



2021
Annual Report
of the Czech Academy of Sciences



Top research in the public interest



Czech Academy
of Sciences



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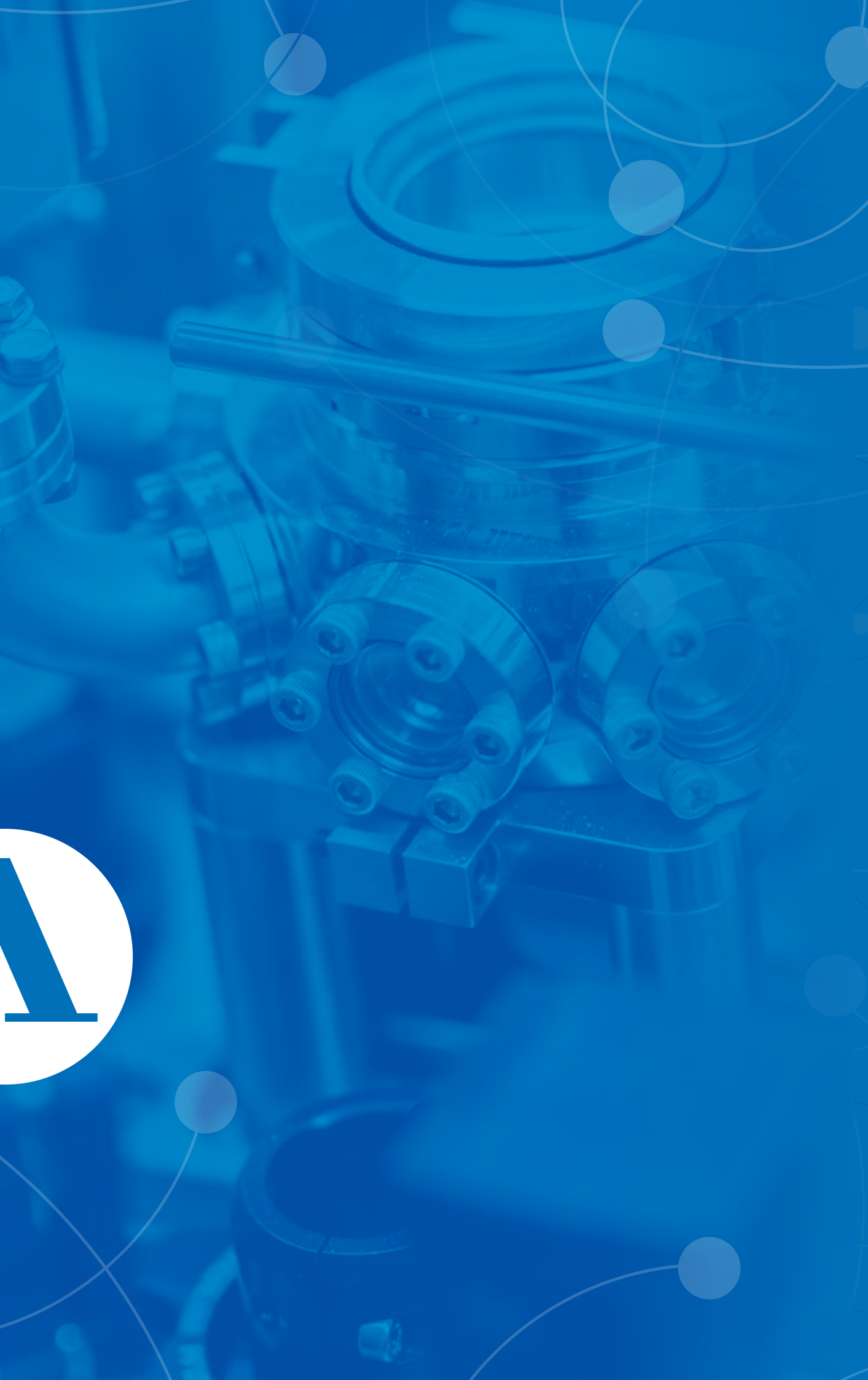
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A professional portrait of a woman with short, dark, wavy hair, wearing glasses and a dark blazer. She is standing with her arms crossed, looking slightly to the right of the camera with a gentle smile. The background is a textured, brown wall. On the right side, a portion of a blue patterned carpet and a red spherical object on a stand are visible.

Interview

with the President
of the Czech Academy of Sciences

2021 was marked by the covid-19 pandemic, just like the year before it. How do you feel the Czech Academy of Sciences (CAS) fared during this time?

I am very pleased that we - in collaboration with universities and other institutions - were able to respond promptly to the outbreak of the covid-19 pandemic right as it began. Later, when it became clear that we would face subsequent pandemic waves, our institutes actively developed new testing methods, tested new materials for the production of protective gear to prevent the spread of viruses, took part in production of protective face masks, helped with testing for the presence of coronavirus in the Prague public transport system and with economic analyses, and developed psychological, ethical and legal recommendations related to provision of health care during the pandemic. Spontaneous activities organised by CAS science promotion specialists for children, parents and science fans were very well received during this period. All of these activities are posted on our website and social media under the hashtag #Veda_proti_covidu.

Was the scientific community able to explain issues pertaining to the covid-19 disease to the public in a comprehensible way?

I am pleased to report that many CAS scientists actively participated in public discussions about covid-19 and helped create and sustain a rational, cultivated discourse in Czech society. Their consistent explanatory and educational work and ability to comprehensibly formulate responses to complex questions about the covid-19 pandemic in the mass media helped politicians as well as society as a whole better understand the fight against this disease. However, the pandemic also brought to light the Czech Republic's lack of preparedness in terms of communication, particularly in relation to the large quantity of distorted reports, half-truths and misinformation about covid-19 that flooded public discourse.

Another major event in 2021 was the periodic evaluation of CAS institutes. How did that turn out, in your opinion?

The evaluation that we've just completed demonstrated that the Academy is, despite limited institutional funding, unequivocally the most productive scientific research institution in the Czech Republic and that it has a number of world-class research teams, which I did not find surprising. In fact,

I would say that it is our duty. On the other hand, of course I would like to see even more world-class teams at the CAS. One of the goals of the evaluation was to reflect the results into differentiated levels of institutional funding for all institutes. I believe it was successful primarily because the Academy is the only institution in the Czech Republic that undergoes a demanding evaluation process which delves all the way to the level of individual research teams, 360 of which were registered and evaluated. If the Academy is to continue to defend its reputation and position in the Czech and international scientific communities into the future, it must not compromise on scientific research quality. However, such quality depends considerably on securing financial stability for CAS institutes over a longer timeframe. We cannot allow situations such as the one we are witnessing right now, in which there is a risk that CAS institutes will have to spend increased funding based on evaluation results to cover energy costs. In this regard I intend to make an even stronger appeal to relevant government officials and legislators in cooperation with the CAS' major partners.

The CAS continues to be the Czech Republic's highest-performing scientific institution. Which CAS institute research results do you find truly gratifying?

We have achieved a number of significant research results across our different scientific areas; current results are regularly posted on our website. Out of all of the results I would like to mention at least one example that has application potential in the fight against the covid-19 pandemic, which made me very happy. Scientists from the Institute of Biotechnology and the Institute of Organic Chemistry and Biochemistry recently succeeded in developing a new precision protective covid-19 antibody test and sign a licensing agreement with the American company Immunotech which will make it possible to market this new test kit in the near future. This new type of test can quickly determine the level of protective covid-19 antibodies and distinguish them from other antibodies that do not provide direct protection. It will make time-consuming and costly antibody testing far simpler, more precise and more affordable.

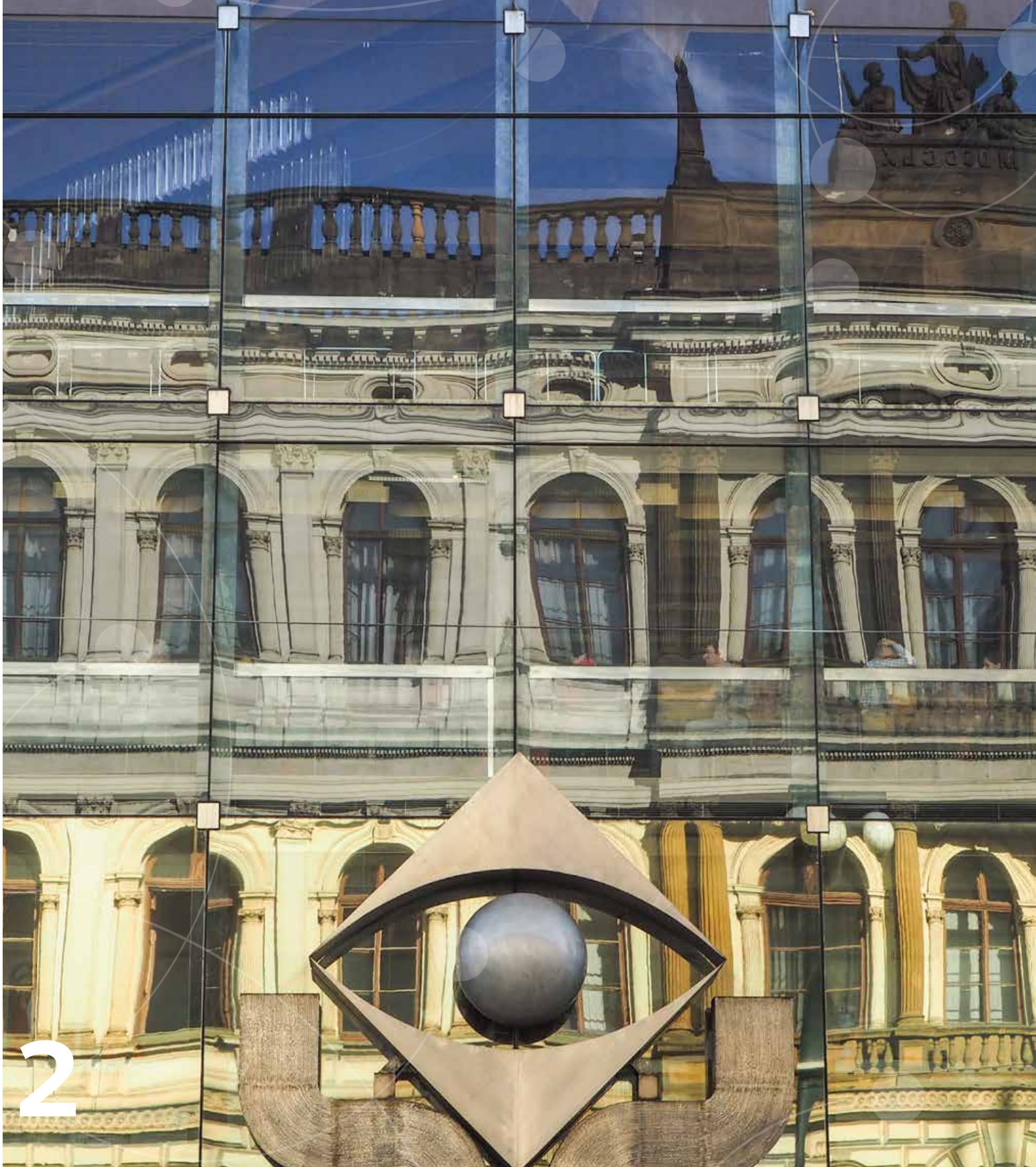
Of course I would be even happier if a Czech company was behind the marketing of this product. In any case, I congratulate the team on its achievement.

You began your second four-year term as President of the CAS in 2021. What expectations did you bring to this term of office and what do you expect the Czech Academy of Sciences to achieve under your leadership?

In my policy statement, I stated that my main goal, along with raising the level of CAS research quality even further and strengthening the CAS' role in society, is to decrease CAS institutes' overdependence on targeted funding and increase institutional funding from the CAS section of the state budget. In this regard, I consider the adoption of two memoranda on the financial stabilisation of science and research in the Czech Republic, concluded with the government of Prime Minister Bohuslav Sobotka, and subsequently with the government of Andrej Babiš, as quite significant. In these memoranda, we committed to effective fulfilment of the objectives of the National Research, Development and Innovation Policy of the Czech Republic and implementation of the Innovation Strategy of the Czech Republic, while the government committed to an annual five percent, or at least four percent, increase in institutional funding. I firmly believe that the government of Petr Fiala will respect this commitment and resolve to project it in the mid-term outlook of the state budget for science and research. And I will do my utmost to renew this commitment - both in regard to steadily increasing inflation and primarily to steeply rising energy costs. Specifically, in four or five years I would like to see the CAS as an institution which gives scientists space to develop their own conceptual work without unnecessary bureaucratic demands or dependence on grant calls, and as an institution that connects science with a high-quality education system and a respectable business environment that realises how important science and research are for the future of our country.



Prof. RNDr. Eva Zažímalová, CSc.
President of the Czech Academy of Sciences



2



Mission and Structure

of the Czech Academy of Sciences

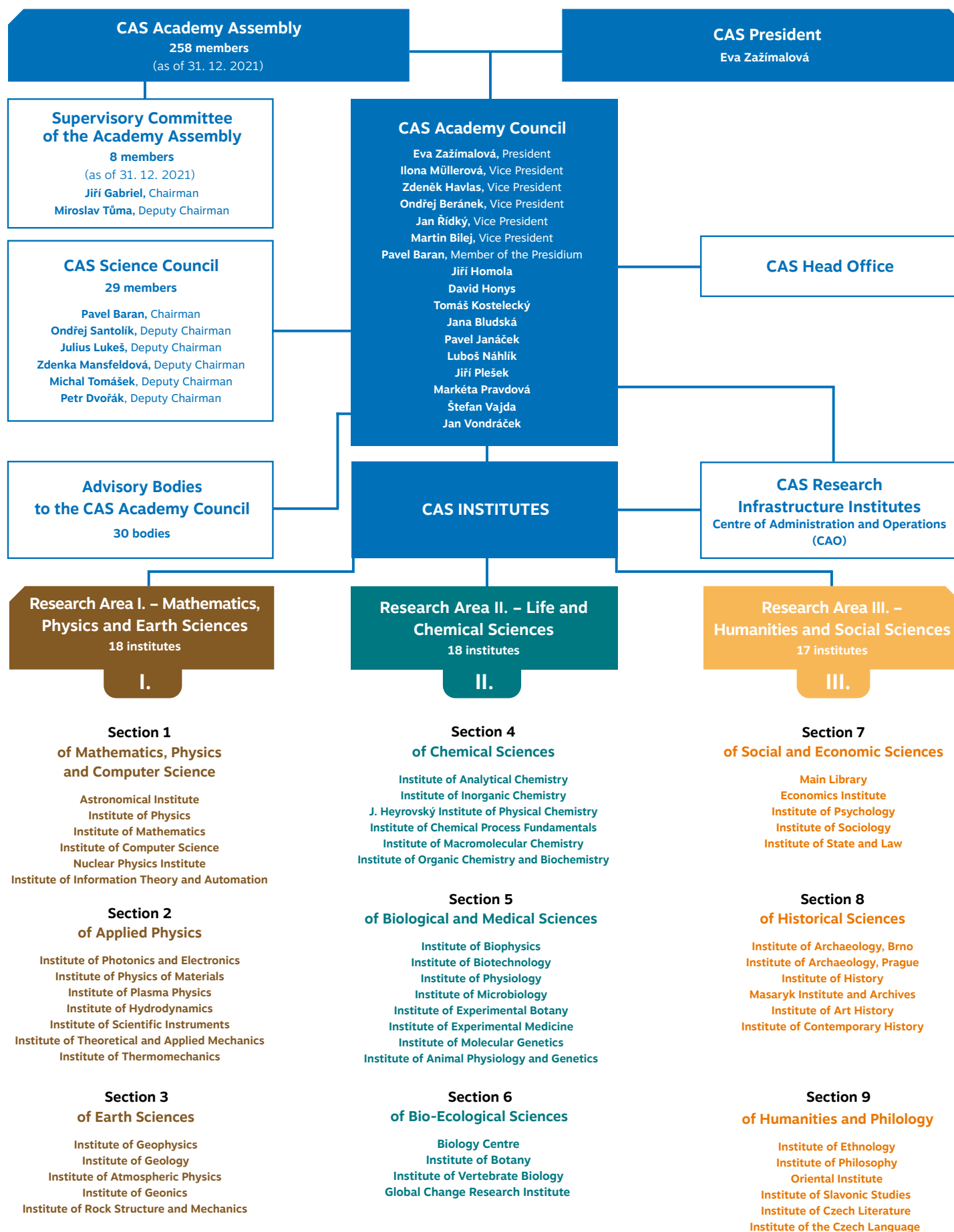
The Czech Academy of Sciences (CAS) was established by Act No. 283/1992 Coll. The CAS conducts research through its institutes which are established as public research institutions. More than 11,000 employees work at the Academy, over 7,000 of whom are university-educated.

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 at an international level while respecting the current needs of Czech society and culture.

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

The CAS also develops cooperation 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 structure of the CAS is illustrated on the following page.







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Czech Academy of Sciences

System of Research, Development and Innovation

The Czech Academy of Sciences (CAS) is part of a Czech tradition of scientific institutions that dates back almost 300 years which began with the founding of the first enlightenment society, Societas incognitorum, in Olomouc (1746), continued with the Prague-based Private Society of Sciences (1769),

which was the basis for the Royal Czech Society of Sciences (1784), and led finally to the founding of the Emperor Franz Josef Czech Academy for Science, Literature and Art (1890–1952), the direct predecessor of the contemporary CAS.



Although the CAS grappled with the covid-19 pandemic in 2021 like all of Czech society, it continued to pursue intensive research, educational, popularisation and cultural activities in the spirit of the cultural heritage of its predecessors and in line with its long-term development concept. Attention naturally focused on strengthening partnerships with universities and further development of collaborative ties with the business sector and state administration and public institutions. In this regard, the CAS fully utilises the potential of the Strategy AV21 platform, whose goals include coordination of research efforts by CAS institutes to address socially relevant problems and challenges. Based on Strategy AV21, the CAS initiated close collaboration with a number of academic, business and state administration entities. Strategy AV21 research programmes also became more closely linked to existing national strategies, above all the *Innovation Strategy of the Czech Republic 2019–2030*, *National RIS3 Strategy*, *National Research, Development and Innovation Policy of the Czech Republic 2021+ (R&D&I 2021+)* and *National Economic Strategy of the Czech Republic*.

Aside from top research and reflection of societal challenges, another fundamental part of the CAS mission is knowledge and technology transfer (KTT) to economic and societal practice. In order to systematically integrate KTT into CAS institutes, the Academy Council of the CAS approved a white paper on a KTT strategy for the CAS

based on an analysis of the current state of KTT at CAS institutes. The main objective of this strategy is to streamline implementation and commercialisation of research results, particularly in the Czech Republic, and thus support disciplines with a high added value of knowledge and highly qualified human resources for the economy. This initiative also aims to support KTT projects, even in the social sciences and humanities, identify and protect intellectual property and qualitative development of the Technology Transfer Office of the CAS, whose main task is to coordinate and support KTT at CAS institutes.

Undoubtedly one of the most significant events of 2021 for the CAS was the finalisation of the eighth round of the international evaluation of institutes and teams for the period 2015–2019. The international character of research and the CAS' efforts to conduct research at a world-class level was projected into the regular evaluation of CAS institutes, in which foreign experts play an extensive role and which utilises criteria commonly applied in countries with advanced science and research systems. Evaluation of all 54 CAS institutes for the 2015–2019 period took place during

the difficult period impacted by the covid-19 pandemic.

The evaluation results were projected into differentiated levels of institutional support for CAS institutes and also used as a basis for evaluation of CAS institutes according to the national Methodology 2017+. Both evaluations confirmed the CAS' position as a highly productive component of the national research, development and innovation system (R&D&I) with a broad base of research teams capable of conducting cutting-edge research on European and global levels that benefits Czech society in many valuable ways. The CAS' research efficacy is also demonstrated by the fact that the CAS maintained its position as the highest-performing Czech scientific research institution in the prestigious Nature Index ranking.



In 2021, the CAS and its representatives played active roles in the implementation of a number of conceptual R&D&I documents which are of fundamental importance to the advancement of Czech research and development, namely the:

- **National Renewal Plan in the context of the National Economic Strategy of the Czech Republic**
- **National Research, Development and Innovation Policy of the Czech Republic 2021+ (R&D&I 2021+)**
- **Innovation Strategy of the Czech Republic 2019–2030**
- **National RIS3 Strategy**
- **National Methodology M17+**
- **Major amendment to the Act on Support of Research and Development from Public Funds**
- **Development of the Czech state budget for 2022–2024**
- **Implementation of Memoranda regarding support of research, development and innovation in the Czech Republic**

National Renewal Plan in the context of the Economic Strategy of the Czech Republic

The CAS is actively engaged in the implementation of the *National Renewal Plan* (NRP), which is part of the *National Economic Strategy of the Czech Republic* under component 5.1 *Excellent research and development in priority public interest areas in health care*, which is overseen by the Ministry of Education, Youth and Sports. Total estimated expenditures for this component equal CZK 5,000 million. Investments into the scientific system in health care research priority areas aim to intro-

duce systemic change through the establishment of research consortia, which will focus primarily on research in infectious diseases, neuroscience, oncological diseases, cardiovascular diseases and metabolic disorders, including research into the socio-economic impacts of health risks. The main objective of the NRP is to help EU countries recover from the impacts of the covid-19 pandemic and support investment into the environmental and digital transformation of the European economy. In 2021, CAS representatives took part in the NRP commenting process and in preparation of methodological conditions for applicants and recipients of NRP projects in collaboration with the owners of the component.

National Research, Development and Innovation Policy of the Czech Republic 2021+ (R&D&I 2021+)

The National R&D&I 2021+ Policy is the overarching strategic national R&D&I document, which plays an important role in the development of the state R&D&I budget. It also contributes to fulfilment of some criteria related to the possibility of drawing on European Union funds during the 2021-2027 period. It also serves as the strategic framework for development of all components of the R&D&I system in the Czech Republic. CAS representatives actively participated in the preparation of this important document, paying special attention to changes resulting from major societal challenges as well as new technological trends, particularly through measure No. 27 which aims to redefine research priorities to increase the Czech Republic's resilience to global threats. Current issues include e.g. climate change, ecological sustainability, energy, health care, quality of life, food security, the aging population, digitalisation and robotisation. The CAS has actively engaged in implementation of all relevant parts of the *National R&D&I 2021+ Policy* since the beginning of 2021. It pays special attention to societal challenges through Strategy AV21 platforms focused on supporting interdisciplinary and interinstitutional research on socially relevant themes.

Innovation Strategy of the Czech Republic 2019–2030

The most prosperous countries today include those which have decided to support science, research and innovation as key national priorities. The CAS played an active role in the preparation, overall development and implementation of the *Innovation Strategy of the Czech Republic*, which contains the key goals and framework tools for anchoring science and research as key parts of the economic and public policy transformation in the Czech Republic. Particular attention was paid to implementation of *Innovation Strategy Action Plans*. The task of reducing the administrative burden associated with science and research is an important part of the document; the corresponding working group is led by Pavel Baran, who is both the Research, Development and Innovation Council (R&D&I Council) Vice-Chairman and CAS Science Council President. The *Innovation Strategy of the Czech Republic* is an ambitious document that follows on the *National R&D&I Policy* and *National RIS3 Strategy* and focuses on presenting the Czech Republic as a country that aims to become a leading innovator over the next decade. The fulfilment of objectives from the *National R&D&I Policy* and *Innovation Strategy of the Czech Republic* is also supported by essential documents concerning the financial stabilisation of science and research in the Czech Republic, and the Czech government's commitment to systematically increase institutional support for long-term conceptual development of research organisations by at least four percent per year.

