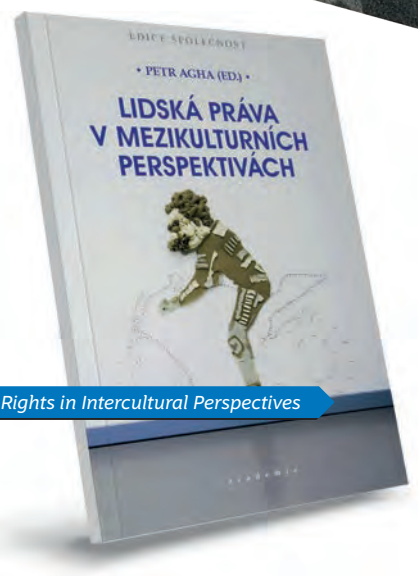
A. Scull: Madness in Civilization

The largest CAS publishing house is the Academia Publishing House, which is a leader among Czech publishers and releases work from all scientific disciplines. The Academia Publishing House publishes original scientific monographs and works by Czech scientists, classic scientific works, translations of foreign books, popular-educational literature, non-fiction literature, encyclopedias, dictionaries, language textbooks, manuals and university textbooks, the popular-educational magazine *Živa* and high-quality Czech and translated fiction.

In 2019, the Academia Publishing House published a total of 126 books, 11 new *Science Around Us* brochures and four new brochures in the Strategy AV21 series. Five monographs, including e.g. *Human Rights in Intercultural Perspectives* by P. Agha (Academia) and *Living Soil* by M. Šimek et al. mentioned above (Academia) were published under the Strategy AV21 research programmes and also co-financed by the Publishing Support Programme.



D. Dobiáš (ed.) Dvůr Králové and Zelená Hora Manuscripts in Culture and Art



P. Agha (ed.): Human Rights in Intercultural Perspectives

Cooperation

with scientific organisations

The Czech Academy of Sciences is a long-standing supporter of the activities of scientific societies in the Czech Republic. Scientific societies link renowned experts from universities, the Czech Academy of Sciences and ministerial research institutes, as well as students and other individuals interested in the given scientific disciplines. Furthermore, they are an important link between the professional public and international scientific organisations: through their members, scientific societies associated in the Council of Scientific Societies of the Czech Republic are involved in 174 international scientific organisations.

The Czech Academy of Sciences is a long-standing supporter of the activities of scientific societies, including the Learned Society of the Czech Republic and scientific societies associated in the Council of Scientific Societies of the Czech Republic.

The CAS provides systematic, long-term support to scientific societies associated in the **Council of Scientific Societies of the Czech Republic** (RVS), which has been an independently registered association as of 1 January 2019. Today, the Council of Scientific Societies of Czech Republic associates 85 scientific societies with more than 25,000 members. Many scientific societies are interdisciplinary in nature and some are not represented in academic or other scientific institutions.

In 2019, societies published a total of 31 internationally noteworthy journals, of which seven had an impact factor, e.g. *Preslia* (Czech Botanical Society – IF 3.07), *Fottea* (Czech Phycological Society – IF 1.72), *Plant Protection Science* (Czech Society for Plant Pathology – IF 1.42) and the *Journal of Geosciences* (Czech Geological Society – IF 1.27), and 44 national professional journals, 18 web magazines and 41 newsletters. Books and anthologies were also important publication platforms for scientific societies; in 2019, they published a total of 19 books and 68 anthologies (the latter primarily collections of conference papers).