National RIS3 Strategy

The National Research and Innovation Strategy for Smart Specialisation of the Czech Republic 2021–2027 (National RIS3 Strategy) is a National R&D&I Policy implementation tool for application-oriented research in the Czech Republic. It focuses mainly on support of promising sectors and their transformation in relation to activities with a higher added value, through e.g. greater emphasis on support for digitalisation, nanotechnologies, biotechnology, photonics, artificial intelligence, advanced materials, etc. It is also an essential prerequisite for EU cohesion policy R&D&I interventions. This strategy incorporates the conclusions of the

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The financial stability of the scientific research environment is one of the main prerequisites for the successful development of CAS institutes and other research organisations operating in the R&D&I system. The long-term goal is to increase direct institutional support to key actors in Czech science and research - the Czech Academy of Sciences and universities - up to 70% of their total budgets.

previous programming period of 2014–2020 as well as new European Union-level strategic documents. CAS representatives take part in preparation of the document through the *RIS3 Steering Committee* and specific working groups, as well as through *National Innovation Platforms*. After several commenting rounds, the *National RIS3 Strategy* was submitted to the R&D&I Council for discussion and subsequently the Czech government submitted it to the European Commission for approval. A total funding allocation of CZK 4.7 billion was approved for RIS3 priorities in the Czech Republic in 2021-2027.

National Methodology 2017+

2021 marked the fourth year of implementation of *Methodology 2017+* on the national level, including evaluation of selected high-quality research results through peer review process using remote evaluators (Module 1 – Quality of selected results) and Module 2 – Research performance). All modules were used for evaluation in 2021 (i.e. including Module 3 – Social relevance, Module 4 – Viability and Module 5 – Strategy and Policies), in specific fields for all research organisations. In this context it is useful to remember that *Methodology 2017+* includes evaluation for the purposes of management and funding of the entire R&D&I system as well as assessment on the specific provider level and for research organisation management needs. Although *Methodology 2017+* is thus primarily focused on the national level, it also defines methodological collaboration among providers, including the CAS, where in-

ternal evaluation that delves all the way to the individual research team level serves the specific management needs of its institutes. To connect the internal evaluation of CAS institutes with the national *Methodology 2017+* evaluation, a dedicated CAS Committee was established which prepared materials for evaluation of all CAS institutes according to this methodology and submitted them to the Office of the Government of the Czech Republic. In December 2021, a tripartite meeting about the *Methodology 2017+* evaluation results was held. It was attended by CAS representatives, relevant members of the R&D&I Council and representatives of expert panels and resulted in an indicative rating of research organisations according to the procedure prescribed by *Methodology 2017+*. The evaluation confirmed the CAS' position as a high-performing component of the national R&D&I system.

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

The major amendment to Act No. 130/2002 Coll., on Support of Research and Development from Public Funds, is of key significance to the R&D&I system. It contains a number of fundamental changes (i.e. it introduces a new type of support called system funding and new tools to reduce the administrative workload and anchors grant project portability, etc.). A draft of the bill was presented for discussion to the Chamber of Deputies of the Parliament of the Czech Republic on

28 December 2020 as Chamber Bill No. 1118/O. On 7 January 2021, the organisational committee discussed the draft bill and appointed a relevant rapporteur and proposed the *Committee for Science, Education, Culture, Youth and Sports* as guarantor. However, the guarantor committee did not discuss the draft bill; the discussion was closed with the end of the parliamentary term, which means that the bill was not approved.

Development of the Czech state budget for 2022–2024

At its 368th session on 28 May 2021, the R&D&I Council approved draft R&D&I funding from the state budget of the Czech Republic for 2022 with an outlook to 2023 and 2024. A total of CZK 7,002 million was proposed for the CAS for 2022 and CZK 7,213 million for 2023 and CZK 7,433 million for 2024. These figures include CZK 210 million for financing of ELI Beamlines and CZK 10 million for ERC.CZ programme project support.

Subsequently the Ministry of Finance of the Czech Republic submitted a preliminary draft schedule of income and expenditures for the sections of the state budget of the Czech Republic for 2022–2024. In this draft, CZK 6,427 million was listed for the CAS category of the state budget for 2022 and CZK 210,000 for expenditures covered by EU



In 2021, there were two regular sessions of the CAS' highest body - Academy Assembly.

budget allocations, and in the mid-term outlook CZK 6,427 million for 2022 and CZK 6,427 million for 2023. The CAS took note of the submitted state budget funding proposal for 2022-2024, but objected in regard to the persisting underfinancing of the CAS. In a letter dated 28 July 2021, ref. No. AVCR-5140/2021 SČAR, the CAS requested an increase in funding for the CAS state budget category to CZK 7,002 million for 2022, CZK 7,269 million for 2023 and CZK 7,547 million for 2024 in connection to the *Memorandum on support of research, development and innovation in the Czech Republic* dated 19 December 2019.

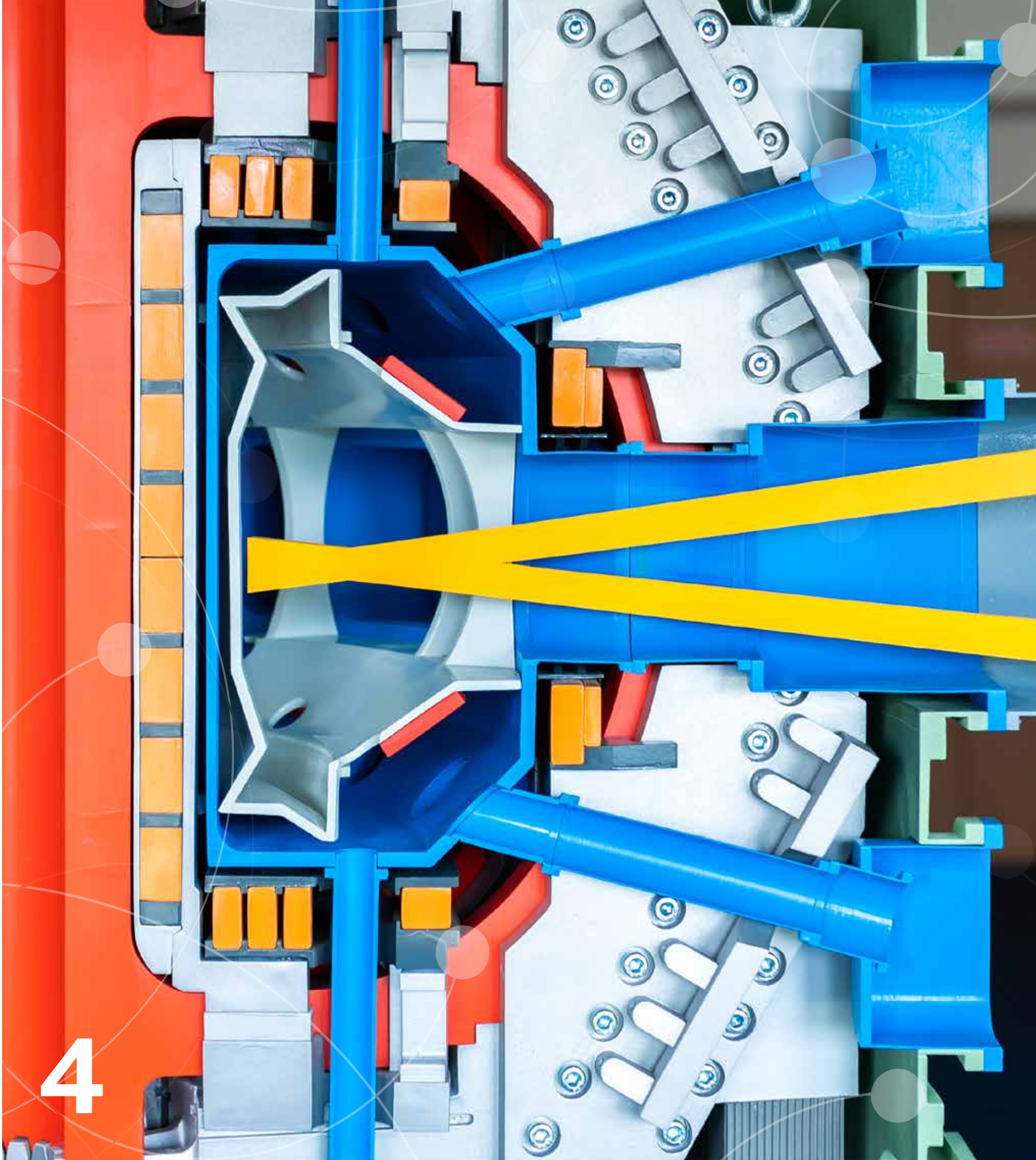
After complicated budgetary negotiations, the Czech government adopted Resolution No. 835 on 27 September 2021, which listed state budget funding of CZK 7,002 million for the CAS for 2022 and CZK 7,002 million in the mid-term outlook for 2023 and for 2024. Subsequently, after cancelling Resolution No. 835 of 27 September 2021, the government of the Czech Republic ap-

proved through its Resolution No. 911 of 20 October 2021 expenditures in the same amount, i.e. CZK 7,002 million for 2022 and CZK 7,002 million in the mid-term outlook for 2023 and for 2024, which corresponds to the original R&D&I Council proposal. The current draft 2022 CAS budget is thus based on this government draft bill on the 2022 state budget of the Czech Republic. The new government of the Czech Republic decided to submit its own bill on the state budget of the Czech Republic for 2022-2024 with the Czech Republic operating on a provisional budget for the first few months of 2022.

Implementation of Memorandum on support of research, development and innovation in the Czech Republic

The financial stability of the scientific research environment is one of the main prerequisites for the successful development of CAS institutes and other research organisations operating in the

R&D&I system. An adequate level of basic institutional funding will enable CAS institutes to concentrate on conceptual scientific and educational work and effective performance of their primary functions. To this end, the CAS participated in elaboration of the *Memorandum on support of research, development and innovation in the Czech Republic*, in which it made a commitment to effective fulfilment of the objectives of the *Innovation Strategy of the Czech Republic*, while the government committed to an increase in institutional funding for long-term conceptual development of research organisations of at least four percent per year. The long-term goal is to increase direct institutional support to key actors in Czech science and research - the Czech Academy of Sciences and universities - up to 70% of their total budgets. For these reasons, this document should be annually applied during the process of developing the state budget for R&D&I, during which the CAS will strive to ensure that it is updated, including in regard to steadily rising inflation.



4



Organisational Measures

2021 was an important year for the Czech Academy of Sciences, as the four-year term of office for the three highest bodies of the CAS ended in March 2021 (2017-2021) and new members had to be appointed for the 2021-2025 term.

CAS President Prof. Eva Zažímalová's first four-year term of office concluded on 24 March 2021. The assembly of CAS institute researchers once again nominated Prof. Zažímalová as the sole candidate for the office of CAS President for a second term. At its LVI. Session on 7 December 2020, the Academy Assembly confirmed her candidacy through a secret ballot vote and on 10 March 2021 Miloš Zeman, President of the Czech Republic, appointed

Prof. Zažímalová as the CAS President for a second term of 2021-2025 effective 25 March 2021.

At the LVII. Session of the CAS Academy Assembly on 23 March 2021, secret ballot voting was held to elect members to two other important CAS bodies, namely the CAS Academy Council and the CAS Science Council, for the 2021-2025 term.

The second phase of the evaluation of research and professional activities of CAS institutes for the 2015-2019 period took place in 2021. Although this phase had been originally planned for 2020, it had to be postponed to 2021 due to the adverse epidemic situation.



The LVIII. Session of the Academy Assembly on 8 December 2021.

In 2021, there were two regular sessions of the Academy Assembly, the CAS' highest body.

The LVII. Session of the Academy Assembly was the fifth session in the 2018-2022 term. Due to the extraordinary measures in the Czech Republic adopted due to the long-term adverse epidemic situation caused by the SARS-CoV-2 coronavirus, this session took place remotely. It was the second remote session in CAS history. It was held on 23 March 2021 and 236 members of the Assembly (91%) took part. The meeting agenda included secret ballot voting to elect members to the CAS Academy Council and CAS Science Council for the 2021-2025 term. For the second time in CAS history, the election took place through an electronic voting application. A total of 15 Academy Council members were elected along with 29 Science Council members, including 20 internal and 9 external members. The Academy Assembly approved all of the submitted documents without comments. The LVII. Session's resolution also included a resolution adopted by the Academy Assembly in per rollam voting No. 3, which took place on 2-5 March 2021 as part of preparations for the LVII. Session of the Academy Assembly. In this resolution, due to the resignation of one member of the Academy Assembly's mandate committee, the Academy Assembly allowed a new member to take the open seat for the rest of the 2018-2022 term and approved the working group for the LVII. Session of the Academy Assembly and voting procedures for secret ballot voting at the LVII. Session of the Academy As-

sembly to elect members of the Academy Council and Science Council for the 2021-2025 term.

The LVIII. Session of the Academy Assembly was the sixth session in the 2018-2022 term. It took place remotely on 8 December 2021 with the participation of 221 members of the Academy Assembly (86%). The Academy Assembly approved all of the documents according to the approved session agenda, including the 2021 CAS financial report, a draft budget for 2022 and report on evaluation of CAS institutes' research and professional activities during 2015-2019.

At its LVIII. Session, the Academy Assembly also expressed its objection to the proposed stagnation in expenditures in the CAS category of the state budget in the mid-term outlook for 2023-2024, asked the incoming government of the Czech Republic to respect the *Memorandum on support of research, development and innovation in the Czech Republic* of 19 December 2019 and the R&D&I Council proposal of 28 May 2021 supporting gradual increasing of the institutional funding component as given by this Memorandum during the government's preparation of the state budget for research, experimental development and innovation for 2022 and subsequent years. The Academy Assembly expressed full support to CAS President Prof. Zažímalová in negotiations with the prime minister of the incoming government and its relevant members about fundamental issues of Czech science policy.

On 24 March 2021 the first four-year term of CAS President Prof. Zažímalová ended. The assembly of CAS institutes' researchers once again nominated Prof. Zažímalová as the sole candidate for the office of CAS President for a second term and at its LVI. Session on 7 December 2020, the Academy Assembly confirmed her candidacy in secret ballot voting.

Since the session was held remotely, for the first time in the history of the Academy Assembly this election was held through an electronic voting application. Through Resolution No. 94 of the Government of the Czech Republic of 1 February 2021, the Government of the Czech Republic took note of the Academy Assembly's proposal and entrusted the prime minister of the Government of the Czech Republic to submit a proposal to appoint Prof. Zažímalová as the CAS President for a second term of office. On 10 March 2021 Miloš Zeman, President of the Czech Republic, appointed Prof. Zažímalová as the CAS President for a second term of 2021-2025 effective 25 March 2021.

24 March 2021 also marked the conclusion of the four-year terms of Academy Council and Science Council members elected for the 2017-2021 period. On 25 March 2021 the four-year terms of Academy Council and Science Council members elected at the LVII. Session of the Academy Assembly on 23 March 2021 began. At the first session of the Science Council on 31 March 2021, the Science Council approved the Science Council Procedural Rules and elected Dr. Pavel Baran as the President

” Similarly to 2020, events planned by the CAS for 2021 were significantly impacted by the long-term adverse epidemic situation caused by covid-19.

of the Science Council and five Vice Presidents of the Science Council for the 2021-2025 term. At the first session of the Academy Council on 6 April 2021, its new members approved the Procedural Rules of the Academy Council and its Presidium for the 2021-2025 term, elected CAS Vice Presidents and members of the Academy Council Presidium for the 2021-2025 term and approved the general division of specific agendas and competences. At subsequent sessions of the Academy Council, the member and administrative composition of specific advisory bodies to the Academy Council was updated and statutes of Academy Council advisory bodies were approved for the new 2021-2025 term.

Aside from Academy Assembly meetings and election of new members to the highest CAS bodies for the new 2021-2025 term, other important activities took place at the CAS in 2021.

The President of the CAS appointed ten new CAS institute directors in 2021 based on selection processes and recommendations from the boards of the relevant institutes.

Due to expiring mandates or termination of employment, the Academy Council appointed new chairpersons and members to CAS institutes' supervisory boards in 2021 (a total of 12 chairpersons, 4 deputy chairpersons and 12 members). Based on evaluation of institutes' annual reports, the Academy Council discussed the Report on CAS institutes' supervisory board for the past period. In January 2021, an online working meeting with supervisory board chairpersons was held about current topics related to the work of the supervisory boards.

In 2021, Instruction No. 1/2021 of the CAS Academy Council was issued, which amended the Sample Election Code for Elections at CAS Institutes. In addition, Instruction No. 2/2021 of the CAS Academy Council on Annual Report on Activities and Financial Management of CAS Institute was issued to unify the content and procedure for compiling annual reports on the activities and financial management of CAS institutes.

The CAS Academy Council consistently emphasises the importance of R&D collaboration between various institutions on the national and international levels. In 2021, this concept was successfully implemented through initiation of collaborative efforts with additional key partners.

In terms of cooperation with the state sector, the CAS concluded a Joint declaration on creation of an Expert group for support of applicants in European Research Council (ERC) calls with Charles University, which aims to increase the number of Czech scientists applying for and succeeding in ERC grant calls. On 20 January 2021, a Memorandum on cooperation between the Ministry of Education, Youth and Sports, the CAS and the Institute of Physics was concluded about the Czech Republic's participation in the legal entity ELI ERIC. On 3 March 2021, Addendum No. 3 to the Declaration of cooperation between Czech Radio and the CAS was signed, thus extending cooperation with this institution until March 2022.

In 2021, the CAS Academy Council Guideline on Support of Regional Cooperation was updated, making it possible to apply for multi-year regional cooperation projects (for a maximum of 3 years) and changing some aspects of submission and discussion of reports on use of grants.

The CAS concluded almost 20 international agreements on cooperation in 2021 and extended the duration of several previous agreements. The CAS concluded an agreement with IOCB Tech, a subsidiary company of the Institute of Organic Chemistry and Biochemistry, which affirmed the initiation of cooperation between the CAS and the Massachusetts Institute of Technology (MIT). New agreements on cooperation were concluded with the French National Centre for Scientific Research (CNRS) and the Brazilian Academy of Sciences (ABC). 2021 also saw the continuing development of new international collaborative links that had been initiated in 2020 with organisations in Taiwan.

CAS Academy Council Guideline No. 6/2021 was issued in 2021 amending CAS Academy Council Guideline No. 2/2019 on Support of CEFRES Platform Research Activities. The Guideline enables changes to research teams (a CAS institute researcher may be the investigator and co-investigator, just like a CNRS researcher - chercheur).

On the basis of the Memorandum on support and cooperation between the CAS and the Chamber of Deputies of the Czech Parliament, CAS institutes published three new expert opinions on current socially relevant research issues ("AVexes").

The focal point of cooperation with universities in the Czech Republic moved from negotiations on agreements between the CAS and university rectors to faculties and specific CAS institutes, which jointly prepare documents for accreditation of study programmes and work together to educate doctoral students.

In terms of international cooperation with universities, in 2021 the CAS placed particular emphasis on expanding collaborative ties with European universities. On 17 September 2021, the CAS concluded an agreement on scientific collaboration in the humanities and social sciences between CAS institutes and the Leibniz Institute for the History and Culture of Eastern Europe (GWZO). The agreement was also affirmed by Minister of Culture Lubomír Zaorálek and Saxon State Minister for Science Sebastian Gemkow. The new platform called Leibniz GWZO Prague is intended to serve as an intermediary between German and Czech research, pedagogical and cultural institutions and as a point of connection for scientists. It will also focus on transferring scientific findings to the public through discussion meetings, exhibitions, publication of books, etc. Negotiations on possible cooperation with the Institut National des Sciences Appliquées (INSA Lyon) also took place and negotiations on cooperation with Leipzig University continued.

In 2021, the CAS held 30 calls for grant applications. In compliance with grant provision requirements pursuant to Act No. 218/2000 Coll., on Budgetary Rules, the Academy Council evaluated the submitted applications and awarded grants correspondingly. The CAS Academy Council continued to strive to simplify the laborious administrative aspects of the grant process. CAS Academy Council Guideline No. 5/2021 on Grants Provided by the Czech Academy of Sciences was issued to specify and clarify the grant provision process.

2021 also saw the adoption of amended Academy Council guidelines on unification of the procedure for submission and discussion of grant use reports, including on support for publication activities (No. 10/2021), which also included a change to the name of an Academy Council advisory body and deletion of the draft phase. An amendment to the Josef Dobrovský Fellowship (No. 11/2021) deleted the age limit of 35 years for researchers nominated to receive the JDF. An amendment to the Otto Wichterle Award (No. 12/2021) established a maximum grant amount per calendar year and recipient. Guidelines were issued on support for instrumentation (No. 13/2021), on support of CEFRES Platform research activities (No. 14/2021), on support of submitters of ERC projects (No.15/2021), which also set the grant amount per ERC project applicant per calendar year, on the Programme for Research and Mobility Support of Starting Researchers (No. 16/2021), on support for international cooperation at CAS research institutes (No. 17/2021) and the Programme to Support Prospective Human Resources – Postdoctoral Fellows (No. 18/2021).

The Academy Council continued its committed efforts to support and recognise excellent scientific results and researchers at CAS institutes. In 2021, an amendment was made to the Guideline on the Academic Premium – Praemium Academiae.

The Academy Council also continued to focus support on Strategy AV21 research programmes. CAS Academy Council Guideline No. 9/2021 on Strategy AV21 was issued with the aim of simplifying administration of Strategy AV21 research programmes, reflecting the experience and needs of Strategy AV21 research programme coordinators and the conclusions of Strategy AV21 board discussions, and aligning the Guideline with cur-

rent practice. In regard to the large quantity of proposed changes, a new Guideline was adopted in lieu of updating the existing one.

The Science Council, which is the Academy Council's elected body charged with conceptual work, provided support for matters relating to preparation and implementation of scientific policy.

The newly elected Science Council adopted a programmatic document for the 2021-2025 term, which accents excellence in scientific work, transparency in assessment and evaluation of scientific results, ethical aspects of research and support for the Strategy AV21 mission.

From the very start of its new term, the Science Council has also worked on other tasks outside of its regular agenda, such as granting of the “Research Professor” Degree, the concept for onboarding promising scientists at CAS institutes and support of academic excellence at the CAS. The Science Council also submitted a proposal outline to the Academy Council that will form the basis for amendments to the Guideline on the Lumina Quaeruntur Research Fellowship.

The Science Council Presidium also played a key role in preparation of a new Guideline on Strategy AV21, which came into effect in autumn 2021.

The Science Council's conceptual work in 2021 also included support to the continuing evaluation of research and professional activities of CAS institutes for the 2015-2019 period. Members of the Science Council also participated in the Coordination Board of the Evaluation and as members of evaluation commissions in the second phase of evaluation.

The Science Council also supported CAS efforts leading to the establishment of an independent Virology Centre sponsored by the Institute of Organic Chemistry and Biochemistry, which the Science Council believes has nation-wide significance.

The Rules for Granting the “Research Professor” Degree by the CAS were amended. The modifications pertained to simplification of the Science Council's voting mechanism for issues related to the scientific degree “Research Professor”; the entire process of changes to commissions for the

defences of dissertations is now managed by the Committee for the “Research Professor” Degree.

A key theme in 2021 was the continuing evaluation of research and professional activities of CAS institutes for the 2015-2019 period in compliance with the schedule and procedure set forth in the document *Methodology of evaluation of research and professional activities of the research institutes of the Czech Academy of Sciences for the period 2015–2019*, which was approved by the Academy Council in 2019. The Academy Council paid heightened attention to implementation of the second phase of the evaluation, which had been postponed from 2020 to 2021 due to the ongoing adverse global epidemic forecast.

In 2021, the purchase of economic-information systems (EIS) for CAS institutes was completed. The CAS management assisted institutes and provided methodological guidance during the preparation of EIS tenders as needed.

Since 1 January 2021, the CAS Head Office has used the new GINIS file service, which meets the requirements of the National Standards for File Service Electronic Systems.