Scientific societies hold an astounding number of symposia, conferences and other meetings each year. In 2019, scientific societies were the main or co-organisers of 105 international conferences, seminars and workshops, as well as 95 Czech and Slovak and 130 national professional and scientific meetings with hundreds to thousands of participants. International conferences and congresses included, for example: the *XVII Eastern European Cadaver Workshop in Regional Anaesthesia and Pain Medicine* (Czech Anatomical Society), *Eucarpia Leafy Vegetables 2019*, *9th International Conference on Genetics and Breeding of Leafy Vegetables* (Czech Society for Plant Pathology), *9th European Conference on Mineralogy and Spectroscopy* (Czech Geological Society), *All Mankind Is of One Origin. 6th International Anthropological Congress of Dr. Aleš Hrdlička* (Czech Anthropological Society), *19th International Nutrition & Diagnostics Conference*, *INDC 2019* (Czech Chemical Society), *Functional Organization of the Cell Nucleus Symposium* (Czech Society for Cell Biology) and the *16th International Congress on Logic, Methodology and Philosophy of Science and Technology, CLMPST 2019* (Czech Division of Logic, Methodology and Philosophy of Science and Technology; 800 participants).

Scientific societies actively supported elementary, secondary and university education by holding 140 events such as mathematics, chemistry, natural science or astronomy knowledge competitions, specialised field courses for secondary school and university students and teachers, summer schools and doctoral seminars. Members of the public also often participated. Examples include the *Astronomical Expedition Summer School (Czech Astronomical Society)*, *Geography Days* (Czech Geological Society; over 1,000 participants across six venues), *European Summer School on Quantitative and Mixed Methods Research Designs: From Designing to Publishing* (Czech Association of Pedagogical Research) and the *Physics Teachers' Inventions Fair* (Union of Czech Mathematicians and Physicists).

Most scientific societies focus on lectures, popularisation and other social activities. In 2019, the societies organised 576 lectures, excursions and seminars, 13 exhibitions and 125 media inputs and broadcasts to stimulate public and, especially, student interest in scientific work, and to promote the application of new findings.
Notable events which scientific societies helped organise in 2019 included the exhibition *About Bones and Implants* (Czech Anatomical Society, Czech Composite and Carbon Society) and *Prehistoric Technology Days* (Czech Archaeological Society) with more than 1,000 participants.

All of the societies' websites are developing well. The website of the Czech Astronomical Society, www.astro.cz, has been particularly successful in the media over the long-term. In 2019, it registered over 1.7 million visitors.

The Learned Society of the Czech Republic (Society) connects prominent scientists from all disciplines. Its goals are to encourage the free cultivation of science in all its manifestations, foster a drive for knowledge and joy from the quest for knowledge, disseminate scientific findings among the public and contribute to education and the development a creative, rational and humanly responsible social environment in the Czech Republic. The Society had 105 regular fellows, 50 foreign fellows and 14 emeritus fellows at the end of 2019.

The Society organised a number of lectures on current scientific and educational issues, including lectures and discussions at plenary sessions, as well as extraordinary public lectures and lectures at the XXV. General Assembly. Professor Peter Moczo, Chair of the Slovakian Learned Society, was a guest at the General Assembly. Five new regular fellows and two foreign fellows were elected at the General Assembly. Lectures at plenary sessions are open to the public.

The Society held a competition for secondary school students and awarded 10 students; it also presented an award to a younger researcher. The Society also recognized two educators for supporting students' interest in science and research at secondary schools, enabling students to work independently and for outstanding student work in competitions. The awards are funded by the Science Support Foundation of the Learned Society of the Czech Republic. The most significant prizes that the Society awarded in 2019 were two medals of the Learned Society of the Czech Republic, Societas Scientarium Bohemica, Ad Laudem et Honorem, for merit in the development of science.

The Society held seven working meetings, organised a professional excursion to the Polabí and Česky ráj region, invited Prof. Kip S. Thorne, winner of the Nobel Prize for Physics, to give a lecture and collaborated with the Bohuslav Jan Horáček Foundation for Česky ráj and other organisations. It published *Learned Society of the Czech Republic 1994–2019*.

The CAS and the Learned Society of the Czech Republic sent a letter to Hungarian President János Ánder in which they stated their concerns regarding the management and funding of science in Hungary. The Learned Society of the Czech Republic issued a statement in which the Society's members and other scientists declared support for student climate strikes. Prof. Pavel Jungwirth represented the Learned Society of the Czech Republic at the "Human Rights and Science" symposium held by the Institut de France – Académie des Sciences and Leopoldina – Nationale Akademie der Wissenchaften in Paris.