Overall, more than 20 internal regulations were approved and issued by the CAS in 2021. In relation to the amendment of the Income Tax Act, CAS Academy Council Guideline No. 1/2021 was issued, which amends CAS Academy Council Guideline No. 2/2017 on the Procedure when Issuing Founder's Prior Consent and for Other Disposal of Assets. With this new Guideline, the limit above which separate movable items are considered tangible property was raised. In this context, CAS Academy Council Guideline No. 2/2021 was issued, amending CAS Academy Council Guideline No. 6/2018 on Support of Instrumentation, which changed, among other things, the determination of the price limit from which an instrument is considered expensive, and the modification of the minimum estimated prices quoted in proposals for acquisition of instruments for Research Area III. CAS institutes.

In 2021, CAS Academy Council Guideline No. 3/2021 on Control Activities Focused on Management of Public Funds at the CAS and its Institutes was issued. This Guideline comprehensively sets forth controlling at the CAS and its institutes, with

the exception of management controls and internal auditing at the CAS, which are set forth in other internal CAS regulations. This Guideline was amended again during 2021 to decrease the administrative workload by enabling CAS institutes to submit a summary report on regular public administration controls once a year, by 30 June, which corresponds with submission of annual reports.

In compliance with the Guideline on the Procedure when Issuing Founder's Prior Consent and for Other Disposal of Assets, the Academy Council issued in 2021 prior consents as defined by the law on public research institutions, which included, primarily, consents with purchase of scientific instruments and equipment for the purpose of main activity performance at institutes in Research Areas I. and II., including purchase of property for the ELI project and HiLASE Centre of Excellence. Additionally, several requests for consent with institute participation in legal entities and establishment of easements pertaining to construction of public infrastructure were also approved.

The acquisition of a training centre in Hojsova Stráž by the Institute of Organic Chemistry and Biochemistry (hereinafter the IOCB Prague) was approved, thereby meeting the long-standing request of leading scientists and organisations in this field, which the IOCB Prague management supported. Also approved was the transfer against remuneration of land parcel No. 804/11 in the Kunratice cadastral area from the CAS Centre of Administration and Operations to the IOCB Prague for the purposes of implementing three research units, namely the Antonín Holý Virology Centre, assuming approval of a change to the land use plan.

Real estate owned by the Institute of Geophysics but located on land parcels in Průhonice Park owned by the Institute of Botany was purchased with the aim of unifying the property ownership rights to the property, i.e. construction land parcels within the set of real estate and ownership of the real estate itself.

Construction was approved of an innovation centre for advanced manufacturing technologies under the PIK Operational Programme project "Brain 4 Industry – Innovation Centre" in the cadastral area of the municipality of Dolní Břežany, including purchase of a land parcel and building rights.

Also approved was the transfer of land parcel No. 4054/9 and part of land parcels No. 4054/13 and 4054/14, all in the cadastral area of Libeň in the city of Prague, from the CAS Centre of Administration and Operations to the Institute of Plasma Physics for the purpose of expanding the Tokamak facility.

Further meetings were held with representatives of the Office for Government Representation in Property Affairs and other concerned authorities in order to obtain the Washingtonova building for the needs of the Czech Language Institute.

The Academy Council approved the disposal of surplus immovable property and movable property of the Institute of Molecular Genetics acquired for implementation of the BIOCEV project after the end of the project's binding sustainability period.

In 2021, three addenda to CAS institute founding deeds were issued (Addendum No. 3 - Institute of Biophysics, Addendum No. 2 - Institute of Slavonic Studies and Addendum No. 4 - CAS Centre of Administration and Operations).

In regard to archaeological heritage preservation, the Czech Academy of Sciences concluded two archaeological research agreements in 2021 with organisations with authorisations pursuant to the state monument preservation law.

In 2021, the CAS management continued to support International Advisory Boards (IAB) at CAS institutes. In compliance with the Guideline on IAB support, in 2021 new IAB were established at additional CAS institutes, including the Institute of Archaeology, Prague, Institute of Geonics, Institute of Vertebrate Biology and Institute of Animal Physiology and Genetics. CAS Academy Council Guideline No. 8/2021 was issued amending CAS Academy Council Guideline No. 9/2018 on Support of International Advisory Boards, in relation to the Academy Council's decision to terminate support to CAS institutes for the work of International Advisory Boards through grant calls.

The Academy Council approved the *White paper on a long-term strategy for knowledge transfer in the CAS environment*. The approved document includes the restructuring of the CAS Technology Transfer Centre with the goal of increasing focus

on its own knowledge and technology transfer in addition to providing educational and support services.

In regard to inter-ministerial commenting proceedings, in 2021 the CAS assessed and took positions on 98 government documents submitted by ministries or other state bodies through the eKLEP Legislative Process Electronic Library. The CAS gave comments in 31 proceedings (32%), including essential and recommendation comments in 8 proceedings, essential comments in 12 proceedings and recommendation comments in 11 proceedings.

In 2021, in compliance with Act No. 106/1999 Coll., on Free Access to Information, the CAS received eight requests for information. The requests were processed in compliance with the law. In three cases, the full scope of the requested information was provided to the applicants. In one case, most of the request was fulfilled and the relevant requested information was provided to the applicant and a decision to reject part of the request was issued for the remainder of the request. One request was postponed because it did not contain all of the legally stipulated information and the applicant did not complete the application in the manner requested within the statutory time limit upon request from the obliged entity. For another request a decision was issued to reject provision of information because the obliged entity did not have the requested information and the obliged entity is not required to have the requested information according to applicable legal regulations. Two requests sent by the same applicant about the same matter were postponed with the justification that the obliged entity does not have the requested information because the matter is not within the authority of the obliged entity as an organisational unit of the state, and the obliged entity therefore does not have the requested information at its disposal and cannot provide it to the applicant. The applicant filed a complaint against the manner in which the request had been processed, but the supervisory body, the Office for Personal Data Protection, confirmed that the CAS had acted correctly in its processing of the request.

The President of the CAS bestowed patronage on eight science and research events in 2021.



5



Selected Results

All 54 research institutes of the CAS, which operate as public research institutions, contributed to the scientific results achieved in 2021. CAS institutes are grouped into three main research areas: the first area comprises physical sciences, the second area covers life and chemical sciences, and

the third area focuses on the humanities and social sciences. CAS scientific research led to many positive results in 2021; nine of the most fascinating outcomes from the three areas are featured on the following pages.

SELECTED SCIENTIFIC RESULTS FROM RESEARCH AREA I. INSTITUTES

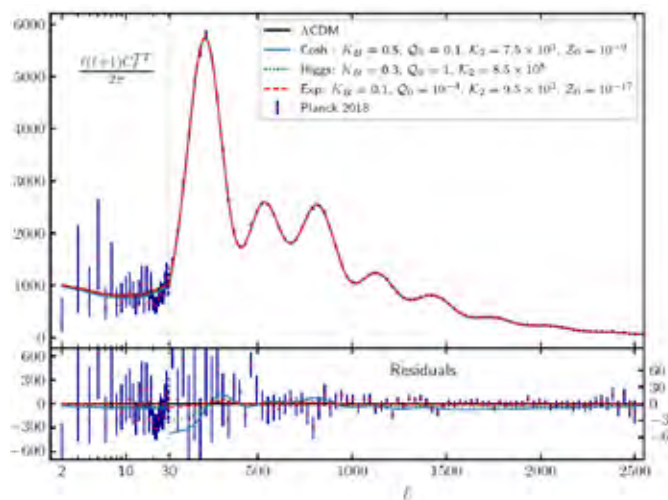
NEW RELATIVISTIC THEORY FOR MODIFIED NEWTONIAN DYNAMICS

Institute of Physics of the CAS

Modern physics is underpinned by two fundamental theories: general relativity and the standard model of particle physics. However, observations demonstrate that the gravitational forces acting on stars in galaxies and galaxy clusters are stronger than those produced by visible matter. The authors are the first to demonstrate that a simple extension to general relativity theory leads to alignment with data on galaxies and with observed cosmic microwave background thermal anisotropies without dark matter.

Bibliographic references:

C. Skordis, T. Złotnik, *New Relativistic Theory for Modified Newtonian Dynamics*, *Phys. Rev. Lett.* 127, 2021, 16, 161302.



The cosmic microwave background temperature anisotropies angular power spectrum

Upper panel: The cosmic microwave background temperature anisotropies angular power spectrum for the standard cosmological model (Λ CDM) and three variations of the new theory (other curves), which in both cases demonstrate unique agreement with the Planck data in both cases. The size of the solid angle in degrees corresponds roughly to the ratio $180/l$ and the first peak corresponds to the angle of 1° .

Lower panel: The model curve deviations from Planck satellite data with data error bars.

ORBITALLY-DRIVEN CHANGES IN GREENHOUSE CLIMATE IN THE EARTH'S PAST

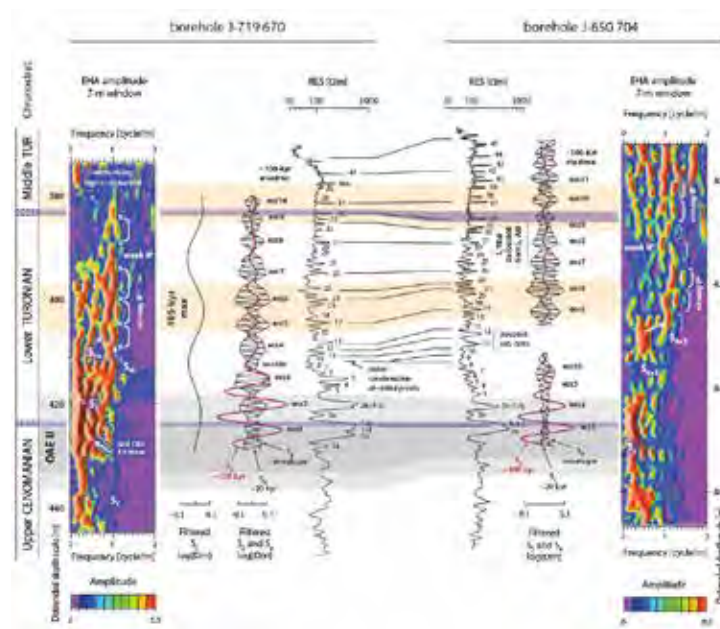
Institute of Geophysics of the CAS

Studying the effects of climate changes during the Earth's past greenhouse periods aids our understanding of greenhouse climate dynamics for more precise estimation of possible future climatic evolution scenarios. Records of climatic orbital cycles on the scale of 10,000 to 100,000 years have been identified in sedimentary strata in Bohemia and Canada dating back 94-89 million years. These cycles affected the global carbon cycle, global sea level and rates of surface erosion.

Bibliographic references:

J. Laurin, D. Uličný, S. Čech, J. Trubač, J. Zachariáš, A. Svobodová, *Chronology and eccentricity phasing for the Early Turonian greenhouse (~93-94 Ma): constraints on astronomical control of the carbon cycle*. *Paleoceanography and Paleoclimatology*. 2021, 36(4), e2020PA004188. ISSN 2572-4517. E-ISSN 2572-4525.

A. G. Plint, D. Uličný, S. Čech, I. Walaszczyk, D. R. Gröcke, J. Laurin, J. A. Shank, I. Jarvis, *Trans-Atlantic correlation of Upper Cretaceous high-frequency sea-level cycles*. *Earth and Planetary Science Letters*. 2022, 578, 117323.



Record of orbital cyclicity

An example of the interpretation of orbital cyclicity in two boreholes in the western part of the Bohemian Cretaceous Basin. The analysis is based on changes in the composition of sedimentary strata, as shown in borehole geophysical data (RES = resistivity log). The cycles, interpreted using spectral analysis, correspond to two periods of the Earth's orbital eccentricity (Ecc in the figure), roughly 100,000 and 405,000 years, that modulate the effects of the Earth's axial precession with an average period of ca. 20,000 years.

HOLOGRAPHIC ENDOSCOPE IMAGING OF MACROSCOPIC OBJECTS

Institute of Scientific Instruments of the CAS

The holographic endoscope enables effective three-dimensional imaging of macroscopic objects. The diameter of the instrument is comparable to the thickness of a strand of hair and is capable of imaging objects even from a distance of several metres.

In the past, holoscopic endoscopes were used only to image micro-objects near the output. In 2021, in collaboration with several prestigious institutions, a series of studies was presented that described exceptional refinement of the possibilities of light transport by multimode optical fibres. This made it possible to image macroscopic objects at large distances from the instrument. With the

involvement of precise photon time-of-flight measurement, this hair-thin instrument is now capable of three-dimensional imaging.

Bibliographic references:

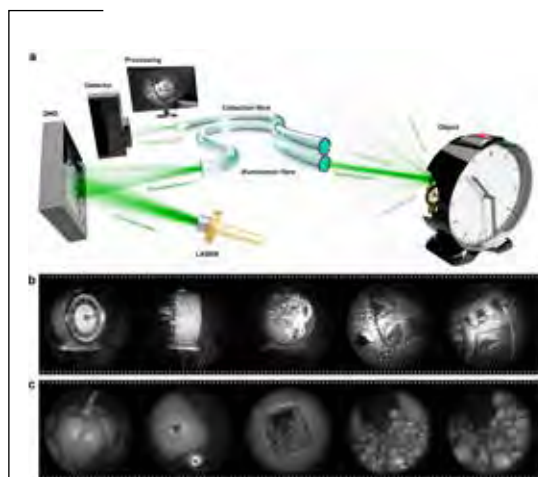
S. Li, S. A. R. Horsley, T. Tyc, T. Čížmár, D. B. Phillips, *Memory effect assisted imaging through multimode optical fibres*. *Nature Communications*. 2021, 12(1), 3751. ISSN 2041-1723. E-ISSN 2041-1723.

S. Li, C. Saunders, D. J. Lum, J. Murray-Bruce, V. K. Goyal, T. Čížmár, D. B. Phillips, *Compressively sampling the optical transmission matrix of a multimode fib-*

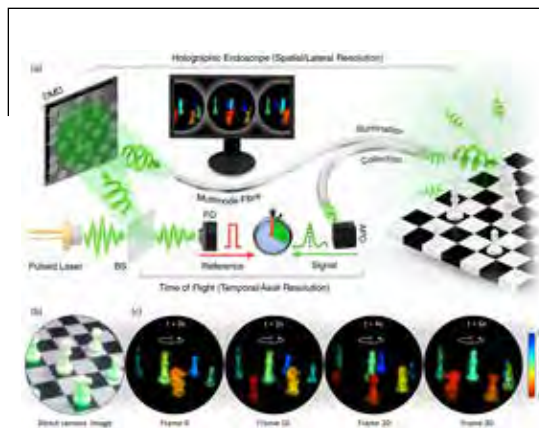
re. Light-Science & Applications. 2021, 10(1), 88. ISSN 2047-7538. E-ISSN 2047-7538.

I. T. Leite, S. Turtaev, D. E. Boonzajer Flaes, T. Čížmár, *Observing distant objects with a multimode fibre-based holographic endoscope*. *APL Photonics*. 2021, 6(3), 036112. ISSN 2378-0967. E-ISSN 2378-0967.

D. Stellinga, D. B. Phillips, S. P. Mekhail, A. SELYEM, S. Turtaev, T. Čížmár, M. J. Padgett, *Time-of-flight 3D imaging through multimode optical fibres*. *Science*. 2021, 374(6573), 1395–1399. ISSN 0036-8075. E-ISSN 1095-9203.



The principle of the far-field imaging holographic endoscope. A sequence of holograms displayed by a digital micromirror device spatially shapes the light wavefronts coupled into a multimode optical fibre so that a far-field focus scans the distal field of view point-by-point.



3D time-of-flight imaging of revolving chess set with a multimode fibre based endoscope.

(a) Diagram of the experimental setup. (b) A snapshot of the real scene being recorded. (c) Typical 3D images obtained with the system. Each frame is captured in 200 ms. The frames show the pieces on a revolving chess board located at a depth of ~30 cm from the distal fibre facet, recorded at a frame rate of 5 Hz. Scene depth is encoded in the colour channels, and scene reflectivity is encoded in the transparency channel.

ARE IVORY ANTIQUES ACTUALLY ANTIQUE? DETERMINATION OF THE AGE OF IVORY USING RADIOCARBON DATING

Nuclear Physics Institute of the CAS

Only antique ivory that originated before 1947 can be commercially traded. Ivory items seized by law enforcement authorities that target online illegal trade were analysed by radiocarbon dating. Some items had documents verifying their antique status that had been elaborated by specialised experts. Radiocarbon dating revealed that 68% of the analysed ivory was conclusively illegal and that the legality of the remaining items is not entirely certain. The antique expert without ^{14}C analyses was inaccurate in 86% of the cases.

Bibliographic references:

J. Kufnerová, K. Pachnerová Brabcová, V. Suchý, Z. A. Ovšonková, J. Frouzová, T. Cajthaml, I. Světlík, *Are ivory antiques actually antique? Crime Law and Social Change*. 2021, 76(OCT), 219–231. ISSN 0925-4994. E-ISSN 1573-0751.

Seized ivory statue is sampled for radiocarbon dating. The sampling was performed with low-speed drilling in hidden areas of the objects (as shown on the illustration) to minimise devaluation. Only about 15 mg of ivory was needed for the radiocarbon dating.



SELECTED SCIENTIFIC RESULTS FROM RESEARCH AREA II. INSTITUTES

NONINVASIVE DIAGNOSIS COMBINING MONITORING OF ASPERGILLUS AND PSEUDOMONAS INFECTIONS: PILOT STUDY

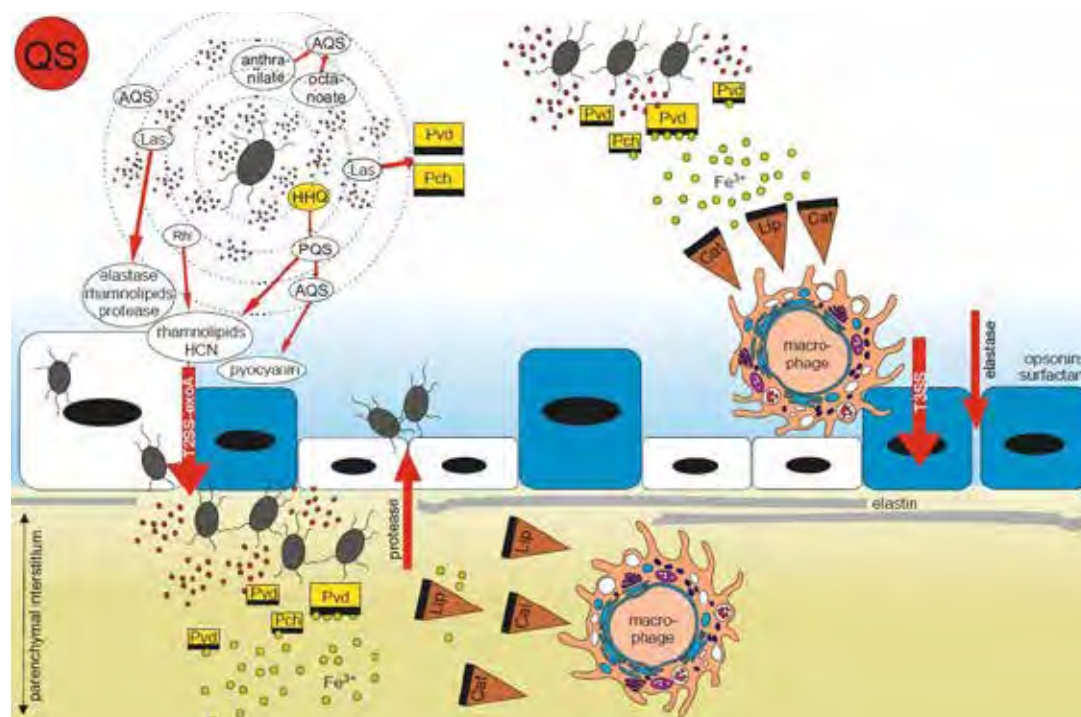
Microbiology Institute of the CAS

In critically ill patients, particularly those in intensive care units experiencing septic attacks, timely diagnosis of mixed infections is critical to a successful therapeutic outcome. Scientists from the Institute of Microbiology applied a breakthrough non-invasive infectious diagnosis method to describe a patient's condition practically in real time.

Bibliographic references:

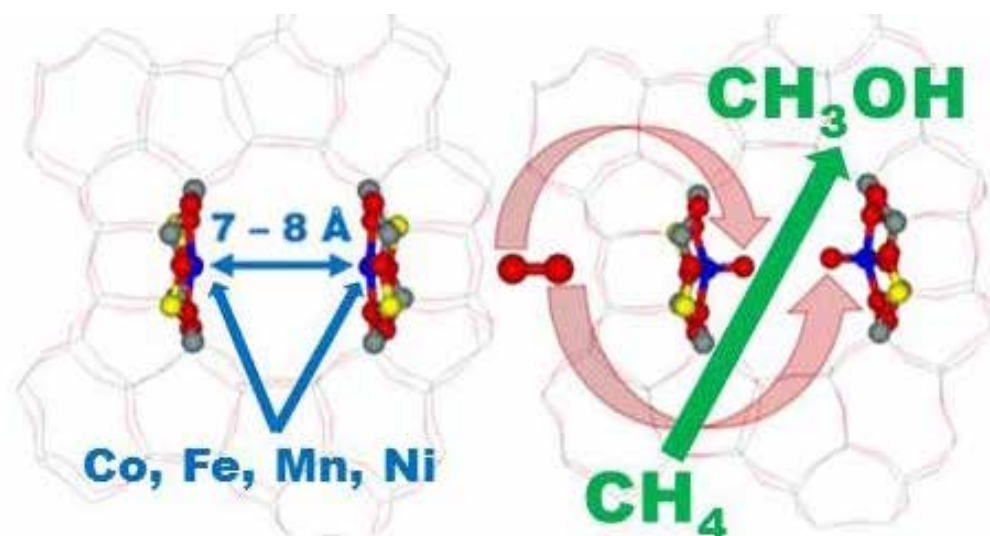
R. Dobiáš et al., *Non-invasive Combined Diagnosis and Monitoring of Aspergillus and Pseudomonas Infections: Proof of Concept. Journal of Fungi* 2021, 7, 730.

Cells of the bacterium *Pseudomonas aeruginosa* communicate with one another and with host immunity cells using molecular mechanisms.



CATALYSTS FOR ACTIVATION OF DIOXYGEN AND SELECTIVE OXIDATION OF METHANE TO METHANOL

J. Heyrovský Institute of Physical Chemistry



Oxidation of methane to methanol on a zeolite catalyser.

Researchers from the J. Heyrovský Institute of Physical Chemistry developed binuclear catalytic centres of two iron ions in a ferrierite zeolite matrix that split dioxygen and subsequently oxidise methane to methanol. The new results show that the binuclear centres of other metals also activate oxygen and oxidise methane and in addition the geometric parameters of these centres, essential for oxygen dissociation and methane oxidation, were found. These discoveries provide the basis for the development of an industrially relevant methane catalyst.

Bibliographic references:

E. Tabor, M. Lemishka, J. E. Olszówka, K. Mlekodaj, J. Dědeček, P. C. Andrikopoulos, Š. Sklenák, *Splitting Dioxygen over Distant Binuclear Fe Sites in Zeolites. Effect of the Local Arrangement and Framework Topology. ACS Catalysis*. 2021, 11(4), 2340–2355. ISSN 2155-5435. E-ISSN 2155-5435.

RECENT EUROPEAN DROUGHT EXTREMES BEYOND COMMON ERA BACKGROUND VARIABILITY

Global Change Research Institute

Europe's recent summer droughts have had devastating ecological and economic consequences, but the severity and cause of these extremes remain unclear. A reconstruction demonstrated that the sequence of recent European summer droughts since 2015 is unprecedented in the past 2,110 years. This hydroclimatic anomaly is probably caused by anthropogenic warming and associated changes in the position of the summer jet stream. The research results of Global Change Research Institute scientists were described in an article published in the prominent journal *Nature Geoscience*.

Bibliographic references:

U. Büntgen, O. Urban, P. J. Krusic, M. Rybníček, T. Kolář, T. Kyncl, A. Ač, E. Koňasová, J. Čáslavský, J. Esper, S. Wagner, M. Saurer, W. Tegel, P. Dobrovolský, P. Cherubini, F. Reinig, M. Trnka, *Recent European drought extremes beyond Common Era background variability. Nature Geoscience. 2021, 14(4), 190–196. ISSN 1752-0894. E-ISSN 1752-0908.*



SELECTED SCIENTIFIC RESULTS FROM RESEARCH AREA III. INSTITUTES

FIRST-LANGUAGE SPEECH LEARNING ACROSS THE LIFESPAN

Institute of Psychology of the CAS

Research by scientists from the Institute of Psychology indicates that the ability to learn a language is not limited by age (either early or advanced age). Rather, it is a natural process which evolves in concert with auditory development and is modulated by perceptions from the environment. Behavioural and neurostudies with children and adults demonstrated that first-language speech learning may start before birth and does not end even in late adulthood. This research is unique nationally and is relevant internationally as it helps us understand a uniquely human trait – language communication.

Bibliographic references:

V. J. Podlipský, Š. Šimáčková, K. Chládková. *Phonetic drift reveals interconnected phonological representations in simultaneous bilinguals: A case study of English and Czech stop consonants. International Journal of Bilingualism.* 2021, 25(3), 789–799, 1367006920932211. ISSN 1367-0069. E-ISSN 1756-6878.

K. Chládková, V. J. Podlipský, N. Nudga, Š. Šimáčková. *The McGurk effect in the time of pandemic: Age-*

-dependent adaptation to a partial loss of visual speech cues. Psychonomic Bulletin & Review. 2021, 28(3), 992–1002. ISSN 1069-9384. E-ISSN 1531-5320.

K. Chládková, Š. Šimáčková, *Distributional Learning of Speech Sounds: An Exploratory Study Into the Effects of Prior Language Experience. Language Learning.* 2021, 71(1), 131–161. ISSN 0023-8333. E-ISSN 1467-9922.

K. Chládková, J. Urbanec, S. Skálová, J. Kremláček, *Newborns' neural processing of native vowels reveals directional asymmetries. Developmental Cognitive Neuroscience.* 2021, 52, 1–14, 101023. ISSN 1878-9293. E-ISSN 1878-9307.

N. Paillereau, V. J. Podlipský, F. Smolík, Š. Šimáčková, K. Chládková, *The development of infants' sensitivity to native versus non-native rhythm. Infancy.* 2021, 26(3), 423–441. ISSN 1525-0008. E-ISSN 1532-7078.

N. Paillereau, V. J. Podlipský, Š. Šimáčková, F. Smolík, Z. Oceláková, K. Chládková, *Perceptual sensitivity to vowel quality and vowel length in the first year of life. JASA Express Letters.* 2021, 1(2), 1–7, 025202. E-ISSN 2691-1191.



Journal Cover:

Developmental Cognitive Neuroscience

EASTERN EUROPE AND THE GEOGRAPHY OF KNOWLEDGE PRODUCTION: THE CASE OF THE INVISIBLE GARDENER

Institute of Ethnology of the CAS

Through the example of informal food provisioning, scientists from the Institute of Ethnology examined processes, by which Eastern European knowledge is kept at the bottom of the knowledge hierarchy in international science and which prevent this knowledge from influencing theory debates. Although informal food practices are widespread and positively motivated in Eastern Europe, Western science has framed them negatively as a strategy of the poorer members of society. But informal food provisioning has reached a significance that would be considered a breakthrough towards a sustainable food sys-

tem in the Western context. The research results were described in an article published in the journal *Progress in Human Geography*, one of the most prestigious geography journals in the world with a high IF.

Bibliographic references:

P. Jehlička, *Eastern Europe and the geography of knowledge production: The case of the invisible gardener. Progress in Human Geography.* 45(5) pp. 1218–1236, 2021, -(20. 1. 2021). ISSN 0309-1325. E-ISSN 1477-0288.



Garden in the "Stadium" gardening community, Polička

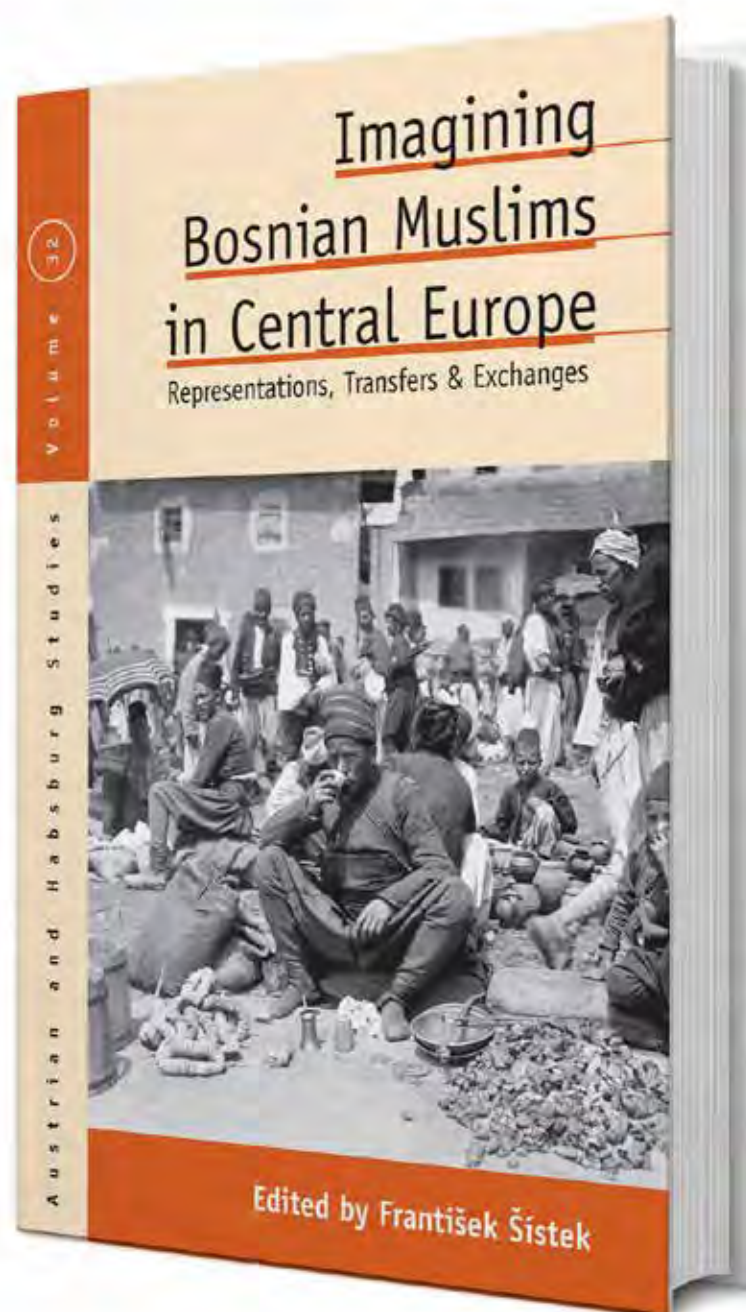
IMAGINING BOSNIAN MUSLIMS IN CENTRAL EUROPE. REPRESENTATIONS, TRANSFERS AND EXCHANGES

Institute of History of the CAS

Slavic Muslims, who have lived since the Ottoman era in Bosnia and Hercegovina, geographically close to the abstract centre of Europe, long played a rather marginal role in the European collective imagination. This book, composed of contributions by historians, anthropologists, political scientists and literary scholars from several European countries, analyses the most important aspects of political, social and discursive interactions, encounters and convergence of Bosnian Muslims with the West since the 19th century.

Bibliographic references:

F. Šístek, L. Hladký, P. Stehlík, B. Jezerník, M. Gabriel, C. Ruthner, O. Pejić, Z. Hesová, Ch. Sabatos, B. Baskar, M. Mandić, A. Bartulović, A Čemernica, M. Šehagić, *Imagining Bosnian Muslims in Central Europe: Representations, Transfers and Exchanges*. New York: Berghahn Books, 2021. *Austrian and Habsburg studies*, 32. ISBN 978-1-78920-774-3.



Book cover:

F. Šístek (ed.): *Imagining Bosnian Muslims in Central Europe. Representations, Transfers and Exchanges*.



7



Strategy AV21

Top Research in the Public Interest

Strategy AV21, approved by the CAS Academy Assembly in 2014, is the result of the CAS' ongoing efforts to help address contemporary societal problems. It is aptly characterised by the motto “Top research in the public interest”, which was registered as a trademark of the CAS in 2021. 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 AV21 research programmes benefit from the wide range of research concentrated within the CAS, which gives them the opportunity to create exceptional connections between findings from the natural, technical and social sciences and the humanities. Strategy AV21 goals are closely aligned with the goals of the National Research and Innovation Strategy for Smart Specialisation of the Czech Republic (RIS3).

”

The CAS' quick response to one of the most recent challenges of contemporary society - the covid-19 pandemic - in 2021 led to the establishment of a new Strategy AV21 research programme focused on virology. This chapter contains some of the many cutting-edge results achieved by 20 Strategy AV21 research programmes in 2021.

The seventh year of Strategy AV21 implementation was marked by many changes. Jiří Plešek, a new member of the Academy Council, was appointed Chair of the Strategy AV21 Council and there were also changes to the composition of the Strategy AV21 Council, which has nine members and two permanent guests. The Council worked to streamline programme management, simplify administration of research programmes and specify Strategy AV21 outcomes. The new CAS Academy Council Guideline No. 9/2021 on Strategy AV21 grants more authority to research programme coordination councils, which can now decide on minor changes to solutions in a given year, enabling them to respond effectively to emerging situations. The Council also proposed limiting the number of research programmes and set a financial limit for total and personnel expenses with the aim of clarifying financing rules. In the second half of 2021, the KIS information system for accepting new research programme proposals was modified and a new Strategy AV21 website was designed. The key objectives were to connect the new website with news on research programme websites using RSS technology, give it an overall refresh and make research programme outcomes accessible to the general public.

Alice Koubová, coordinator of research programme No. 14 “Forms and Functions of Communication”, which concluded in December 2020, continued in 2021 with a new research programme, No. 24 “Resilient Society for the 21st Century. Crisis Potential and Effective Transformation”. Research programme No. 25 “Virology and Antiviral Therapy”, led by Daniel Růžek, began concurrently. This programme was instigated in response to the global covid-19 pandemic and achieved notable success from its early stages.

A collaborative effort between the Czech Centre for Phenogenomics of the Institute for Molecular Genetics and the Biology Centre led to the development of a new covid-19 mouse model. Ordinary laboratory mice are wholly resistant to the SARS-CoV-2 virus and therefore specially genetically modified mice must be used for covid-19 disease modelling. Research programme No. 25 involved the “humanisation” of mouse lung tissue using

a human adeno-associated virus as a vector for the human variant of the ACE-2 receptor. This unique mouse model was used for a study of covid-19 pathogenesis as well as for testing of a wide range of antivirals and antibodies. New monoclonal antibodies and bispecific antibodies were discovered which neutralise the SARS-CoV-2 virus very effectively on the mouse model, and also new molecules which exhibited a high antiviral or immunomodulatory effect.



Martin Palus from the Institute of Parasitology of the Biology Centre at work in the BSL-3 laboratory

Another Strategy AV21 programme achievement with practical application is the founding of a metabolomics service department at the Institute of Physiology as part of research programme No. 18 “Preclinical Testing of Potential Pharmaceuticals”. This laboratory contains state-of-the-art instruments and cutting-edge specialists. It is the only CAS facility to obtain a good laboratory practice certificate, which is an essential prerequisite for analysis of levels of tested new pharmaceuticals in animal experiments prior to their testing on patients. The laboratory has already helped e.g. with the development of the experimental pharmaceutical MitoTam for cancer treatment. Findings in experiments on mice and mini-pigs showed the pharmaceutical distributed in tissue after intravenous and oral administration. These results enable a better understanding of the



Automatic sample dispenser (autosampler), which is part of the liquid chromatograph assembly and mass spectrometer (LC-MS) for organic compound analyses

effects of the pharmaceutical's action on various types of solid tumours in different tissue and increase the potential for commercialisation of the research results.

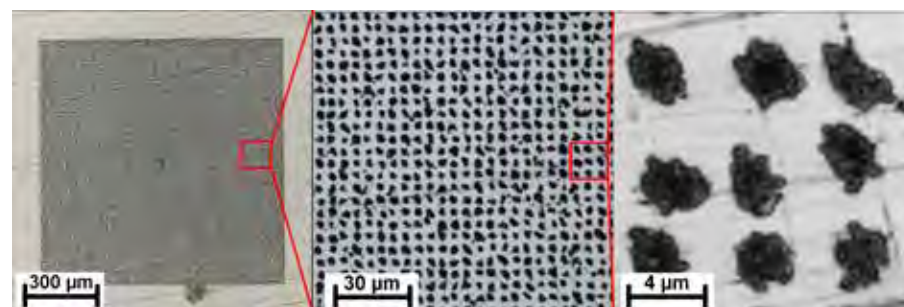
Thanks to Strategy AV21 support, a record was achieved in laser micromachining in research programme No. 17 "Light at the Service of Society". Manufacture of precise periodic micro- and nano-structures is in high demand for future industrial production of functional surfaces that enable e.g. reduction in friction and interfacial adhesion of different types of materials, modification of surface wettability, creation of naturally antibacterial surfaces, etc. This is a field with high potential and societal benefits. Production of these surfaces requires very precise laser instruments such as picosecond and femtosecond laser systems. However, the speed at which large-surface microstructures can be produced remains a problem, as does the efficacy of using high-performance systems and related economic efficiency. One solution for economically viable production of large-surface periodic microstructures is multibeam picosecond machining. In multibeam micromachining, the high energy input laser beam is separated into several other beams by means of a suitable optical sys-



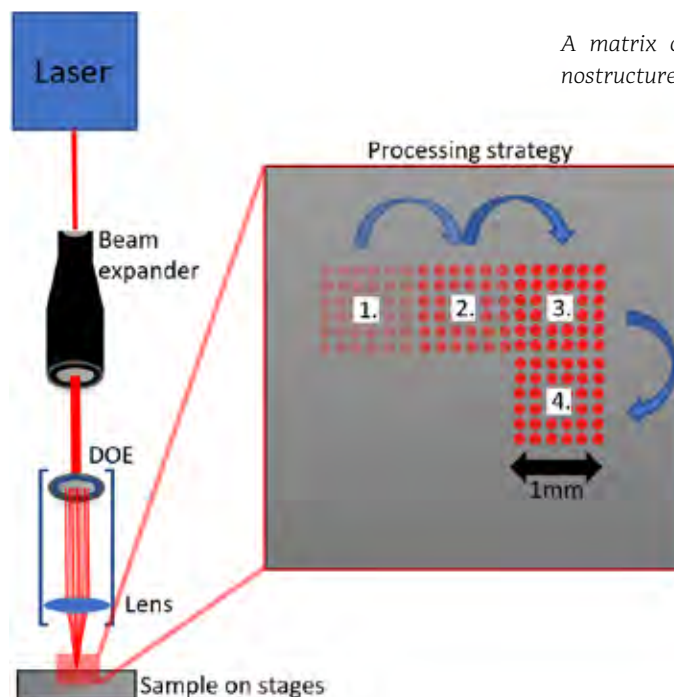
tem and there are parallel machining processes. Thanks to the unique high power laser systems of the HiLASE Centre (Institute of Physics) and new optical prototypes, parallel machining with more

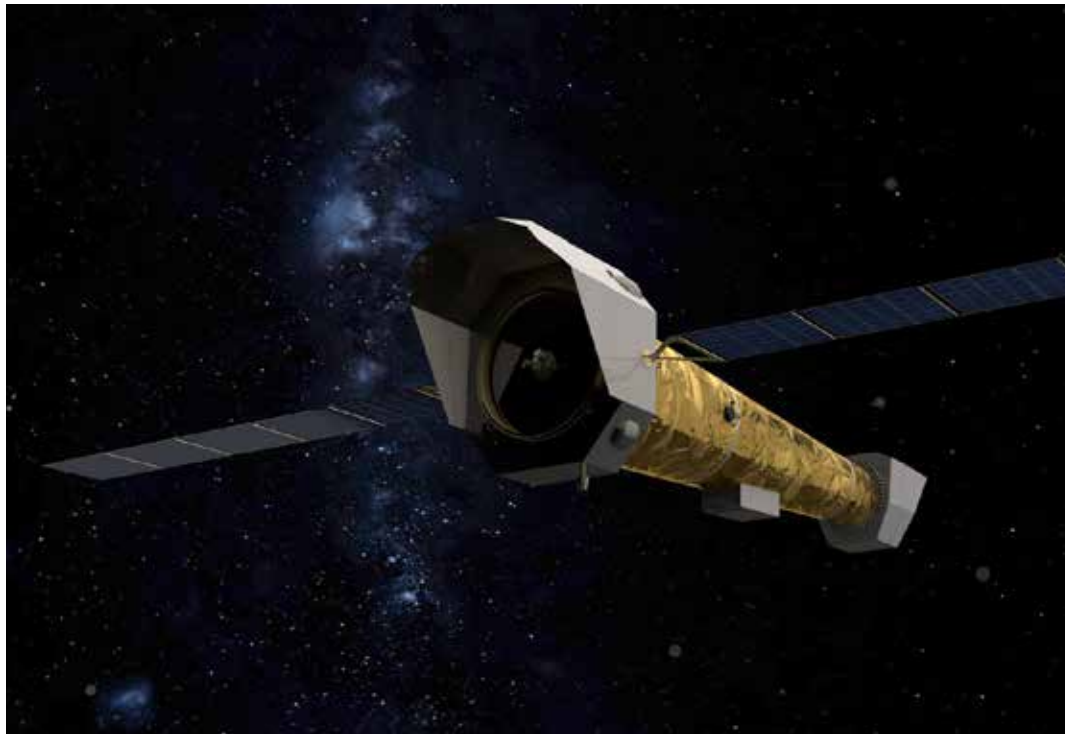
than 40,000 laser beams was achieved, which is currently the world record.

Research programme No. 16 "Space for the Mankind" is an excellent example of use of collaborative synergy, which is so emblematic of the Strategy AV21 platform. Support of Strategy AV21 promotes collaboration between many CAS institutes and with international space agencies, above all the European Space Agency (ESA). An achievement of research programme No. 16 is the engagement of CAS institutes in several major new research space missions in the past three years, namely ATHENA, eXTP, PLATO, ARIEL, Lagrange and LISA. The programme also enabled significant strengthening of collaboration between scientific institutes and industrial companies. Participation in space projects is important for innovation in Czech industry and technology transfer.



A matrix of microparticles with an internal nanostructure created by 40,401 beams simultaneously.

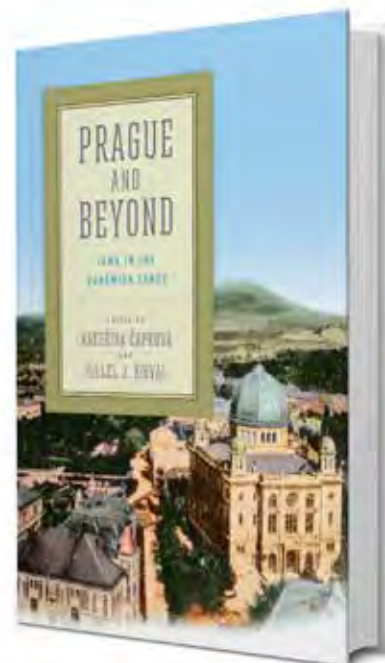




A visualisation of the European Space Agency's ATHENA large X-ray space mission. It will observe the hot and energetic universe, in particular black holes, supernovas and galaxy clusters.

In August, the book *Prague and Beyond: Jews in the Bohemian Lands*, written by a team of nine researchers from the USA, Germany, Austria and the Czech Republic under the leadership of Kateřina Čapková of the Institute for Contemporary History and Hillel Kieval of Washington University in St. Louis, was published by the prominent University of Pennsylvania Press. Research programme No. 15 “Global Conflicts and Local Interactions: Cultural and Societal Challenges” contributed to the book, which is the outcome of a roughly seven-year project. The Czech translation of the book was published in June 2022 by Lidové noviny publishing house.

The article “The materiality of forced labour: settlement waste of communities at WWII mining plant and PoW camp in Rolava (North-West Bohemia)”, written by Jan Hasil, Petr Hasil, Petr Kočár and René Kyselý and published by the *Journal of Conflict Archaeology*, outlines the authors' major outcomes and is yet another of the many successful outputs of the Strategy AV21 programme. *Three eras in the archaeology of modern societies*, a monograph by Jan Hasil et al. that presents the



Book cover:

K. Čapková and H. Kieval: *Prague and Beyond: Jews in the Bohemian Lands*

complete results, will be published by the Academia publishing house in 2022. The monograph is the output of research programme No. 24 “Resilient Society for the 21st Century. Crisis Potential and Effective Transformation” and focuses on archaeological, osteological and archaeobotanical analysis of artefacts and ecofacts obtained through research into waste sites from World War II at the extinct mine near the municipality of Rolava in the Ore Mountains. The housing estate waste was produced by three communities of varying social class: German experts and prisoners of war performing forced labour, mainly of Soviet or French origin. This interdisciplinary analysis of housing estate waste introduces new viewpoints on one of the most important modern archaeological areas in Central Europe and daily life in the context of the largest war in human history.



Geophysical measurements at Rolava using a ground penetrating radar. Photo by P. Hasil



The project team conducting archaeological and construction history research. Photo: P. Hasil.

Another important output of the Strategy AV21 programme are expert opinions for legislators, known as AVexes. In 2021, the paper *Plant viruses: a real threat as well as biotechnological potential of development* was developed. Two Strategy AV21 expert brochures were published by the Academia publishing house: *What do we need political parties for?* and *Organic matter is more precious than gold*.