The Society's website at www.learned.cz provides information about the Society's activities and its members. Lectures or presentations from lectures are also published on the website.


BER
NARD
BOL
ZANO

Awards granted

by the CAS

Each year the Czech Academy of Sciences recognises leading scientists for excellent research results that focus on social priorities, strengthen the international prestige of Czech science and were first published or implemented during the past five years. In 2019, the results of the scientific and popularisation work of CAS researchers were recognised with many specific prizes, medals, honours and other awards. They received prizes not only from the CAS but also from other national and foreign organisations and institutions. The following pages provide an overview of the most important awards.

The President of the Czech Academy of Sciences presented the following awards in 2019:

The Czech Academy for Sciences Prizes for Outstanding Results in Science, Experimental Research and Innovations, achieved in the following research projects:
Institute of History team composed of:
PhDr. Jindřich Dejmek, DSc.
(CAS Institute of History),
PhDr. Ľudovít Hallon, DrSc.
(Institute of History of the Slovak Academy of Sciences),
prof. PhDr. Drahomír Jančík, CSc.
(Charles University, Faculty of Arts),
PhDr. Dušan Kováč, DrSc.
(Institute of History of the Slovak Academy of Sciences),
PhDr. Miroslav Londák, DrSc.
(Institute of History of the Slovak Academy of Sciences),
PhDr. Elena Londáková, CSc.
(Institute of History of the Slovak Academy of Sciences),
doc. PhDr. Jan Němeček, DrSc.
(CAS Institute of History),
prof. JUDr. Jan Kuklík, DrSc.
(Charles University, Faculty of Law),
PhDr. Petr Prokš, CSc.
(CAS Institute of History),
doc. Mgr. Jaroslav Šebek, Ph.D.
(CAS Institute of History),
for the scientific work *Czechoslovakia. History of the State.*

Masaryk Institute and Archives team composed of**:**
PhDr. Dagmar Hájková, Ph.D.,
PhDr. Mgr. Pavel Horák, Ph.D.,
doc. PhDr. Martin Jemelka, Ph.D.,
PhDr. Martin Klečacký, Ph.D.,
doc. Dr. phil. Rudolf Kučera, Ph.D.,
doc. PhDr. Ota Konrád, Ph.D.
(Charles University, Faculty of Social Sciences),
Mgr. Lucie Merhautová, Ph.D.,
doc. PhDr. JUDr. Jakub Rákosník, Ph.D.
(Charles University, Faculty of Law),
PhDr. Josef Tomeš, Ph.D.,
Mgr. Richard Vašek, Ph.D.,
PhDr. Luboš Velek, Ph.D.
for the scientific work *Czechoslovak Republic 1918–1939*.

The Czech Academy for Sciences Prizes for Young Researchers for Outstanding Results of Research, Experimental Development and Innovations achieved in CAS-supported research projects before reaching the age of 35, was awarded to:

- **RNDr. Petra Suková, Ph.D.**, from the Astronomical Institute, for the scientific outcome *Study of nonlinear phenomena in the dynamics of particles around a black hole*
- **Mgr. Jan Kolář, Ph.D.**, from the Institute of Botany, for the scientific outcome *Connections and interactions between human societies and the environment in prehistory*

The 2019 The Czech Academy for Sciences Prizes for Promotion or Popularization of R&D&I was awarded to:

- **doc. RNDr. Martin Pivokonský, Ph.D.**, nominated by the Council for Academic Media and Popularisation of the CAS
- **PhDr. Bronislav Ostřanský, Ph.D.**, nominated by the Oriental Institute
- **RNDr. Mgr. Alice Koubová, Ph.D. et Ph.D.**, nominated by the Institute of Philosophy

Honorary medals awarded to Czech and foreign researchers in 2019:

The Honorary Medal of the CAS "De Scientia et Humanitate Optime Meritis"