List of Strategy AV21 research programmes

AND COORDINATORS

VP01	Hopes and Risks of the Digital Era doc. RNDr. Barbara Zitová, Ph.D. <i>Institute of Information Theory and Automation</i> 09/06/2015 – 31/12/2021	VP16	Space for the Mankind RNDr. Jiří Svoboda, Ph.D. <i>Astronomical Institute</i> 01/01/2017 – 31/12/2023
VP02	Systems for the Nuclear Power Industry doc. RNDr. Radomír Pánek, Ph.D. <i>Institute of Plasma Physics</i> 09/06/2015 – 31/12/2021	VP17	Light at the Service of Society Ing. Tomáš Mocek, Ph.D. <i>Institute of Physics</i> 01/01/2017 – 31/12/2023
VP03	Efficient Energy Conversion and Storage doc. Ing. Miroslav Chomát, CSc. <i>Institute of Thermomechanics</i> 09/06/2015 – 31/12/2021	VP18	Preclinical Testing of Potential Pharmaceuticals MUDr. Jan Kopecký, DrSc. <i>Institute of Physiology</i> 01/01/2017 – 31/12/2023
VP05	New Materials Based on Metals, Ceramics and Composites prof. RNDr. Ludvík Kunz, CSc., dr. h. c. <i>Institute of Physics of Materials</i> 09/06/2015 – 31/12/2021	VP19	Foods for the Future prof. Ing. Jaroslav Doležel, DrSc. <i>Institute of Experimental Botany</i> 01/01/2020 – 31/12/2024
VP06	Diagnostic Methods and Techniques Ing. Ilona Müllerová, DrSc. <i>Institute of Scientific Instruments</i> 09/06/2015 – 31/12/2021	VP20	Water for Life doc. RNDr. Martin Pivokonský, Ph.D. <i>Institute of Hydrodynamics</i> 01/01/2020 – 31/12/2024
VP07	Wellbeing in Health and Disease doc. MUDr. Jakub Otáhal, Ph.D. <i>Institute of Physiology</i> 09/06/2015 – 31/12/2021	VP21	Land Conservation and Restoration prof. Mgr. Ing. Jan Frouz, CSc. <i>Biology Centre</i> 01/01/2020 – 31/12/2024
VP10	Molecules and Materials for Life Ing. Jiří Brus, Dr. <i>Institute of Macromolecular Chemistry</i> 09/06/2015 – 31/12/2021	VP22	Society in Motion and Public Policy doc. Ing. Daniel Münich, Ph.D. <i>Economics Institute</i> 01/01/2020 – 31/12/2024
VP11	Europe and the State: Between Barbarism and Civilisation prof. PhDr. Petr Sommer, CSc., DSc. <i>Institute of Archaeology, Prague</i> 09/06/2015 – 31/12/2021	VP23	City as a Laboratory of Change PhDr. Adéla Gjuričová, Ph.D. <i>Institute of Contemporary History</i> 01/01/2020 – 31/12/2024
VP12	Memory in the Digital Age PhDr. Luboš Velek, Ph.D. <i>Masaryk Institute and Archives</i> 09/06/2015 – 31/12/2021	VP24	Resilient Society for the 21st Century. Crisis Potential and Effective Transformation doc. RNDr. Mgr. Alice Koubová, Ph.D. et Ph.D. <i>Institute of Philosophy</i> 09/02/2021 – 31/12/2025
VP15	Global Conflicts and Local Interactions: Cultural and Societal Challenges Mgr. Jindřich Krejčí, Ph.D. <i>Institute of Sociology</i> 01/01/2016 – 31/12/2022	VP25	Virology and Antiviral Therapy doc. RNDr. Daniel Růžek, Ph.D. <i>Biology Centre</i> 09/02/2021 – 31/12/2025
		M2	Research infrastructure support for Strategy AV21 Ing. Tomáš Wencel, MBA <i>CAS Centre of Administration and Operations</i> 14/07/2015 – 31/12/2021





Projects From Operational Programmes

of EU Structural Funds

In regard to operational programmes co-financed by the European Structural Funds and investment funds, 2021 was at the interface of the ending programming period 2014-2020 and the subsequent programming period 2021-2027. Projects from both programming periods will run simultaneously until 2023. In the new programming period grant programmes will once again be divided into national operational programmes, cross-border coope-

ration and supranational and interregional cooperation programmes.

In 2021, CAS institutes were involved in 160 projects falling under EU Structural Funds operational programmes. The total amount of approved support for the entire duration of nine new projects initiated in 2021 is CZK 49,787,000.

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Operational programmes are a very effective tool for supporting high-quality research at CAS institutes and using this research to make the Czech Republic more competitive.

In regard to operational programmes co-financed by the European Structural Funds and Investment Funds, 2021 was at the interface of the ending programming period 2014-2020 and the subsequent programming period 2021-2027. Projects from both programming periods will run simultaneously until 2023, at which point the eligibility of expenditures from the previous programming period will end. In the new programming period grant programmes will once again be divided into national operational programmes (OP), cross-border cooperation and supranational and interre-

gional cooperation programmes. It is anticipated that CAS institutes will submit projects primarily to the Jan Amos Komenský OP, Technology and Applications for Competitiveness OP and the Integrated Regional Operational Programme. The first grant calls are expected during 2022.

In 2021, CAS institutes were involved in 160 projects falling under EU Structural Funds operational programmes. CAS institutes served as coordinators or beneficiaries of 131 projects, of which 9 were launched in 2021, 92 continued during the

entire year, and 30 were completed during the course of the year. Table 1 provides a summary of CAS institutes' participation in the projects categorised by operational programme. More detailed information about projects launched in 2021 is presented in Table 2. The total amount of approved support for the entire duration of these projects is CZK 49,787,000.

Table 1:
Participation of CAS institutes in operational programme projects in 2021

OPERATIONAL PROGRAMME	Projects launched	Projects ongoing	Projects completed	TOTAL
Integrated Regional Operational Programme	0	1	2	3
OP Enterprise and Innovation for Competitiveness	0	0	2	2
OP Prague - Growth Pole of the Czech Republic	0	0	2	2
OP Research, Development and Education	8	84	22	114
OP Employment	0	6	0	6
OP Environment	1	0	1	2
Cross-border Cooperation Programme Interreg V-A Austria – Czech Republic	0	1	0	1
Cross-border Cooperation Programme Interreg V-A Slovakia – Czech Republic	0	0	1	1
TOTAL	9	92	30	131

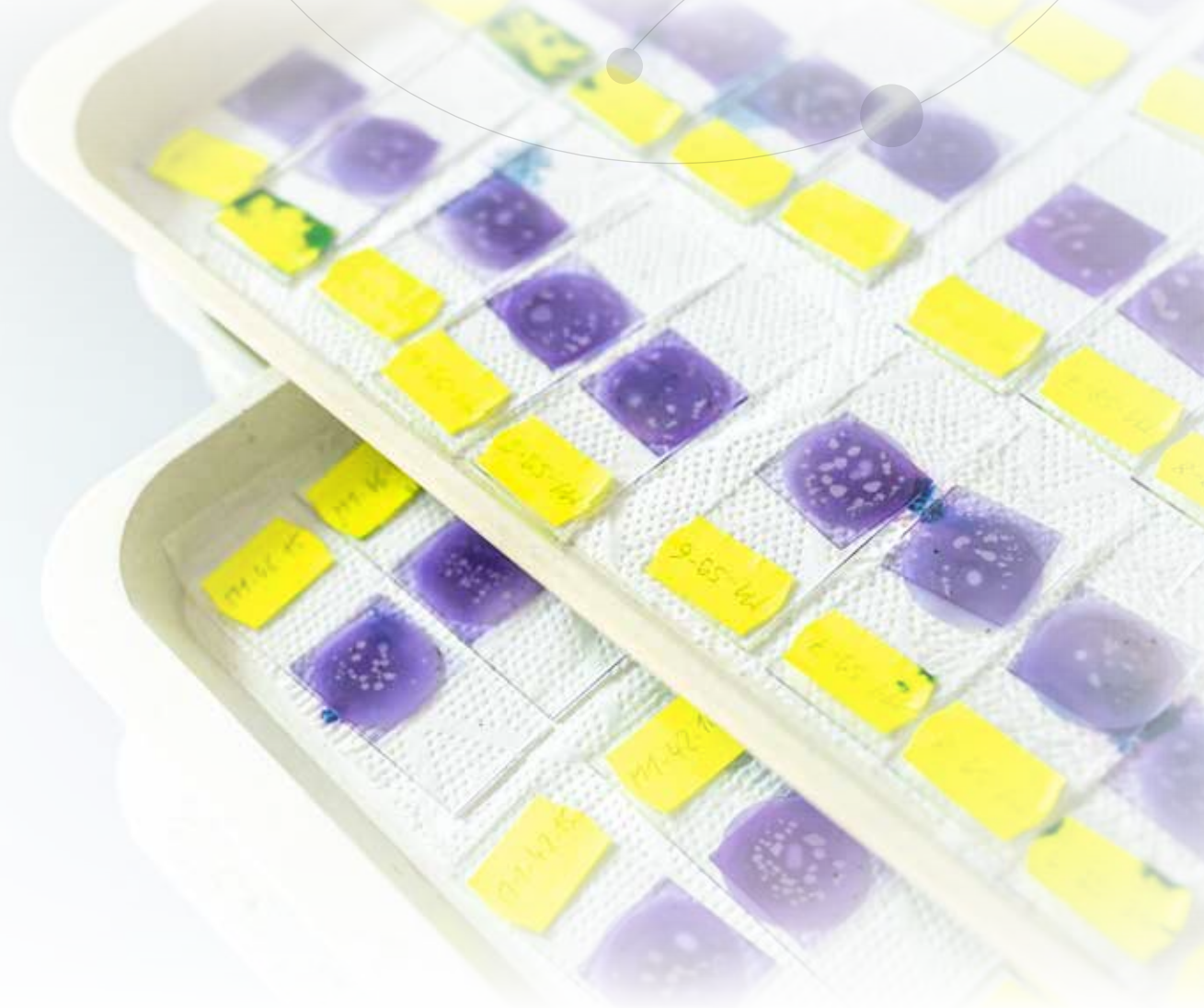


Table 2: Operational programme projects launched in 2021

Beneficiary	PROJECT	Total approved support for the project in thousands of CZK
OP Research, Development and Education		
Inst. of Botany	Support of quality H2020-MSCA-IF-2019 projects	6,830
Inst. of Botany	Mobility 2020	7,120
Inst. of Ethnology	Hunting uncontrollable pigs in a new wilderness: the anthropology of recreational hunting	3,200
Inst. of Ethnology	International mobility of research, technical and administrative employees at the Institute of Ethnology	3,497
Inst. of Philosophy	Strengthening mobility in philosophy research II	7,125
Inst. of Microbiology	Strengthening mobility of researchers – MSCA-IF IV	7,714
Inst. of Vertebrate Biology	MO-ZOOL-EK - International mobility of researchers in the fields of ZOOlogy and ECOlogy	3,016
Global Change Res. Inst.	International mobility of research, technical and administrative employees at the Global Change Research Institute	3,321
OP Research, Development and Education		
Inst. of Physics of Materials	Energy saving measures at the Institute of Physics of Materials, particularly workshops and electron microscope buildings	7,964



9



Practical Application of Research

Despite the ongoing pandemic, interest in the transfer of knowledge to practice and in promotion of high-quality collaboration between research and industry partners developed dynamically in 2021. The newly elected members of the Academy Council brought a fresh spirit to strategic development. Ilona Müllerová, the new Vice President for Physical Sciences and the longstanding director of one of the most application-oriented institutes was appointed as the knowledge and technology transfer coordinator. She brings extensive personal experience in cooperation with industry to the position.

Under her leadership the white paper on a long-term strategy for knowledge and technology transfer in the CAS environment was developed and then approved by the Academy Council in October. Additional staff was hired for the Technology Transfer Office of the CAS (TTO). Martin Smekal became the new director of TTO, bringing experience that will be significant for further specification of the knowledge and technology transfer strategy at the CAS and for development of concrete activities and initiatives in implementation of this strategy.

White paper on a long-term strategy for knowledge and technology transfer in the CAS environment

This document focused on formulating the vision for knowledge and technology transfer (KTT) at the Czech Academy of Sciences and also outlining key areas on which the strategy will focus.

The vision of the long-term strategy is that CAS institutes are sought-after providers of knowledge for Czech and international industry, public administration bodies, the non-profit sector and the public. The share of licensed intellectual property will increase thanks to support of exceptional knowledge transfer projects. Active support for establishment of spin-off companies will lead to new transfer funding opportunities from private sources and strengthen the competitiveness of the Czech Republic. Long-term development and cultivation of the knowledge transfer environment will raise the social relevance of research.

The key areas of focus are 1) Identification and protection of intellectual property and 2) Support of concrete KTT projects. Support of knowledge transfer in the social sciences and humanities is also a clear priority. Comprehensive planning of the organisational aspects of transfer activities will also be a priority in the upcoming period, particularly through the Technology Transfer Office of the CAS.

KTT advisory bodies were established to support knowledge and technology transfer activities and coordination within the CAS. There are two such bodies: the CAS Technology Transfer Council and the CAS Intellectual Property Rights Council. Both bodies and their members actively engage in addressing current issues related to development of KTT within the CAS' scope of activity.

Practical aspects of transfer

The CAS Technology Transfer Centre has built a high-quality knowledge base and also develops practical professional competences. In 2021, expert staff actively supported more than one hundred knowledge transfer cases at various CAS institutes.

The most frequent topics addressed with institutes in 2021 included:

- setting up a strategy for protection of intellectual property,
- thinking through and formulating a commercialisation plan,

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Before the end of 2021, the Academy Council approved the white paper on a long-term strategy for knowledge and technology transfer in the CAS environment. Additional staff was hired for the Technology Transfer Office of the CAS.

- looking for partners or investors for further development of technologies,
- negotiating the terms and conditions of collaboration or a contract as well as specific contractual relationships.

In 2022, the goal will be to further develop and expand these activities systematically. One area that will be emphasised is proactively searching for and assessing promising technologies (ensuring qualitative and quantitative assessment and provision of “realistic” feedback). Another area is support for development of promising technologies for use in practice (e.g. development of industrial prototypes or validation of commercial potential, i.e. proof of concept).

Inspiration from existing international knowledge and technology transfer support systems will be an important resource for further development of transfer activities at the CAS. Transfer support systems operating in Germany will be one of these resources, thanks to existing contacts with the most significant organisations such as the Max Planck Society, Fraunhofer Society and Leibniz Society. It will also be fitting to discuss these experiences with the transfer management and support community in the Czech Republic, e.g. through an expert conference in the first half of 2022 with key speakers from the aforementioned institutions.

Knowledge transfer also relates to the humanities and social sciences

Perception of the term ‘technology transfer’ is shifting to a more apt ‘knowledge transfer’ concept, e.g. as evidenced by the fact that in 2021 humanities and social sciences institutes also took great interest in transfer discussions, which resulted in many interesting and useful outputs. These outputs are very practical and beneficial to specific groups of people or institutions, e.g. local self-government.

Two working groups were established in relation to the involvement of the social sciences, humanities and arts in KTT. These groups, taking a long-term view, seek to ensure that the knowledge transfer concept is not limited to patent licensing and that it moves beyond income, i.e. the money earned from an invention, to impact, i.e. the positive effect on society and specific individuals. Social relevance and responsibility should not be limited to measuring profit. The first working group was established at the European professional association ASTP Proton, which is a partner to CAS knowledge transfer staff. The second group was established at the national association Transfera.cz, where Charles University sets the main direction of interest and discussion and CAS institutes are equal partners.

Top research in the public interest

The CAS mission is top research focused on issues and challenges that contemporary society faces. Topics like the Czech Republic's energy future, health of citizens, artificial intelligence or the quality of public policy are complex issue areas which must be addressed through broad-based interdisciplinary research, both basic and applied. The CAS strategy responds to current societal challenges with thoughtfully formulated research programmes based on collaboration between disciplines and institutions. CAS research programmes are open to partners from universities, business and state and regional administration institutions as well as international research groups and organisations.

Aside from Strategy AV21 and presentation of its outputs, a new website, the *CAS Transfer Portal*, was launched in March 2021; it is focused on direct presentation of the application potential of research and its outputs as well as knowledge and technology transfer at the CAS. The portal includes news about knowledge transfer and

opportunities for further development of transfer competences, as well as an offering of knowledge transfer services and a database of results, technologies and laboratories with application potential. Opportunities for connecting with industrial and other partners are thus further developed. The portal's information potential is used by institutes in all research areas.

Development of competences and deepening expertise

In today's world it has become clear that knowledge transfer demands a high level of expertise and professionalism, requires and connects knowledge not only from research areas but also from the fields of law and economics, and calls for strong interpersonal skills and the ability to translate between the specific languages of scientists, financial investors, civil servants and local governments, lawyers or manufacturing companies.

Over the long-term the CAS is creating a competence development system for knowledge transfer staff to ensure that the needs of institutes are covered as best as possible in this rather complex area. In 2021, a training course called "Transfer specialist quickly and easily" was held for new knowledge

transfer staff at CAS institutes. In addition, a comprehensive series of seminars for scientists and innovators was held focused on the fundamentals of working with the outputs of innovations and opportunities to apply them in practice.

Achievements in 2021

The following section lists selected examples of results of research for practical application.

There were several noteworthy knowledge and technology transfer projects implemented in collaboration with the CAS Technology Transfer Centre and specific institutes in 2021.

Institute of Thermomechanics – support of commercialisation of Plasma Shock Peening technology through sale of a license to a new Czech start-up.

Institute of Inorganic Chemistry – provision of water treatment technology to a commercial partner leading to sale of related expertise.

J. Heyrovský Institute of Physical Chemistry – ensuring funding from a private partner for development and validation of commercial use (proof of concept) of methanol production technology from methane.

Outlook for the next period

Solid prerequisites have been established to continue successful research for practical application. In particular, a proactive approach to promoting knowledge and technology transfer is needed in the period ahead across all research areas of the CAS to create new programmes inspired by successful organisations for commercialisation of R&D results abroad and to continue working towards the vision of close, high-quality collaboration between CAS institutes and domestic and foreign industrial companies.



Selected examples of research

for practical application results

Astronomical Institute

The Astronomical Institute prepared technical standard ČSN No. 158 on limiting disruptive light, which will be published in 2022. It will serve engineers, construction contractors, investors, manufacturers, state administration bodies and self-government and, on a more general level, introduces a tool to limit light pollution across society.

Institute of Physics

Large-scale testing for covid-19 in the Prague public transport took place, which entailed sampling and testing, measurement and assessment of samples. Expert reports were elaborated.

Institute of Physics

A low-temperature plasma source of hollow cathodes was developed and produced for an

end customer, IQS Group s.r.o. The company uses it for its industrial depository facility.

Institute of Geophysics

The Institute of Geophysics provides daily forecasts of geomagnetic activity which are broadcast during weather forecasts.

Institute of Photonics and Electronics

The Institute of Photonics and Electronics maintains the National Time and Frequency Standard and ensures distribution of reference signals. For example, it provides a back-up reference signal for telephone switchboards for CETIN a.s. and provides technical oversight for equipment for linking to frequency sources.

Institute of Atmospheric Physics

The Institute of Atmospheric Physics assesses

wind conditions for Meridian Nová Energie s.r.o., CVEE Býšov s.r.o. and JRD Energo s.r.o. to help evaluate the suitability of areas for construction of wind power plants. Models with a height profile of 200m also estimate electricity production including uncertainty estimation.

Institute of Physics of Materials

To increase aircraft safety at Aircraft Industries, a.s., Kunovice, metallographic material analyses and fractographic analysis of fatigue fractures were conducted on aircraft landing gear pins subjected to fatigue tests.

Institute of Plasma Physics

Protective corundum coatings for key glass furnace components, such as molybdenum stirrer shafts, were developed and prepared for

KAVALIERGLASS, a.s. The technology is now in production at the company.

Institute of Geonics

The Institute developed special abrasives for machining hard-to-machine materials for PTV, spol. s.r.o. and VUSTE-APIS, s.r.o. using Abrasive Water Jet (ABJ) technology, including a prototype of a Smart Recycling Line using Industry 4.0 principles, with optimisation of recycling of used abrasives with an efficiency of up to 70% and automatic control.

Institute of Computer Science

Classification of malicious computer communication was generalised for Cisco Systems, Inc., which will further serve for classification of cyber attackers with a special focus on use of time series and machine learning methods from heterogenous data.

Nuclear Physics Institute

Development and testing of new types of ionising radiation detectors. Temporal and spatial responses of TIMEPIX and TIMEPIX3 detectors were measured for Advacam s.r.o. with an ion irradiation micro-beam at the Tandatron accelerator.

Institute of Hydrodynamics

The Institute developed a characterisation and optimisation of coagulation of treated wastewater from three wastewater treatment plants for Sweco Hydroprojekt a.s. (Podlázky, Kvasiny and Solnice wastewater treatment plants), which will serve as a source of raw water for production of operational water for Škoda auto a.s.

Institute of Scientific Instruments

Experimental calculation of heat transfer by conduction and radiation simultaneously across an interlayer superinsulation sample under defined mechanical compression of the sample, in a vacuum and over a temperature range of 10-300 K. In-situ sample thickness was measured using electrical capacity sensing and sample elasticity was evaluated simultaneously. All measurements were performed in the unique Spaceman apparatus, which simulates the cosmic environment. The superinsulation research was conducted for RUAG Spave GmbH.

Institute of Rock Structure and Mechanics

For ČEZ, a. s., the Institute calculated the seismic hazard probability curve for the Dukovany and Temelin nuclear power plants, the uniform response spectrum and deaggregation of the seismic hazard. Seismic events are monitored in the Richard Mine radioactive waste repository in Litoměřice for the Radioactive Waste Repository Authority (SÚRAO).

Institute of Theoretical and Applied Mechanics

Pipe materials were tested for CEPS a.s. as part of preparations for the entry of hydrogen into the Czech Republic's gas industry distribution network, where hydrogen will be blended into natural gas – P2G "Power to Gas".

Institute of Thermomechanics

Aerodynamic measurements on an improved profile grille consisting of a rotor blade cut of a gas turbine compressor were conducted for Doosan Heavy Industries & Construction of South Korea. A new method of mounting the model blade grids into a high-speed aerodynamic tunnel, which allows adjustment of the required flow parameters, was designed for the project.

Institute of Biophysics

Under the project NanoHA "The use of nanofibers based on hyaluronic acid in cosmetics and medicine", insoluble hyaluronate-based films obtained by heterogeneous cross-linking with iron were characterised in collaboration with Contipro a.s. It is expected they will be used as resorbable implants.

Biology Centre

In response to the current global covid-19 pandemic, a functional biochip sample with an ultra-resistant polymer layer was developed. In conjunction with the quartz crystal microbalance (QCM) method, the functional biochip offers a rapid and sensitive viral particle detection method with minimal sample preparation requirements. An important component of the biochip is its unique polymeric layer, which combines two key properties: resistance to non-specific binding and a strong ability to bind biorecognition elements. The functional biorecognition element is a peptide layer. Due to the peptide structure design, the peptide specifi-

cally recognises and captures SARS-CoV-2 viral particles in solution/medium. The presence and, where applicable, concentration of viral particles are assessed using the QCM method.

Biology Centre

Within the programme for biocontrol of selected potato pathogenic bacteria, a methodology was developed that describes the optimisation of molecular methods for the diagnosis of *Pectobacterium atrosepticum* and *Dickeya solani* which is based on real-time PCR and SybrGreen real-time PCR including sample preparation, DNA isolation, specificity control and evaluation.

Institute of Biotechnology

The article *Targeting Mitochondrial Iron Metabolism Suppresses Tumour Growth and Metastasis by Inducing Mitochondrial Dysfunction and Mitophagy* was published for potential use in cancer treatment.

Institute of Physiology

Improvements in bioprinting technology consisting in the possibility of mixing different hydrogels and different cell types in the bioprinting process were filed as a utility design in the project "Modular 3D bioprinting system for printing biocompatible hydrogel and polymer scaffolds for tissue engineering".

Institute of Microbiology

The project "Development of a new Hydal PHA base material for microplastic replacement" was completed successfully. The aim of the project was to develop new materials based on Hydal PHA to replace microplastics in cosmetics and other manufacturing industries. The project involved development geared towards replacement of fillings, microparticles in toothpastes and other products. Microplastics are dangerous as they penetrate the food chain and the entire ecosystem. Hydal PHA particles eliminate this danger and prevent waste because they are 100% biodegradable in the ecosystem. The outcomes include a proven technology for the production of ground P3HB and a functional sample of the resulting material.

Institute of Analytical Chemistry

A methodology titled Separation of highly hazardous and hazardous biological agents

from samples by means of chip-based isoelectric focusing (chip-IEF) for control of biological weapons prohibition was approved. The methodology describes a procedure for separation of bacterial highly hazardous and hazardous agents from samples using chip-based isoelectric focusing (chip-IEF). The chip-IEF method uses a newly developed unique prototype device for vertical isoelectric focusing in a chip-based flow design, which, unlike existing techniques, enables separation of bacteria. Chip-IEF separation works even for carefully inactivated bacteria, which significantly reduces the safety risks when handling samples that may contain highly hazardous and hazardous biological agents.

Institute of Inorganic Chemistry

The Institute of Inorganic Chemistry developed an original synthesis of refractory materials with enhanced resistance against acids and new materials for neutron shieldings with a high hydroxide aluminium powder content. These materials are intended for nuclear waste storage sites.

Institute of Chemical Process Fundamentals

The Institute worked with DEKONTA, a.s. to develop a device for the separation of microplastics from water. The device may be used industrially for final-stage water treatment or treatment of drinking water, either in continuous operation or in sedimentation process mode.

J. Heyrovský Institute of Physical Chemistry

Photoactive nanocomposite systems to improve the environment were applied. The result is a map of insulated prefabricated houses infested with algae in the Czech Republic and mapping and cataloguing of historical buildings in the capital city of Prague suitable for treatment with photoactive nanocomposite coatings. Teluria Paints and Varnishes, s. r. o. plans to apply the developed materials for preventive surface treatment of historical buildings and other monuments. PRAGOTHERM, facade service s.r.o., plans to apply the developed nanocomposite coatings, which have a self-cleaning effect against algae growth, for preventive surface treatment of insulated facades.

J. Heyrovský Institute of Physical Chemistry

A method for production of hydrophobic magnetic sorbent was developed. Magnetic sorbents based on porous silicates are materials that can be applied to the management of environmental disasters. The sorbent's magnetic properties simplify its application as they allow easy collection of used sorbent, which is a key part of the application of these materials in the remediation of environmental disasters. Vakos a.s. will incorporate the developed sorbent into its production portfolio.

Institute of Macromolecular Chemistry

The Institute collaborated with Thermo Fisher Scientific Brno s.r.o. on the development of a new microscopic method that allows powder electron diffraction patterns to be obtained quickly and easily with a raster electron microscope.

Institute of Molecular Genetics

A gene-edited line of poultry was developed that is resistant to the avian leukosis virus subgroups A and K. The result is artificially created resistance to retrovirus in domestic poultry.

Institute of Organic Chemistry and Biochemistry

A prostate-specific membrane antigen (PSMA) inhibitor drug was patented. These are hydroxamate-based prodrugs of GCPII inhibitors that can be used to treat diseases associated with pathological increases in glutamate levels or excessive activation of the glutamatergic system.

Institute of Organic Chemistry and Biochemistry

Substituted pyridopyrrolopyrimidine ribonucleosides were patented for therapeutic use. This innovation describes novel 4-substituted pyridopyrrolopyrimidine ribonucleosides, which contain pyridine nitrogen at the 5th or 7th position and exhibit potent cytostatic and cytotoxic effects on cell lines preferentially of tumour origin and on a wide spectrum of cancers of various histogenetic origin.

Institute of Archaeology, Brno

The Institute began collaborating with the South Moravian Region to develop a concept to gradually lay the groundwork for the establishment

of citizen science in detector prospecting in the region. The collaboration qualitatively influences and enhances the preservation of archaeological sites and tangible monuments as part of the national cultural heritage. It also impacts engagement of civil society in science.

Economics Institute

The study *Macroeconomic models for forecasting and monetary policy analysis in developing countries* was produced. It contains macroeconomic forecasts for 27 mostly developing countries using structural macroeconomic FPAS models. They are available on the website which was developed as part of the GRASP project (granted by the Ministry of Education, Youth and Sports). "Macro Risk", a statistical model-interpreted set of indicators of macroeconomic imbalances, was also elaborated for 70 countries.

Institute of Sociology

As part of an international comparative project, a study mapping sexual harassment and gender-based violence at universities and research organisations in the Czech Republic was developed. The study covered legislation, existing policies and attitudes reflected in public opinion. The results will be used by universities, research organisations and research funders to set standards ensuring a safe environment in these institutions.

The Czech Language Institute

The Institute continued to work with the Centre for Detection of Educational Results (CERMAT) on final linguistic revisions of the matriculation examination assignment in the subject of Czech language and literature, development of tasks for the matriculation examination and reading comprehension. The aim of the collaboration is to increase the quality of the final examination assignment and use its informational and motivational functions to achieve a sustained increase in the linguistic and literary proficiency of graduates and the interested public.

Institute of State and Law

Researchers at the Institute are members of the Council of the Government of the Czech Republic for Human Rights, specifically the Committee for the Prevention of Torture, the working group on penal policy and the Committee for Human Rights and Modern Technologies.

$\exists \tau^{-1} \in \Gamma$ (Γ je grupa) k \ddot{a} . $\delta_0 \tau^{-1} \cdot z = x$
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 $\alpha(G)$





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 9,968 in 2020 to 10,107 in 2021. A total of 4,940 employees are paid through extra-budgetary allocations (which equalled 49.22% in 2021 compared to 48.99% in 2020). The number of re-

search institute employees with university degrees who have passed arduous attestations pursuant to the Career Development Rules for CAS Employees with University Degree and have been classified in the relevant qualification levels grew year-on-year from 6,072 to 6,188.

”

The Czech Academy of Sciences and its institutes expended a total of CZK 5,711,804,000 on salaries and wages and CZK 196,749,000 for other payments for work (OON). The total average monthly salary at the CAS was CZK 47,097 with year-on-year growth of 2.04% from 2020.

Chart 1: Number of employees and average monthly salary at the CAS

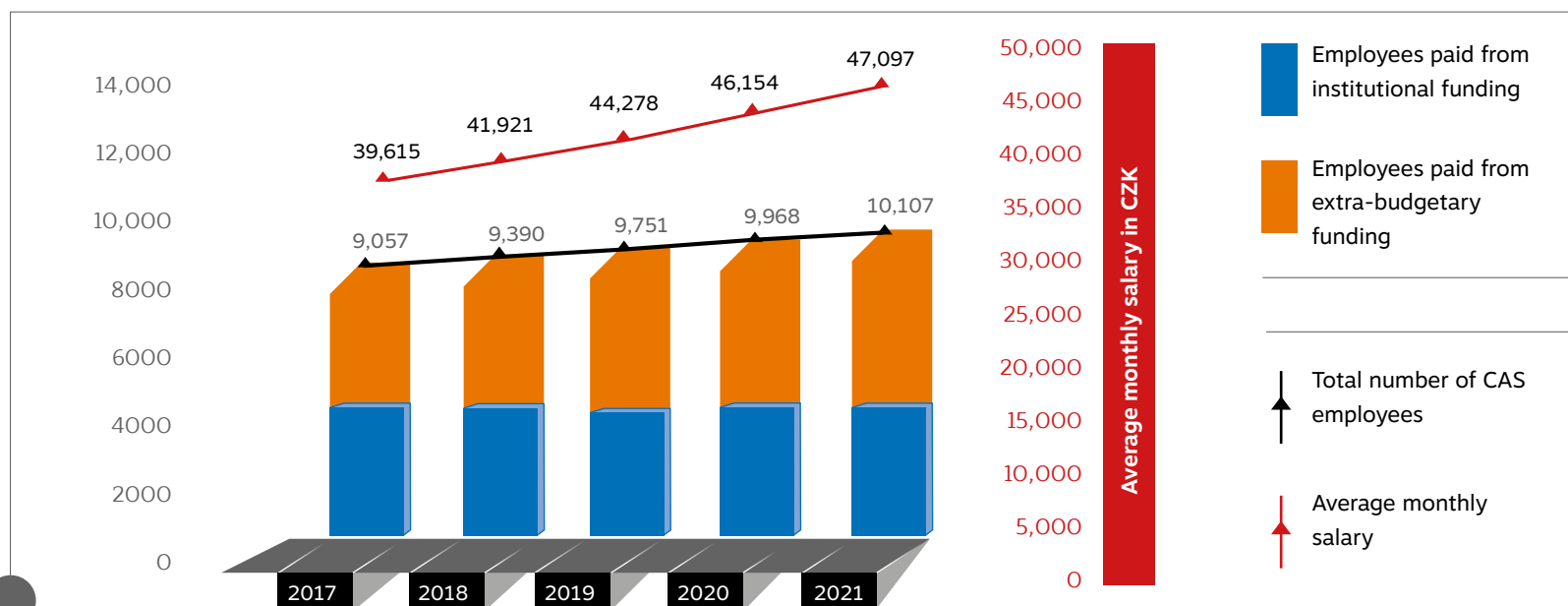


Table 3 provides a more detailed look at the number of CAS employees categorised into employees of the CAS Head Office and employees of all CAS research institutes.

Table 3: Number of CAS employees

Year	2017	2018	2019	2020	2021
CAS public research institutions	8,983	9,314	9,672	9,893	10,037
CAS Head Office	74	75	79	75	70
CAS TOTAL	9,057	9,390	9,751	9,968	10,107

At the CAS Head Office, CZK 46,807,328 was expended for salaries and CZK 5,412,589 for other payments for work performed for 69.93 employees (recalculated as average FTE). Deferred liabilities totalling CZK 4,851 for salaries and CZK 40,448 for other payments for work performed were carried over. The average monthly salary of CAS Head Office employees was CZK 55,779 in 2021.

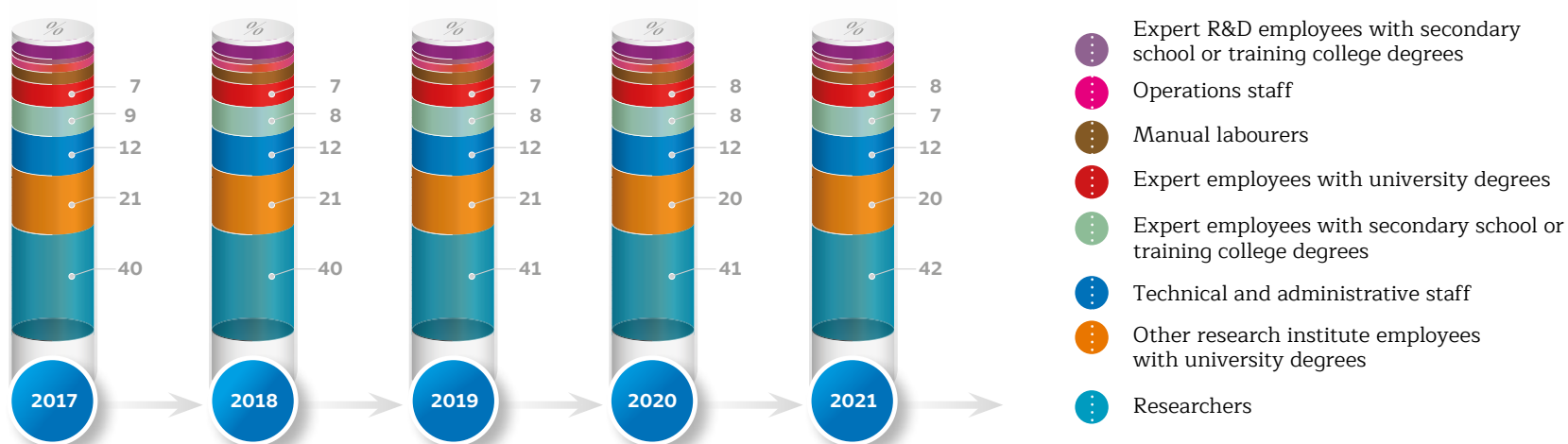
The total spent across all CAS institutes (public research institutions) in 2021 for 10,037 CAS employees was CZK 5,664,997,000 for salaries and CZK 191,336,000 for other work performed. The average monthly salary equalled CZK 47,033 with year-on-year growth of 2.08% from 2020.

The table below provides a more detailed look at average monthly salaries at public research institutions (including all funding sources – institutional and extra-budgetary) for each employee category.

Table 4: Number of employees and average monthly salary per category for 2021

Category	Average recalculated number of employees	Average monthly salary in CZK
Researchers	4,178	58,956
Other research institute employees with university degrees	2,011	37,087
Expert employees with university degrees	820	45,705
Expert employees with secondary school/training college degrees	733	34,706
Expert R&D employees with secondary school/training college degrees	227	35,774
Technical and administrative staff	1,220	46,649
Manual labourers	504	27,901
Operations staff	344	26,634
Total	10,037	47,033

Chart 2: CAS research institute employee categories





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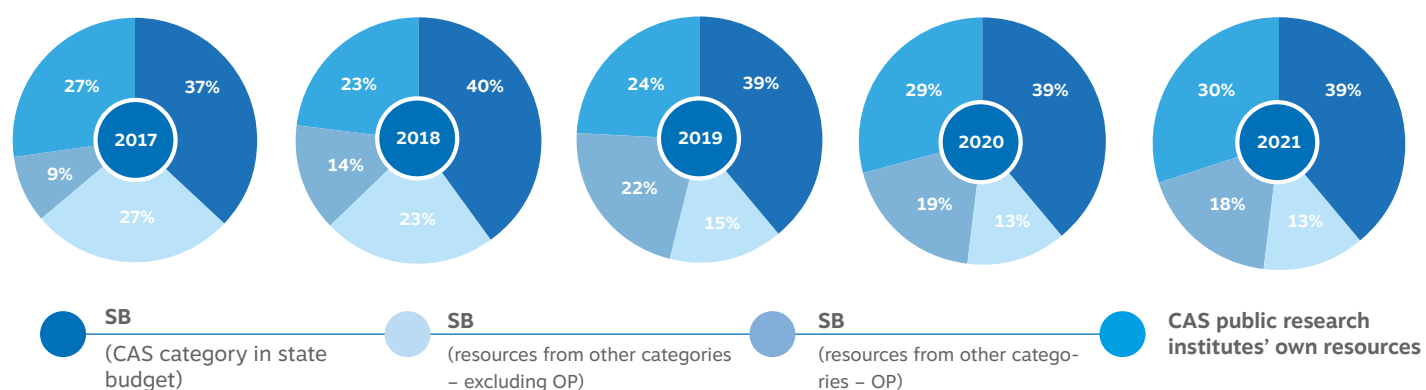


Financial Resources

and their use

In 2021, the Czech Academy of Sciences managed a total of CZK 17,829.28 million, of which CZK 6,948.29 million came from the CAS category in

the state budget (SB). This state budget funding equalled 39% of the CAS' total financial resources in 2021.

Chart 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 5: Structure of financial resources (actual) in mil. CZK

CATEGORY	Non-investment resources	Investment resources	TOTAL
Resources from the CAS budget category	5,553.82	1,394.48	6,948.29
Subsidies from other budget categories	4,547.53	938.70	5,486.22
GA CR grants	1,874.03	24.45	
TA CR projects	478.76	0.04	
Projects of other ministries, including operational programmes	2,194.73	914.21	
Public research institutes' own resources	5,394.76		5,394.76
Commissions relating to main activity	288.30		
Publication sales	82.55		
Rent	50.20		
Licenses	2,951.62		
Sale of goods and services	221.37		
Conference fees	6.14		
Interest, exchange rate profit	281.12		
Sale of material and securities	679.72		
Foreign grants and gifts	433.86		
Resources from own funds	234.58		
Other	165.31		
Total resources	15,496.10	2,333.18	17,829.28

CAS institutes used CZK 13,922.94 million of the total non-investment resources of CZK 15,496.10 million to cover their own expenses.

”

In comparison to 2020, the total expenditures of CAS institutes (public research institutions) increased by CZK 570.64 million.

Given that CAS institutes are managed as public research institutions in the system of non-governmental organisations and they are permitted to close their accounts by 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 2020, the total expenditures of CAS institutes (public research

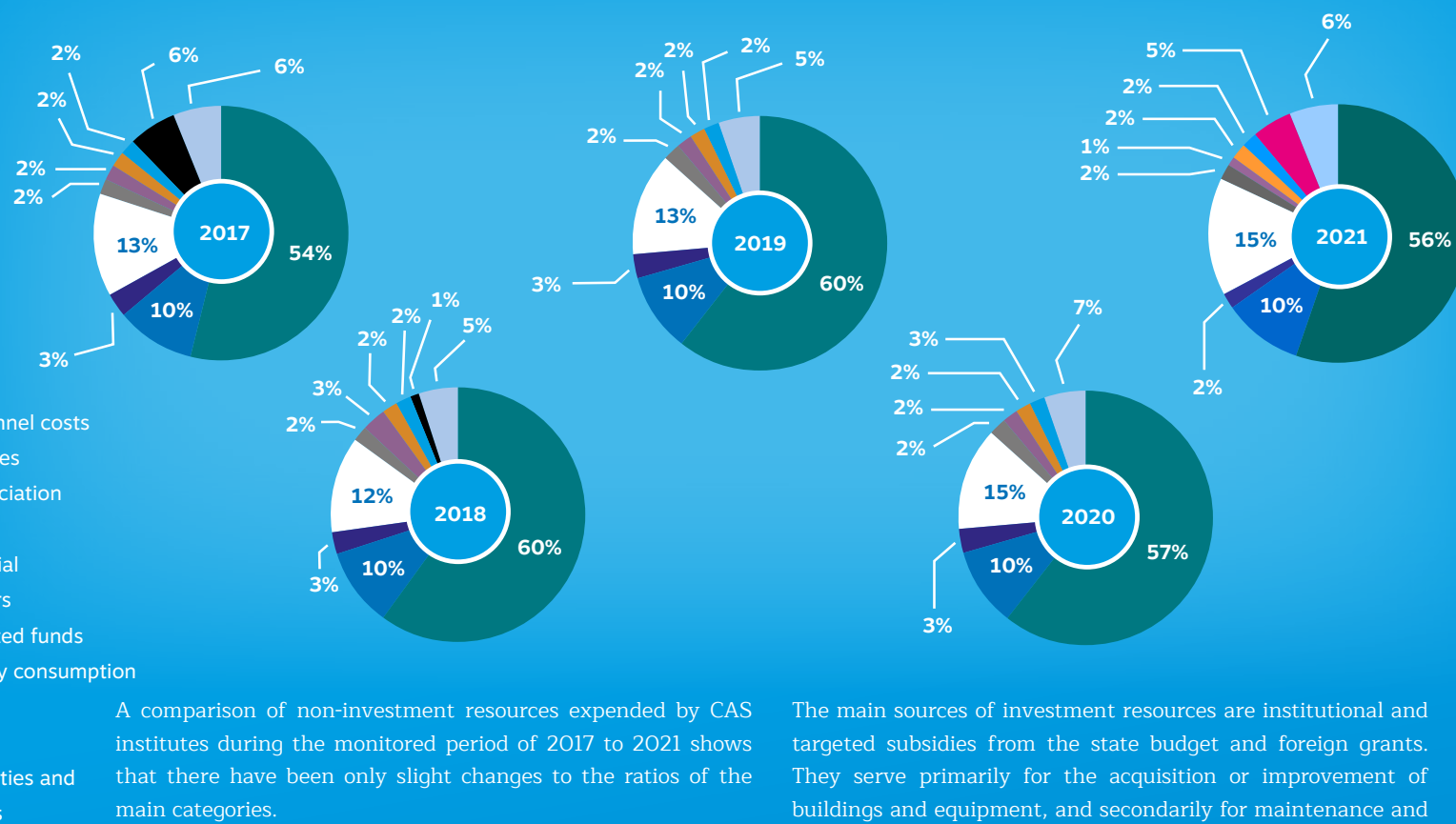
institutions) increased by CZK 570.64 million. A detailed breakdown of the expenditures of CAS institutes is provided in the following table.

Table 6: Structure of non-investment expenditures of CAS institutes (in mil. CZK)

TYPE OF EXPENDITURE	2020	2021	Coefficient
Personnel costs (wages, mandatory insurance paid by the employer, sickness insurance benefit reimbursements)	7,554.50	7,833.32	1.04
Materials (e.g. books, journals, small tangible assets, consumable supplies, protective gear)	1,323.97	1,329.05	1.00
Energy, water, fuel	340.48	329.62	0.97
Services (postal services, small tangible assets, rent, conference fees, other services)	2,002.50	2,055.77	1.03
Repairs and maintenance	237.99	241.71	1.02
Travel expenses	65.92	101.84	1.54
Creation of targeted funds in total	261.49	242.55	0.93
Transfer to social funds and other social expenses	261.27	288.61	1.10
Taxes and fees	300.15	337.46	1.12
Depreciation of fixed assets	216.01	237.97	1.10
Exchange rate losses	299.96	93.06	0.31
Securities and shares (sale of)	412.82	672.11	1.63
Other expenses (accident insurance, fines, damages)	151.56	249.33	1.65
Inventory change - own performance	0.14	-18.18	-131.46
Activation of material, goods, services and property	-76.48	-71.28	0.93
CAS institutes expended a total of	13,352.30	13,922.94	1.04

A significant cost item consists of depreciation of assets acquired with subsidies amounting to CZK 2,848.53 million, which is not included in this table.

Chart 4: Use of non-investment resources (in %)



A comparison of non-investment resources expended by CAS institutes during the monitored period of 2017 to 2021 shows that there have been only slight changes to the ratios of the main categories.

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 7: Investment resources of CAS institutes (in mil. CZK)

Financial resource	2020	2021	Coefficient
Resources from the CAS category of the state budget	1,366.3	1,394.1	1.02
Resources from other ministries, including operational programmes	951.9	938.7	0.99
Depreciation	213.0	244.1	1.15
Transfer of additional profits	43.4	31.7	0.73
Foreign grants and gifts	27.7	39.0	1.41
Revenue from sale of fixed assets	33.2	74.6	2.25
Aggregation of funds to acquire fixed assets	4.1	13.1	3.20
Total	2,639.6	2,735.3	1.04

Table 8: Use of investment resources by CAS institutes (in mil. CZK)

Type of expenditure	2020	2021	Coefficient
Financing of construction	1,040.0	851.9	0.82
Acquisition of instruments and equipment	1,639.3	1,532.1	0.93
Maintenance and repairs	31.5	119.1	3.78
Other	246.3	283.7	1.15
Total	2,957.1	2,786.9	0.94

Resource generation in 2021 equalled CZK 2,735.3 million and CAS institutes used a total of CZK 2,786.9 million in 2021. The asset reproduction fund decreased by CZK 51.6 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 and intent of public administrative controlling pursuant to Act No. 320/2001 Coll., on financial controlling, as amended.

The Division of Public Administration Control of the CAS Head Office is responsible for controlling at CAS with respect to the CAS' role as the founder of CAS institutes and provider of grants from public funding. The Division of Public Administration Control conducts every control in compliance with Act No. 255/2012 Coll., on inspection ("Inspection Code") and with internal CAS regulations, namely CAS Academy Council Guideline No. 3/2021 on Control Activities Focused on Management of Public Funds at the CAS and its Institutes.

Public administration controls and follow-up financial controls of grant recipients are conducted pursuant to the approved annual plan in alignment with the thematic focus of specific controls. Division of Public Administration Control controlling provides for the content and practical implementation of the requirement to verify management of state budget funding disbursed by the CAS as the administrator for the science and research budget category.

Controls conducted in 2021 pertained to verifying affected entities' fulfilment of legally stipulated conditions during utilisation of budget funding, record-keeping and subsequent reporting. The Division of Public Administration Control also examined compliance with procedures for the preparation, implementation and financing of capital investments as stipulated by valid legal regulations and internal rules, including due diligence in public property management. Throughout 2021, the Division of Public Administration Control also verified whether all transactions were properly reported in accounting, intangible

and tangible asset records were properly maintained and the principles of economy, effectiveness and efficiency were followed during use of the controlled entities' financial resources and assets.

The Division of Public Administration Control paid particular attention to controlled entities' contractual relations in regard to exercising property rights for intangible assets and optimising use of tangible assets and to supplier-customer relations. As in previous years, contractual relations were also verified in regard to fulfilment of legal obligations, particularly in relation to public tenders and the contract registry. Heightened attention was also paid to verifying whether the controlled entities use an internal controlling system, decision-making and approval processes and internal controlling mechanisms set by the management of the controlled institutes. Fulfilment of conditions stipulated by the labour code including employee liability for loss events at work is also controlled regularly.

Control findings were described in control reports in compliance with valid legal regulations. Cases of non-compliance were subsequently discussed at length with the management and responsible employees of the controlled entities. The Division of Public Administration Control subsequently analysed the identified problems in greater detail. After appropriate generalisation, the Division of Public Administration Control discussed the basis of each case, including a solution corresponding to the valid legal regulation, with employees of the economic departments of CAS institutes at regular meetings in order to prevent repeated occurrence of the identified irregularities in the future. In all cases, control reports and conclusions were submitted to the President of the CAS and other members of the Academy Council Presidium for discussion at CAS Academy Council sessions.