- **Ing. Vladimír Nekvasil, DrSc.**, Institute of Physics
- **Prof. Dr. Roland Wiesendanger, Dr. h. c.**, University of Hamburg, Germany
- **prof. PhDr. Petr Sommer, CSc., DSc.**, Institute of Philosophy
- **MUDr. Radim Šrám, DrSc.**, Institute of Experimental Medicine
- **Ing. Bohumil Štíbr, DrSc.**, Institute of Inorganic Chemistry

The Bernardo Bolzano Honorary Medal for Merit in Mathematical Sciences

- **Ing. František Matúš, CSc.**, Institute of Information Theory and Automation (In memoriam)

The Ernst Mach Honorary Medal for Merit in Physical Sciences

- **Prof. Theodor Wolfgang Hänsch**, Ludwig-Maximilians-Universität München, Germany
- **prof. Bożena Czerny, Ph.D.**, Center for Theoretical Physics, Polish Academy of Sciences
- **RNDr. Jan Kočka, DrSc.**, Institute of Physics

The Jaroslav Heyrovský Honorary Medal for Merit in Chemical Sciences

- **Prof. Alan Thomas Dinsdale**, Brunel University London, Great Britain

The František Křižík Honorary Medal for Merit in the Technical Sciences and for the Implementation of Results of Scientific Research

- **Ing. Ilona Müllerová, DrSc.**, Institute of Scientific Instruments

The Gregor Johann Mendel Honorary Medal for Merit in Biological Sciences

- **doc. RNDr. Jan Kirschner, CSc.**, Institute of Botany

The Jan Evangelista Purkyně Honorary Medal for Merit in Biomedical Sciences

- **prof. RNDr. František Kolář, CSc.**, Institute of Physiology
- **RNDr. Zdeněk Drahota, DrSc.**, Institute of Physiology

The František Palacký Honorary Medal for Merit in Historical Sciences

- **Prof. Dr. Alain Soubigou**, Université de la Sorbonne, Paris, France
- **prof. PhDr. Petr Vorel, CSc.**, Faculty of Philosophy, University of Pardubice

The Vojtěch Náprstek Honorary Medal for Merit in Science Popularisation

- **Ing. Václav Krištůfek, CSc.**, Biology Centre
- **Ing. Martin Šálek, Ph.D.**, Institute of Vertebrate Biology of the CAS
- **doc. PharmDr. Alena Sumová, CSc., DSc.**, Institute of Physiology

The Honorary Medal for Merit for the Czech Academy of Sciences

- **Ing. Emil Šípek, CSc.**, Institute of Physics

Major awards presented to CAS researchers by other institutions

The Silver Commemorative Medal of the Senate of the Parliament of the Czech Republic was awarded to:

- **doc. RNDr. Luboš Perek, DrSc.**, of the Astronomical Institute, for merit in the development of global and Czech astronomy
- **RNDr. Václav Cílek, CSc.**, of the Institute of Geology, for life-long publishing work

The Gold Medal of Charles University for a lifetime contribution to the study of sacred archaeology and medieval spiritual culture was awarded to:

- **prof. PhDr. Petr Sommer CSc., DSc.**, Institute of Philosophy

The L'ORÉAL Czech Republic Scholarship for Women in Science was awarded to:

- **Hedvika Kadlecová, Ph.D.**, Institute of Physics

The Ministry of Health of the CR Award for Health Research and Development was awarded to:

- **prof. MUDr. Ladislav Vyklický, DrSc.**, Institute of Physiology
- **Mgr. Pavel Krejčí, Ph.D.**, Institute of Animal Physiology and Genetics

The Ministry of Agriculture Award for Best Implemented Outcome was awarded to:

- **prof. Mgr. Ing. Miroslav Trnka, Ph.D.**, Global Change Research Institute

The Honorary Medal of the Minister of Justice and Chair of the Legislative Council of the Government of the Czech Republic for a Contribution to the Development of Czech Law was awarded to the following Institute of State and Law researchers:

- **JUDr. Jan Bárta, CSc.**
- **prof. JUDr. Dr. Karel Eliáš**
- **JUDr. Miloslava Hálová, Ph.D.**
- **doc. JUDr. Bohumil Havel, Ph.D.**
- **JUDr. Vlastimil Pihera, Ph.D.**
- **doc. JUDr. Petr Tégl, Ph.D.**

The National Prize of the Government of the Czech Republic "The Czech Head", the VEOLIA Award Doctorandus for Natural Science was awarded to:

- **Ing. Daniel Bím, Ph.D.**, Institute of Organic Chemistry and Biochemistry (in cooperation with the J. Heyrovský Institute of Physical Chemistry)

A Ministry of Defence Memorial Plaque for Care of War Graves was presented to:

- **Bc. Jiří Padevět** Centre of Administration and Operations

The Neuron Award for Young Promising Scientists was awarded to:

- **Petr Kohout, Ph.D.**, Institute of Microbiology

The Jacques Derrida Prize for Social Sciences for publication and research in the social sciences was awarded to**:**

- **Lucie Drechselová, Ph.D.**, Oriental Institute

The French state medal Chevalier dans l'Ordre des Palmes Académiques for merit in education, science and culture was awarded to:

- **PhDr. Taťána Petrasová, CSc.**, Institute of Art History

The Society of Polymer Science Japan SPSJ International Award was presented to**:**

- **prof. Ing. Karel Dušek, DrSc.**, Institute of Macromolecular Chemistry

A letter of thanks for long-standing service to the CAS was presented by the President of the CAS, Eva Zažímalová, to 16 employees from eight CAS Institutes.

Granted scientific degrees

“Research Professor”

The scientific degree “Research Professor” was established by Decision XXI. at a session of the Academy Assembly on 18 December 2002 and has been repeatedly confirmed by resolutions of the Government of the Czech Republic on the Statutes of the Czech Academy of Sciences, most recently in Resolution No. 614 of 24 May 2006.

The granting of the scientific degree is governed by the provisions of Art. 62 of the Statutes of the Czech Academy of Sciences. In order to implement this provision, the Academy Council adopted the Rules for Granting the Research Professor Degree by the Czech Academy of Sciences.

The Czech Academy of Sciences grants the scientific degree of Research Professor to scientists in recognition of outstanding and original scientific work that contributes to the advancement of research in a specific scientific field and characterises the awardee as a scientist of distinguished stature. Degrees decided upon by the Science Council of the CAS.

At its 10th session on 30 January 2003, the Science Council of the CAS established a Committee for the Research Professor Degree as an auxiliary and advisory body for matters related to the granting of the scientific degree. The Science Council decides on granting of scientific degrees solely on the basis of proposals by the Committee for the Research Professor Degree and the results of scientific degree award proceedings.

At its 11th session on 10 April 2003, the Science Council of the CAS approved a sectoral structure for commissions for the defences. There are currently 32 permanent commissions for disciplines in Research areas I., II. and III. A total of 388 members have been appointed to commissions for the defences, of which 168 are from CAS Institutes, 185 from universities and 35 from other institutions.

In 2019, the Science Council granted the scientific degree to the following researchers:

MSc. Marcelo F. Ciappina, Ph.D., Res. Prof.
Institute of Physics

Dissertation: *Attosecond Physics at the Nanoscale: The Next Frontier*
Commission: Physics of Condensed Matter Systems
Degree granted: Research Professor in Physico-Mathematical Sciences

RNDr. Tomáš Masopust, Ph.D., DSc.
Institute of Mathematics

Dissertation: *Complexity of Verification and Control of Modular Discrete Event Systems*
Commission: Informatics and Cybernetics
Degree granted: Research Professor in Physico-Mathematical Sciences

doc. RNDr. Jaroslav Turánek, CSc., DSc.
Veterinary Research Institute

Dissertation: *Lipid-based nanoparticles for construction of drug delivery systems, vaccines and theranostics*
Commission: Molecular Biology and Genetics
Degree granted: Research Professor in Molecular-Biological and Medical Sciences

Patrick Martin Lyons, B.A., M.A., Ph.D., DSc.
Institute of Sociology

Dissertation: *Political Knowledge in the Czech Republic*
Commission: Sociology
Degree granted: Research Professor in Social and Human Sciences