Despite the long-term adverse situation caused by the covid-19 epidemic and related government regulations that fundamentally restricted or hindered people's mobility and social contacts, the Division of Public Administration Control fulfilled the approved 2021 public administration controlling plan for academic institutes. In 2021, the Division of Public Administration Control controlled a total of CZK 590,883,682 in financial resources provided to CAS institutes from the CAS budget category. During 2021, the Division of Public Administration Control conducted and completed controls at the following eight CAS institutes:

- Institute of Art History
- Institute of Slavonic Studies
- Institute of Experimental Medicine
- J. Heyrovský Institute of Physical Chemistry
- Institute of Computer Science
- Institute of Archaeology, Brno
- Institute of Physics of Materials
- Masaryk Institute and Archives

Control reports were handed over to the directors and chairpersons of the supervisory boards of the controlled entities with the exception of the Masaryk Institute and Archives, where the report will be handed over in January 2022. The

directors of the controlled institutes subsequently adopted relevant measures to remedy the identified irregularities. The Division of Public Administration Control will continue to monitor implementation of these measures.

Based on an Academy Council decision, the Division of Public Administration Control conducted a follow-up control at the Economics Institute in June 2021 to verify fulfilment of measures adopted by the director of the Economics Institute to eliminate irregularities identified in a control.

In 2021, the Division of Public Administration Control also controlled use of grants and accounting in the CAS budget among recipients which have a founder other than the CAS. Controls were conducted at 6 scientific societies associated in the Council of Scientific Societies of the Czech Republic (hereinafter also as the "Scientific Societies"):

- Czech Botanical Society
- Czech Immunological Society
- Czech Political Science Association
- Linguistic Association of the Czech Republic
- Journal of the Moravian Foundation
- Czech Society of Cardiology

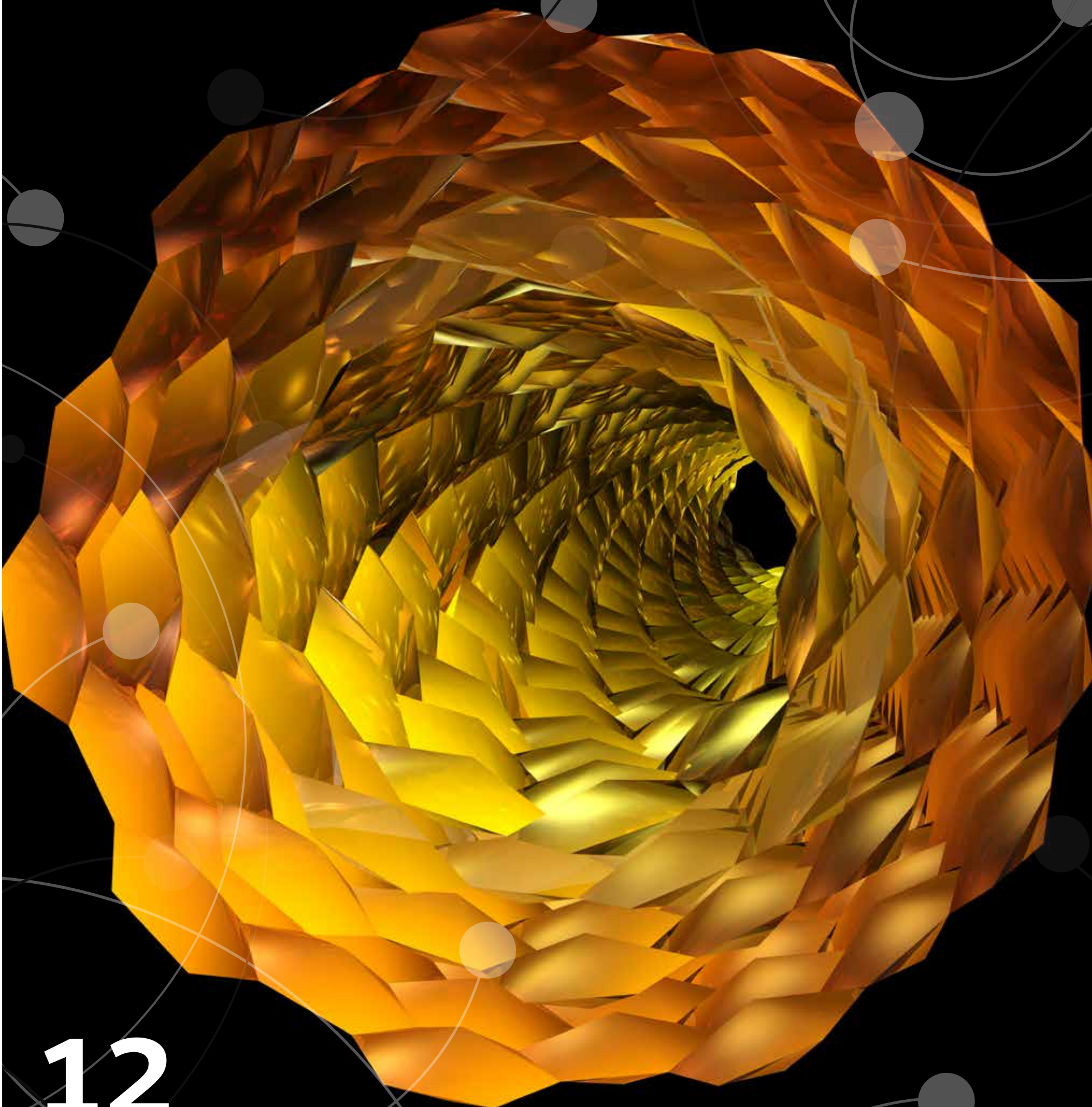
The Division of Public Administration Control conducted detailed audits of use of 15 project grants in a total amount of CZK 745,000 at these societies. This was 10% of the total volume of funding provided to the given entities in 2020.

In 2021, the Division of Public Administration Control also controlled allocation, use and accounting of grants provided by the CAS to CAS institutes and to scientific societies for research, educational and similar activities totalling CZK 591,628,682.

Upon request from CAS institutes, the Division of Public Administration Control also conducts audits of accounting of funding provided to the given institute through EU framework programme projects. In 2021, partial audits were conducted of ongoing EU framework programme projects totalling EUR 2,088,260.36, which equals CZK 54,598,214 per the given exchange rate.

The Division of Public Administration Control is also responsible for processing complaints and suggestions sent to CAS bodies and the CAS Head Office. In addition to cases sent directly to the Division of Public Administration Control the Divi-

sion of Public Administration Control maintains records of other complaints addressed to other CAS Head Office departments or the management of CAS institutes and in some cases takes part in resolving these complaints. In 2021, the Division of Public Administration Control recorded 11 complaints and notifications, three of which were deemed justified and one of which is still being resolved.



12



Support of Excellence

The scientific 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) intended for scientists in all scientific fields who are working on excellent research. Another means of support is the Otto Wichterle Award for selected promising young researchers.

The Czech Academy of Sciences supports prominent foreign scientists who are invited to collabo-

rate with the CAS through the Lumina Quaeruntur Research Fellowship and the Jan Evangelista Purkyně Fellowship. The CAS also offers targeted support for early career scientists through three further programmes: the Programme to Support Prospective Human Resources – Postdoctoral Fellows, the Programme for Research and Mobility Support of Starting Researchers and the Josef Dobrovský Fellowship Programme. Each year, the prestigious Czech Academy of Sciences Prizes reward successful scientists for their outstanding scientific achievements.

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 on 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 their research 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 grants in terms of its significance and prestige as well as the amount of financial support awarded.

THE 2021 ACADEMIC PREMIUM AWARD-WINNERS INCLUDE:

RNDr. Šárka Nečasová, DSc.

Institute of Mathematics

Šárka Nečasová has worked at the Institute of Mathematics since 1995 and has significantly enriched the theory of compressible and incompressible fluid flow around moving rigid bodies. She has developed new approaches to investigate the asymptotic behaviour of viscous fluids.

She also proved the Žukovsky hypothesis in 2019 using partial differential equations. With colleagues G.P. Galdi and V. Mácha, she proved the theoretical assumption that neither fluid type nor shape affects the stability of a rotating rigid body with a fluid-filled cavity. These types of



rotating bodies stabilise and permanently rotate.

Šárka Nečasová specialises in mathematical analyses of fluid mechanics models, dynamics of solid substances and their interaction. Such models have huge application potential. They can advance understanding, for example, in biomedicine (numerical prediction of blood clotting, simulation of vocal cords, generation and detection of sound) or in the environmental sciences (oceanography, meteorology – the effect of flow on deformation of bodies, acoustic wave propagation models). RNDr. Nečasová wants to direct development of a new mathematical theory and further improvement of existing flow models and interaction of fluids with a structure towards

practical applications in medicine and industry.

Šárka Nečasová graduated from the Mathematics and Physics Faculty of Charles University, and then worked as a PhD student at the Faculty of Mechanical Engineering at the Czech Technical University in Prague. Her doctoral thesis was at the Faculty of Nuclear and Physical Engineering at the Czech Technical University in Prague. She defended her habilitation thesis at the L'Université de Pau et des Pays de l'Adour in France. She has also held internships and lectureships at universities in Würzburg, Beijing, Nanjing and Seoul, and the Tata Institute in Bangalore, India.

In 2013, she was awarded the "Doctor of Sciences" (DSc.). Since 2018, she has been a member of the Learned Society and since 2020 she has been the Chair of Section 1 Mathematics-Physics.

Prof. RNDr. Patrik Španěl, Dr. rer. nat.

J. Heyrovský Institute of Physical Chemistry

Patrik Španěl's scientific focus is an exemplary combination of the disciplines he studied: he graduated in physical electronics from the Mathematics and Physics Faculty of Charles University, and focused on ionised gas physics while pursuing his PhD at Leopold-Franzens Universität in Innsbruck. It is the ions in gases that allow the aforementioned very sensitive measurements.

The particles he is interested in occur in the air (and in human breath) in the smallest concentrations (on the order of 10^{-9}). These are units of molecules compared to the billions of molecules in exhaled air, which conventional spectrometers are unable to measure.

Interestingly, Patrik Španěl's path to the study of human breath led through ion reactions in interstellar clouds. As a student, he was introduced to ion chemistry and one of the areas he explored was how organic molecules form in space, in interstellar clouds.

Then he began pondering what other areas ion chemistry could be applied to, and he focused his research on trace analysis of air and human breath.

The methods that he helped develop are used by customs officers to avoid being poisoned when opening and checking deliveries or cargo containers. Precise detection of vapours can also provide



valuable information during monitoring of polluted air, production of semi-conductor chips, food quality inspection and increasingly in medicine. However, small, affordable instruments for these purposes are still lacking and there is room to improve the precision and reliability of measurements.

The findings obtained by Patrik Španěl's team will lead to the development of practical analytical instruments and methods.

Prof. RNDr. Vojtěch Novotný, CSc.

Biology Centre



Vojtěch Novotný is a leading Czech biologist who primarily studies the ecology of tropical forests in comparison to Central European forests. Since 1997, he has managed a research station in Papua New Guinea and has also worked in the forests of Panama, Guyana, Cameroon and Vietnam. He has also held positions in the United Kingdom and USA.

He built a research group at the Biology Centre consisting of 10 laboratories that study ecology and the evolution of biodiversity, each with a slightly different methodological emphasis on

ecology, phylogeny, biochemistry or biostatistics. This international team has become one of the leading ecology institutes in the Czech Republic and has been awarded European Research Agency grants.

Vojtěch Novotný also focuses on developing research capacity in the tropics, in particular in Papua New Guinea, where he founded and leads the NGO New Guinea Binatang Research Center. It operates internationally significant research infrastructure, including vegetation areas on which more than a quarter of a million plants can be observed using a crane to examine the crowns of trees or study forest areas from 200 to 3700 m above sea level. The centre also trains half of all postgraduate biology students in the country and its education

of paraecologists is considered a model for other tropical countries. Center staff also helped establish and administer two protected tropical forest areas of 300 km².

Vojtěch Novotný's work creates research and study opportunities for Czech students in the tropics, as well as similar opportunities for students from tropical countries in the Czech Republic.

Vojtěch Novotný graduated from the Faculty of Science at Palacky University in Olomouc. He described his findings from the largest tropical island in a book of feuilletons titled *Papuan (Half) Truths*. He is a member of the Learned Society of the Czech Republic and Academia Europaea. He also teaches at the University of South Bohemia in České Budejovice.



The purpose of programmes promoting excellence at the Czech Academy of Science is to strengthen top research at its institutes both morally and financially



LUMINA QUAERUNTUR FELLOWSHIP

The Lumina Quaeruntur Fellowship provides financial aid to promising researchers, enabling them to compose their own research teams and fund their work for up to five years. The fellowship has two key conditions: the fellow must submit a project proposal to the European Research Council (ERC) or a similar international grant agency during the fellowship, and the length of the fellow's scientific practice since receiving a doctorate must be no more than 10 years. Both Czech and foreign researchers are eligible for the fellowship.

IN 2021, SIX SCIENTISTS FROM DIVERSE CAS INSTITUTE DISCIPLINES BECAME LUMINA QUAERUNTUR FELLOWS:



Dr. Dominik Kriegner

Institute of Physics

His research group focuses primarily on new experimental research of thin layers of unconventional magnetic-multipole materials. The project objective is to find wholly new materials and phenomena with the potential for spintronics.



Elisabeth Hehenberger, Ph.D.

Biology Centre

Her new research programme will enrich existing research into molecular unicellular eukaryote evolution in an original way at the laboratories of the Parasitology Institute of the Biology Centre. She will focus on how to clarify the early stages of relationships between host organisms and endosymbionts, which are organisms that live in the host's cells.



Martin Fotta, Ph.D.

Institute of Ethnology

Through ethnographic and archival research, Martin Fotta's team will monitor how the social status of Roma has changed in relation to concrete racial systems and socio-economic contexts (colonisation, slavery, exile and migration).



Dr. phil. Mag. rer. soc. oec. Jan Jakub Surman

Masaryk Institute and Archives

His research looks at the role of science in the development of the Czechoslovak Republic with a particular focus on the interwar period. A major turning point occurred after World War I: science and technology were recognised as the key to victory. But they can also be devastating and scientists are willing to expose and further develop this destructive aspect.



Ing. Mgr. Šárka Mikmeková, Ph.D.

Institute of Scientific Instruments

The project that Šárka Mikmeková is currently preparing is intended to develop objective methods of classifying microstructures in all types of advanced steel at a high precision level (over 95%). The new laboratory will be the first in the Czech Republic to integrate artificial intelligence into material research. Her research aims to be an important source of support for examination of new types of steel in both the academic and industrial sectors.



Ing. Matěj Velický, Ph.D.

J. Heyrovský Institute of Physical Chemistry

His research at the interface of electrochemistry, spectroscopy and nanomaterial research pushes the boundaries of contemporary scientific knowledge. He will focus on extremely sensitive and thin 2D materials in his project supported by the Lumina Quaeruntur Fellowship.



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 innovative teams at their respective institutes. In 2021, the CAS funded 14 J. E. Purkyně fellows with total funding of CZK 11,725,000. New proposals have not been accepted since 2018. Funding for previously approved projects will continue until 2022 (until 2023 in one case).

OTTO WICHTERLE AWARD

This award is intended for extraordinarily talented, promising CAS scientists up to 35 years of age. The award bears the name of Professor Otto Wichterle, an outstanding world-class Czech chemist, 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 scientific disciplines. In 2021, CAS President Eva Zažímalová bestowed the Otto Wichterle Award to the following 24 young scientists:

I. MATHEMATICS, PHYSICS AND EARTH SCIENCES

RNDr. Petra Suková, Ph.D.
Astronomical Institute
Ing. Jan Berger, Ph.D.
Institute of Physics
Mgr. Maksym Buryi, Ph.D.
Institute of Physics
Ing. Ladislav Chytka, Ph.D.
Institute of Physics
Tomasz Kania, Ph.D.
Institute of Mathematics
RNDr. František Lukáč, Ph.D.
Institute of Plasma Physics
Ing. Petr Vondráček, Ph.D.
Institute of Plasma Physics
RNDr. Zuzana Roxerová, Ph.D.
Institute of Geophysics

II. LIFE AND CHEMICAL SCIENCES

Haider Golam, Ph.D.
J. Heyrovský Institute of Physical Chemistry
Mgr. Rafał Łukasz Konefał, Ph.D.
Institute of Macromolecular Chemistry
RNDr. Zuzana Morávková, Ph.D.
Institute of Macromolecular Chemistry
RNDr. Eliška Procházková, Ph.D.
Institute of Organic Chemistry and Biochemistry
RNDr. Tomáš Slanina, Ph.D.
Institute of Organic Chemistry and Biochemistry
Mgr. Petra Beznosková, Ph.D.
Institute of Microbiology
Mgr. Anzhelika Butenko, Ph.D.
Biology Centre
RNDr. Pável Matos-Maraví, Ph.D.
Biology Centre
RNDr. Martin Volf, Ph.D.
Biology Centre
Ana Novoa, Ph.D.
Institute of Botany
Mgr. Barbora Pafčo, Ph.D.
Institute of Vertebrate Biology
Mgr. Zuzana V. Harmáčková, Ph.D.
Global Change Research Institute



III. HUMANITIES AND SOCIAL SCIENCES

JUDr. Jakub Drápal, M.Phil., Ph.D.
Institute of State and Law
PhDr. Jan Květina, Ph.D.
Institute of History
Johana Wyss, MSc., D. Phil.
Institute of Ethnology
Mgr. Ivo Pezlar, Ph.D.
Institute of Philosophy

PROGRAMME TO SUPPORT PROSPECTIVE HUMAN RESOURCES – POSTDOCTORAL FELLOWS

at CAS institutes is intended for starting postdoctoral fellows (within two years of the defence of their Ph.D. dissertation or equivalent, or four years in the case of long-term study abroad or parental leave).

In 2021, through programme calls, 27 candidates were supported in the 16th call and 31 candidates in the 17th call (with funding commencing on 1 January 2021 or 1 July 2021).

PROGRAMME FOR RESEARCH AND MOBILITY SUPPORT OF STARTING RESEARCHERS

This programme, initiated in 2016, was created to support the development of collaboration between CAS institutes and prominent international scientific research institutions and enable starting researchers to independently take part in active international collaboration. In 2021, support totalling CZK 6,540,000 was awarded to 25 projects.

JOSEF DOBROVSKÝ FELLOWSHIP PROGRAMME

This 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 research. In 2021, total funding of CZK 338,000 was provided for 10 study visits at two CAS institutes. The following researchers received support:

Isidora Grubački, M.A. Institute of Contemporary History
Mgr. Magdalena Bystrzak, Ph.D. Institute of Czech Literature
Cezary Rosiński, Ph.D. Institute of Czech Literature
Dr. phil. Jana Kantoříková, Ph.D. Institute of Czech Literature
Mgr. Jana Lainto, M.A. Institute of Czech Literature
Mgr. Magdalena Brodacka Institute of Czech Literature
Lena-Marie Franke, M.A. Institute of Czech Literature
Alexandra Pietroch, M.A. Institute of Czech Literature
Mgr. Anna Mašlanka Institute of Czech Literature
Dr. Alena Heinritz Institute of Czech Literature

ERC-CZ/AV PROGRAMME

This is a programme to support projects of researchers who have received an A in the second round of the European Research Council expert panel evaluation (i.e., not supported due to a lack of funding) or a B. In 2021, the CAS continued to support one project with funding of CZK 6,900,000. The project investigator is:

Mgr. Iva Mozgová, Ph.D.
Biology Centre



CZECH ACADEMY OF SCIENCES AWARDS

Each year, the Czech Academy of Sciences bestows these awards on outstanding researchers for exceptional research results focused on societal priorities which have strengthened the competitiveness of Czech science internationally, and which were first published or implemented within the last five years. In 2021, the Award of the Czech Academy of Sciences for outstanding results of great scientific significance was bestowed by CAS President Eva Zažímalová upon the following researchers:

Mgr. Dušan Coufal, Th.D.,
nominated by the Institute of Philosophy

for the scientific work *Faith Tournament. Controversy over the chalice at the Basel Council 1431-1433.*

TEAM OF AUTHORS NOMINATED BY THE ASTRONOMICAL INSTITUTE, INSTITUTE OF ATMOSPHERIC PHYSICS AND INSTITUTE OF PLASMA PHYSICS

for the scientific work *Solar Orbiter: participation of CAS institutes in the cutting-edge ESA space mission to the Sun.*

TEAM OF AUTHORS NOMINATED BY THE INSTITUTE OF EXPERIMENTAL MEDICINE

for the scientific work *5-fluorouracil and other fluoropyrimidines in colorectal cancer: past, present and future.*





13



International Cooperation

In alignment with the CAS Concept of Support of International Cooperation, the Czech Academy of Sciences has long been committed to increasing its institutes' international engagement, heightening their international profile and raising awareness of their ground-breaking scientific achievements beyond the borders of the Czech Republic. Despite the covid-19 pandemic, the CAS continued in its efforts to actively engage in supranational initiatives in 2021. The Czech Academy of

Sciences systematically sought out new research opportunities through bilateral or multilateral collaboration programmes, and worked to diversify possible international research destinations for its scientists. Support for participation in European Union programmes is another traditional and integral part of the CAS' efforts toward greater international involvement. The CAS also dedicated sustained energy to activities in international organisations.

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Succeeding in highly competitive ERC grant calls is a sign of a scientist's excellence, courage and visionary nature and the ground-breaking character of his or her idea. A new mentoring initiative implemented in collaboration with Charles University is intended to help promising young researchers who are interested in these prestigious grants refine their research ideas.

International scientific collaboration was limited to some degree in 2021 due to the continuing covid-19 pandemic. Similarly to 2020, most planned activities could not take place and only some of them could be shifted to an online environment; others were postponed for the next year and several had to be cancelled entirely. Events that had to be postponed yet again included the traditional meeting of V4 country academy of sciences representatives, a meeting of management of the CAS and Slovak Academy of Sciences, Czech-Taiwanese Days of Technology, and a joint Czech-Israel workshop on the topic of Law between State and History planned in collaboration with the Israel Academy of Sciences (IASH). In an effort to at least partially support and intensify CAS institutes' international collaboration within existing conditions, the CAS took part in a two-day online conference called UK – V4 Frontiers of Science Meeting 2021 in June. The conference was initiated by the British Royal Society and co-organised by the academies of science of the Visegrad countries to connect talented young scientists and ignite discussion around their research themes and current trends. The CAS led a panel on Life Science and Pandemics headed by Luděk Berec of the Biology Centre. In May, CAS representatives took part in a Czech-German roundtable on the Dioscuri programme, which was organised by the Max Planck Society and Czech Ministry of Education, Youth and Sports. In September, the CAS organised an online meeting for scientists from CAS institutes and selected laboratories from the National Applied Research Laboratories (NARLabs) in Taiwan. In addition, the Academic Prague annual meeting took place in the autumn, bringing together representatives of the CAS, of diplomatic missions of foreign countries in the Czech Republic and of Czech universities.