The ceremony granting Research Professor scientific degrees took place on 19 September 2019 in the hall of the CAS Main Library, Národní 3, Prague

PhDr. Zuzana Parusniková, CSc., DSc.
Institute of Philosophy

Dissertation: *Reason and Scepticism Hume and Popper*
Commission: Philosophy
Degree granted: Research Professor in Social and Human Sciences

doc. Ing. Jiří Němeček, Ph.D., DSc.
Faculty of Civil Engineering, CTU of Prague

Dissertation: *Nanoindentation-assisted characterization of heterogeneous structural materials*
Commission: Applied and Theoretical Mechanics
Degree granted: Research Professor in Technical Sciences

doc. RNDr. Eva Bártová, Ph.D., DSc.
Institute of Biophysics

Dissertation: *Structure of chromatine and epigenetic processes in the context of cell differentiation and DNA repair*
Commission: Botany, Experimental and Ecological Biology
Degree granted: Research Professor in Biological-Ecological Sciences

PhDr. Alena Hadravová, CSc., DSc.
Institute of Contemporary History

Dissertation: *Sphaera octava I–IV. Historical development of ideas about the sphere of fixed stars*
Commission: General and Czech History
Degree granted: Research Professor in Historical Sciences

The DSc. Degree: A Sign of Quality and Prestige

Annexes

The Annual Report of the Czech Academy of Sciences for the provision of information pursuant to Act No. 106/1999 Coll., on Free Access to Information, as amended, for the period from 1 January to 31 December 2019

a)	Number of submitted requests for information	12
	Number of decisions issued to reject a request	0
b)	Number of submitted appeals against a decision to reject a request	0
c)	Number of court judgments examining the legality of a decision to reject of a request	0
d)	Number of exclusive licences granted	0
e)	Number of complaints submitted pursuant to Section 16a of the Act	0

List of Abbreviations Used

CAS	Czech Academy of Sciences
CTU	Czech Technical University in Prague
ERC	European Research Council
EU	European Union
GA CR	Grant agency of the Czech Republic
R&D	Research and Development
R&D&I	Research, Experimental Development and Innovation
RDI Council	Research, Development and Innovation Council
TA CR	Technology Agency of the Czech Republic

2019 Annual Report on the Activities of the Czech Academy of Sciences

Published by the CAS Head Offce in cooperation with the Centre of Administration and Operations in 2020
Národní 1009/3, 110 00 Prague 1

Editors: Markéta Pravdová, Jana Cmarková, Viktor Černoch

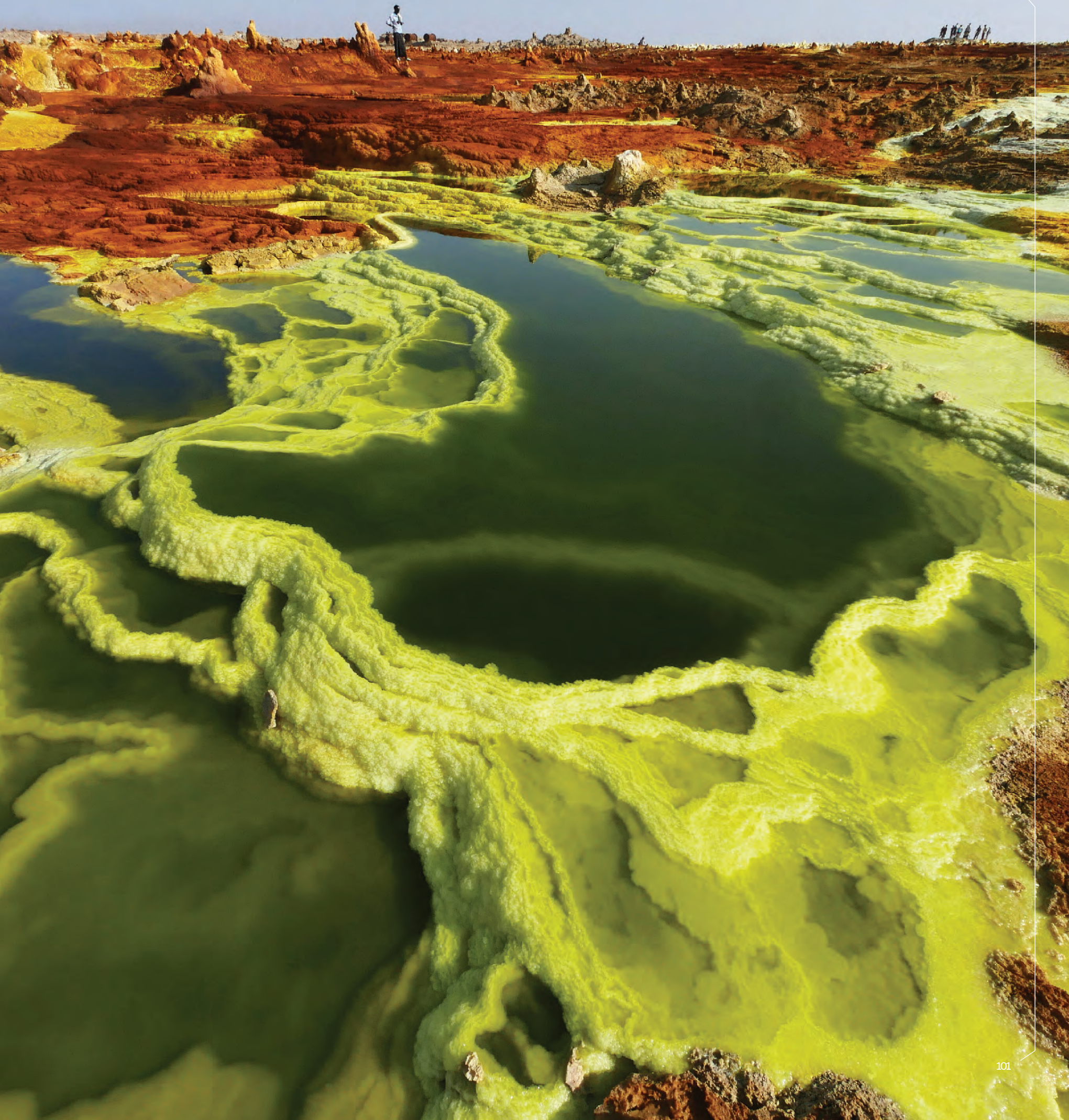
Editorial collaboration: Jana Olivová, Irena Vítková

Graphics: Josef Landergott

Printing: UNIPRESS, spol. s r. o

Translation: Helen Lenda

Photographs and illustrations: Jana Plavec / Czech Academy of Sciences, Pavlína Jáchimová / Czech Academy of Sciences, CAS Institutes and offices, Photogenic Science, Shutterstock, Profimedia, photo on pg. 66: Martin Stolař / MAFRA / Profimedia



Czech Academy of Sciences

The Czech Academy of Sciences (CAS) was established by Act No 283/1992 Coll.

The CAS carries out research through its institutes which are established as public research institutions. More than 11,000 employees work at the Academy, over 7,000 of whom are university-educated.

The primary mission of the CAS and its institutes is to conduct research in a broad spectrum of natural, technical and social sciences and the humanities. This research, whether highly specialised or interdisciplinary in nature, aims to advance the development of knowledge at an international level, while respecting the current needs of Czech society and respecting Czech culture.

The institutes of the CAS participate in education, primarily by educating young researchers through the implementation of doctoral study programmes, as well as through the pedagogical activities of their researchers at universities.

The CAS also develops cooperative ties with applied research and industry. A range of joint international projects and exchanges of researchers with partner institutions abroad reinforce the integration of Czech science into the international framework.

Czech Academy
of Sciences

Czech Academy of Sciences
Národní 3, 117 20 Prague 1

Phone: +420 221 403 111
E-mail: info@cas.cz
www.cas.cz