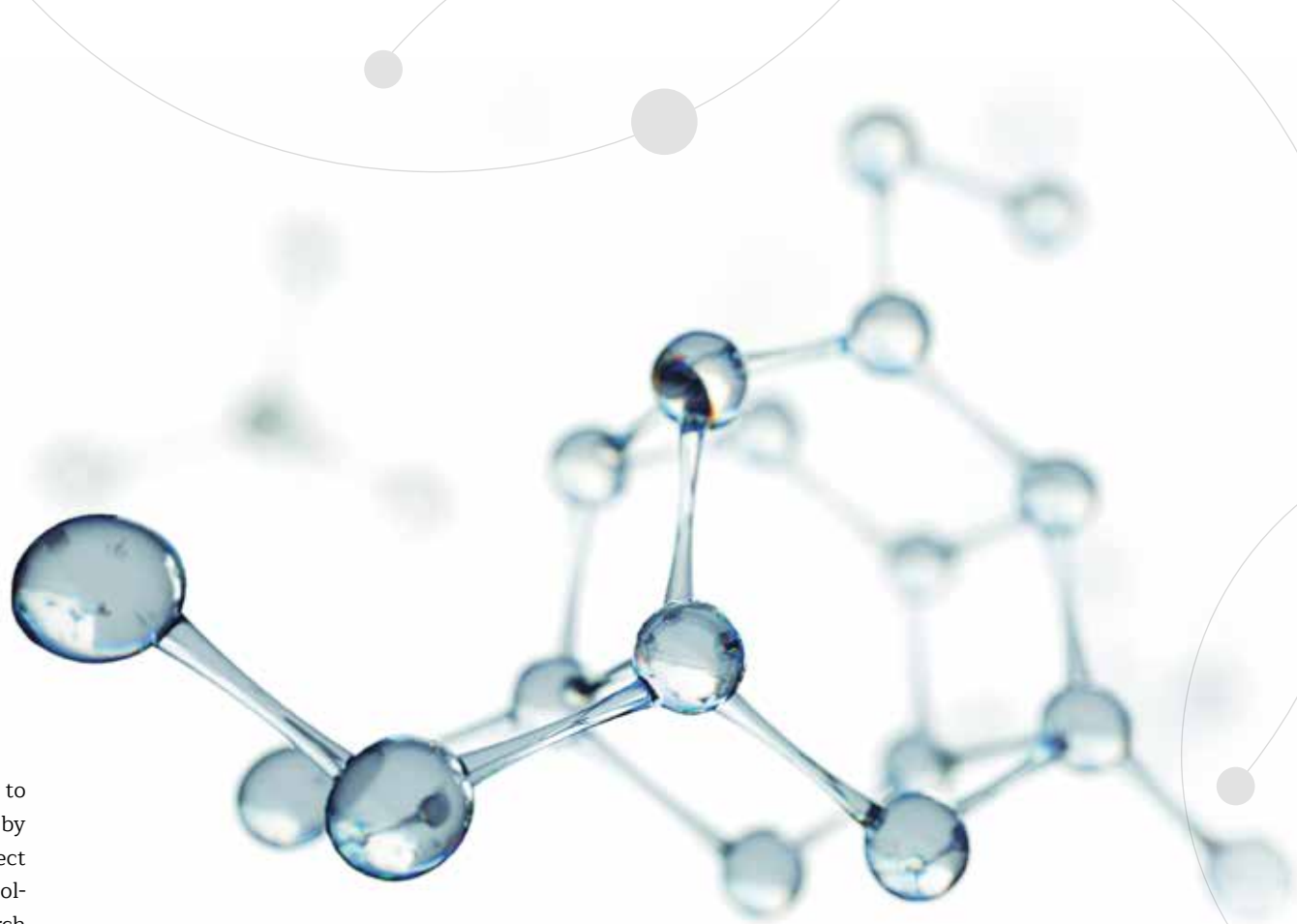
Despite pandemic restriction measures, several international delegations visited the CAS. During the second half of the year, representatives of foreign embassies located in Prague visited the CAS. These included courtesy meetings with ambassadors from Armenia, Chile, South Africa and the Taiwan Economic and Cultural Office. In September, the CAS leadership met with Saxon Minister for Science Sebastian Gemkow on the occasion of the ceremonial inauguration of the Czech-German Leibniz GWZO Prague research platform. In October, CAS leadership received a Taiwanese government delegation led by Minister of Science and Technology Tsung-Tsong Wu, which included representatives of several scientific institutions (NARLabs, Hsinchu Science Park). CAS representatives met online or offline with scientific diplomats who work at Czech representation offices in Israel, the USA and Taiwan and took part in several international trips, namely to Belgium, Esto-



Saxon Minister for Science Sebastian Gemkow

nia, Latvia, Poland and the United Kingdom, to promote scientific collaboration and initiation of new contacts. However, many international visits had to be cancelled due to the adverse epidemic situation in the partner countries.

As the largest research organisation in the Czech Republic, the CAS plays a very active role in international non-governmental organisations, both by fully supporting and co-creating their activities and representing their mission – primarily seeking common approaches to scientific and societal challenges – both domestically and abroad. For several years, the CAS has been an active member of prominent international organisations including the European Academies Science Advisory Council (EASAC), All European Academies (ALLEA), International Science Council (ISC), InterAcademy Partnership (IAP) and others. Throughout last year elected representatives of the CAS actively participated in online panel sessions, working groups and committees and participated in the preparation of expert articles. In 2021, the CAS successfully nominated four experts to newly established ALLEA and EASAC working groups. In cooperation with the International Human Rights Network of Academies and Scholarly Societies (IHRNASS), of which the CAS is a member, the CAS supported a declaration calling for the governments of Myanmar and Nicaragua to uphold human rights. The CAS also joined an appeal to the political representatives of China, Iran and the United Arab Emirates to release three detained scientists.



ERA Cooperation

The CAS' long-term, committed efforts to strengthen engagement in activities supported by the European Research Area (ERA) include direct participation in creation of European science policy and increasing its participation in EU research initiatives.

CAS institutes consistently express a high level of interest in EU framework programmes, which give scientists the opportunity to expand their network of professional contacts, gain access to unique research facilities and above all to help address current pressing societal challenges. Aside from implementation of concluding projects funded from the previous two EU framework programmes, scientists actively applied for the first grants from Horizon Europe, a new seven-year EU programme supporting research and innovation. In 2021, CAS institutes worked on 182 projects. There was one, very last project funded by EU Framework Programme 7, for which the EU granted EUR 1,115,000 in 2021 through an ERC Synergy grant, whose co-investigator is Jan Řidký from the Institute of Physics, and 180 Horizon 2000 projects, for which CAS institutes received EUR 13.3 million from the European Commission in 2021, and last but not least the first Horizon Europe project, which has provided the Institute of Plasma Physics with EUR 292,000 so far.

To increase the success of Czech applicants in European Research Council (ERC) grant competitions, through which the EU supports visionary projects going beyond the frontiers of current knowledge, a joint expert group was founded in January 2021 by Charles University and the CAS,

which works in close cooperation with the CAS Technology Centre. In addition, a CAS grant call to support ERC project applicants was announced for the first time in 2021. The CAS' reward for its consistent efforts were three grants for young scientists, namely for Hana Cahová and Tomáš Slaniņa (both from the Institute of Inorganic Chemistry and Biochemistry) and Kateřina Rohlenová (Institute of Biotechnology), who were successful in the formidable international competition of the ERC grant program.

For the third year in a row, the CAS also focused on staff of project departments at scientific institutes. In June 2021, project managers learned about the new developments in the Horizon Europe Framework Programme at a group meeting, and in November an educational seminar for new European project administrators was held. Through systematic support of project managers, the CAS aims to help improve the support system and services for researchers, and thus reduce the bureaucratic workload that falls on scientists in relation to preparation and implementation of EU projects.

Aside from research, CAS scientists also provide independent expert advisory services to Eu-

ropean institutions. Involvement in EU-level advisory groups and expert panels enables the CAS to play a role in creating European research and innovation policy priorities and to initiate legislative changes according to cutting-edge scientific findings. An important success in this regard was the appointment of CAS President Eva Zažímalová to the Group of Chief Scientific Advisors to the EU. The CAS' highest representative assumed this office in May 2021.

In December 2021, the CAS became a signatory to the Research and Innovation for the Future of Europe manifesto, which is an appeal to include research and innovation in the Conference on the Future of Europe to thrust these areas into the centre of debates about the EU's challenges and future priorities.

Bilateral and Multilateral Collaboration

In 2021, the CAS took part in bilateral and multilateral collaboration with European and non-European countries through joint research programmes. The CAS continued to update contractual documents, extended existing collaborative ties and entered into several new bilateral agreements on collaboration through joint mobility projects. These included, e.g. the French National Centre for Scientific Research (CNRS), one of the largest research organisations in Europe, and the Taiwanese Academia Sinica, a leading research organisation in Taipei. Declarative agreements on collaboration with Kyoto University in Japan and the Brazilian Academy of Sciences (ABC) were signed as well. An important event was the culmination of long-standing efforts to initiate collaboration with the Massachusetts Institute of Technology (MIT). The agreement between MIT and IOCB Tech, a subsidiary of the Institute of Inorganic Chemistry and Biochemistry, which was signed in April 2021, marked the factual establishment of collaborative ties between MIT and the CAS, and in fact the whole of the Czech Republic (MIT-Czech Republic Seed Fund). In September 2021, MIT held its first project competition for scientists from any research institution in the Czech Republic. Ten project proposals were submitted (which will be evaluated in the first quarter of 2022).

Many bilateral collaboration programmes supporting researcher mobility were significantly affected by the pandemic and could not be implemented as planned. Thus, CAS support for bilateral projects in 2021 amounted to only CZK 4.3 million. Similarly to the previous year, the CAS, in agreement with international partners, granted a one-year extension to international collaboration projects due to end in 2021 while maintaining funding according to the original project proposal. Implementation was extended for 30 joint mobility projects. In a new tender for projects supporting researcher mobility, 41 projects from 13 countries were supported out of a total of 114 submitted proposals.

In terms of multilateral collaboration in 2021, CAS institutes continued to address two ERA-



CAS President Eva Zažímalová (centre), Dr. Z. Havlas (left) and Prof. D. Honys (right) at the contract signing ceremony with NARLABs (National Applied Research Laboratories) of Taiwan

NET Cofund projects co-financed by the European Commission. In December 2021, the Institute of Sociology concluded the DAISIE project within the NORFACE partnership, which was extended by 12 months due to the covid-19 pandemic. The project was supported with funding of CZK 424,000 in its final year. A CAS grant of CZK 1.49 million was awarded last year to the VICTOR-E project implemented by the Institute of Contemporary History within the HERA partnership. These two partnerships announced a unique joint interdisciplinary programme called CHANSE in 2021, which is also co-financed by the European Commission. CAS institutes expressed remarkable interest in the programme. In regard to other multilateral activities in 2021, in addition to three ongoing SEA-Europe JFS projects (J. Heyrovský Institute of Physical Chemistry, Institute of Inorganic Chemistry, Institute of Microbiology and the Biology Centre), another project was initiated and supported with the participation of a CAS team, this time from the Institute of Microbiology. A total of CZK 3.52 million was expended for

the projects in 2021. CAS institute scientists also had the opportunity to take part in new tenders for multilateral projects on the SEA-Europe JFS and EIG CONCERT-Japan platforms in 2021. An indication of the CAS' effort to contribute to the functioning of these platforms by participating in process issues is the fact that the CAS took on the role of organiser for one workshop held through the EIG CONCERT-Japan partnership which aimed to present the main outcomes of the winning projects from one of the previous calls.

CEFRES Platform cooperation

Under French-Czech CEFRES Platform cooperation between the CAS, the French National Centre for Scientific Research (CNRS), Charles University and the French Embassy in the Czech Republic, the research team comprised of Michèle Baussant (Institut des sciences sociales du politique, CNRS) and Johanna Wyss (Institute of Ethnology of the CAS) continued in its work on the project "Europe: a resentful confederation of

vanquished peoples? Raw and lapsed memories of post-imperial (European) minorities". The third tender also took place last year and the international committee supported a two-year project led by investigators Petr Gibas (Institute of Sociology of the CAS) and Chloé Mondème (École Normale Supérieure de Lyon) called "Home beyond species: More-than-human dwelling in the age of crises", which will begin in February 2022.

2021 was a jubilee year for the CEFRES Platform cooperation, as CEFRES (the French Research Center in Humanities and Social Sciences) celebrated its 30th anniversary. On this occasion, the CAS, Charles University and CEFRES organised an international conference titled "Knowledge, power and academic freedom in Europe

(and beyond)", which succeeded in connecting representatives of the academic and diplomatic spheres from the two countries. The gala conference was divided into two parts, one in May and the second in November 2021. During the conference there was discussion about the past, i.e. the founding of CEFRES in 1991 to renew French-Czech collaboration and scientific research in the humanities and social sciences in Central Europe, and the present and future of Czech-French relations in the European context. There was also discussion about relations between academic knowledge and power and related academic freedom.

Since its founding, the CEFRES French-Czech Platform has given Czech and French students, postdoctoral fellows, scientists and others the opportunity to take part in many seminars, workshops and conferences, and in addition since 2014 it has supported two important projects led by French-Czech teams included in the TANDEM programme, which aspire to win ERC grants and one of which has already done so.





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Regional Cooperation

The Czech Academy of Sciences helps Czech regions and microregions improve their 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 Re-

gion (2015), Central Bohemian Region (2016), Karlovy Vary Region (2016), Olomouc Region (2017), South Bohemian Region (2018), Pilsen Region (2019), Šumava National Park Administration (2019), Liberec Region (2020) and the Moravian-Silesian Region (2020). In 2021, these agreements were implemented through 19 joint projects which were financed according to agreements between CAS institutes and their regional partners.

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Collaboration between CAS institutes and regional partners such as regions and microregions of the Czech Republic focuses on addressing social, economic, ecological, natural and cultural issues through basic research and application projects.

In 2021, CAS institutes from the sections of Applied Physics, Earth Sciences, Chemical Sciences, Biological and Medical Sciences, Historical Sciences and Humanities and Philology were engaged in regional cooperation. Projects focused on the following topics: threats to water management and agriculture (terrain monitoring of water levels in soil profiles), ensuring the safety of underground mines (scanning to identify the precise condition of underground mines), study of medicinal plants (research into the effects of cultivation methods on the content of biologically active substances in natural resources), preparation of space missions (design of technology for observation of meteors from orbit), archaeological research as a way of enhancing cultural, educational and tourism portfolios in regions as well as reviving awareness of significant personalities in regional and municipal Czech and Czechoslovak history.

These collaborative projects are 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), Šumava National Park Administration (2019), Liberec Region (2020) and the Moravian-Silesian Region (2020). In 2021, these agreements were implemented through 19 joint projects which were financed according to agreements between CAS institutes and their regional partners.

Section of Earth Sciences

- Geophysical Museum Skalná in the Skalná Primary School (Skalná).
- 3D spatial survey of the underground of the Svornost mine to identify the real layout of the mining areas, including follow-up analyses (Jáchymov).
- Drainage and 3D laser scanning of the St. Antonín Paduánský mine in Horní Město to identify its real layout and volume including identification of mine water courses for possible future use for the municipality of Horní Město, phase II – expansion of measurement station and findings and time series (Horní Město).

Section of Chemical Sciences

- Radio spectrum observation of ionospheric disturbances (Karlovy Vary).
- Development of the land component of space missions (Valašské Meziříčí).
- Monitoring the quality of plant matrices from the Apiaceae and Asteraceae families in relation to their complex cultivation technology (Brno).

Section of Biological and Medical Sciences

- Phosphorus cycle in alternative waste water treatment systems (Pardubice).
- Study of use of compost to raise the organic content in soil and improve soil absorption as a measure to fight drought in the Central Bohemian Region (Dobříš).

Section of Applied Physics

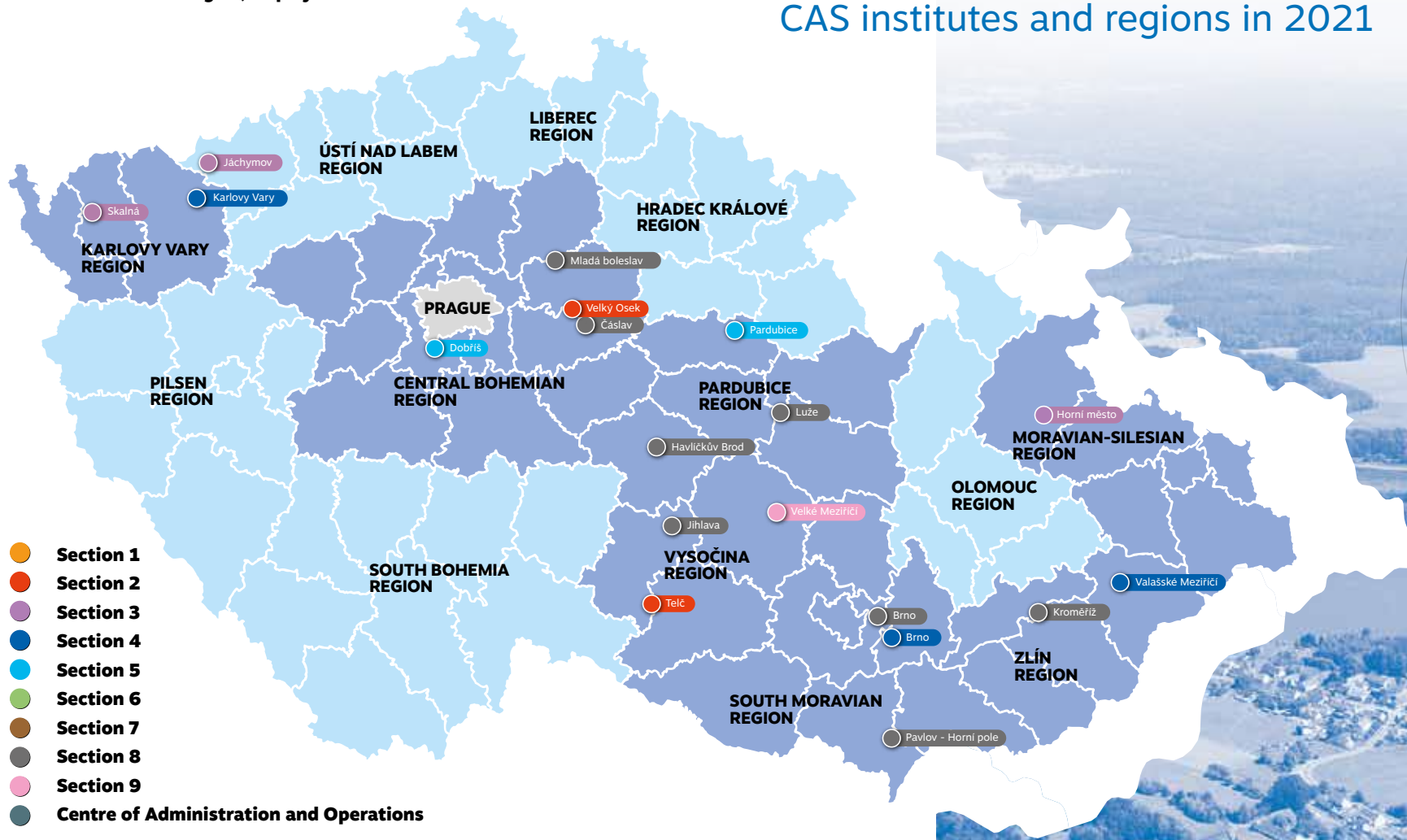
- Technological research of the Štamberk castle ruins in the wider context of the region (Telč).
- Determination of the water balance in the Elbe Lowland in the municipality of Velký Osek cadastral area (Velký Osek).

Section of Humanities and Philological Sciences

- Current philosophy: Science and art (Velké Meziříčí).

Map of the distribution of projects of the Programme for regional cooperation between CAS institutes and regions in 2021

- Contract with region, project
- Contract with region, no project
- No contract with region, project
- No contract with region, no project



- Section 1
- Section 2
- Section 3
- Section 4
- Section 5
- Section 6
- Section 7
- Section 8
- Section 9
- Centre of Administration and Operations

Section of Historical Sciences

- Havlíček, Havel! Conference on the occasion of the 200th anniversary of Karel Havlíček Borovský's birth (Havlíčkův Brod).
- Celts and Germans in the Dalešice Dam region (Jihlava).
- Making the archaeological collections at the Košumberk Castle in the Chrudim region accessible. Part IV. (Luže).
- Josef Dürich, forgotten victor (Mladá Boleslav).
- Otakarka. New informative and educational exhibition on the history of the building and the Čáslav castle area, with a panoramic view and information on other historical sites and tourist destinations in the region (Čáslav).
- Hradisko near Kroměříž – a Bronze Age fortress (Kroměříž).
- Interpretative potential of archaeological findings and data in the Pavlov site - Horní Pole for opportunities to study the younger prehistory of Moravia (Horní Pole).
- Protection - preservation - knowledge. Contribution of citizen science in archaeology to learn about the past of the South Moravian Region (Brno).



15



The environment and sustainable operations

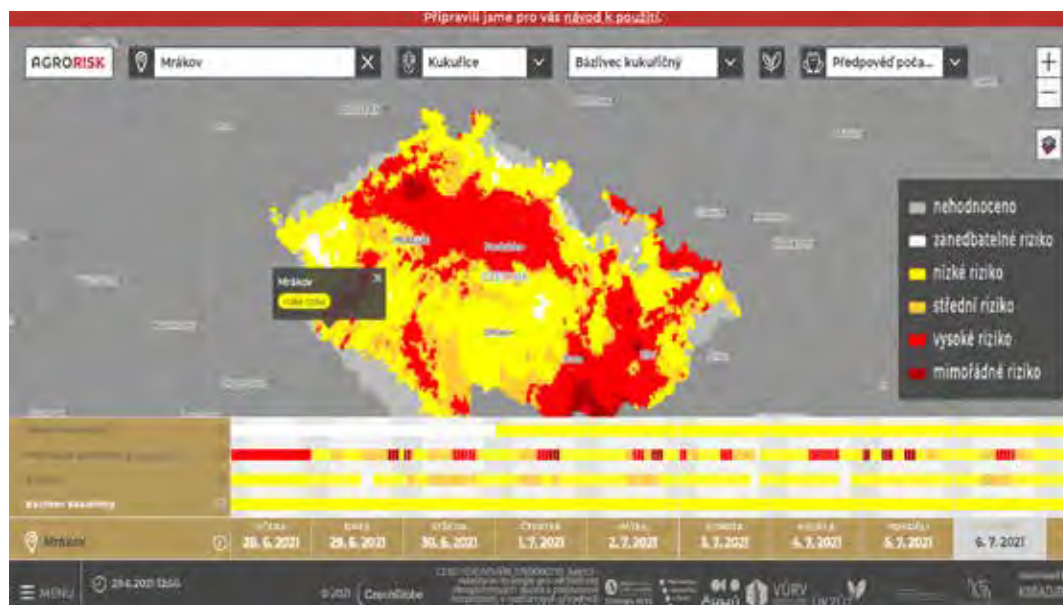
in Scientific Research
and Research Infrastructure

In its work, the Czech Academy of Sciences also dedicates itself to the crucial societal issues of sustainability and environmental protection. The members of the Environmental Committee and the Energy Research Committee, which the CAS has established as permanent advisory bodies to

the Academy Council, are leading experts in their fields. CAS institutes' own research also delves into issues of environmental sustainability through the Strategy AV21 programme with its focus on current issues (e.g. Land Conservation and Restoration, Foods for the Future, Water for Life, etc.).



Home page of the www.agrorisk.cz website, an early warning system for abiotic and biotic risks that threaten field production and the landscape. Selection of a cadastral area (red ellipse) brings up the local weather forecast (blue) and the number of current risks (green) including a 9-day forecast of these risks. In total, about 60 risks are currently monitored, both of a general nature (e.g. strong wind) and plant specific (diseases and pests), and more are being gradually added.



An example of a traffic light warning system on the website www.agrorisk.cz, for biotic risks, specifically showing suitable conditions for occurrence of corn rootworm pests. The red and pink colours inform farmers that they should prepare the necessary insecticides. Thanks to information from the website, interventions can be economical, timely and thus ecologically sound. How and with what? Even this type of information is available for dozens of diseases and pests, whose infection pressure is monitored by the website.

The websites of the Global Change Research Institute are an example of application of research outcomes focused on climatic change impacts on agricultural crop production.

The interactive websites www.klimatickazmena.cz, www.vynosy-plodin.cz and www.agrorisk.cz focus on crop cultivation and production of raw materials for food. The user friendly website www.klimatickazmena.cz is intended for the broadest public and captures climate change impacts on agriculture, as well as ways of adapting farming through easy to understand charts, maps and text. In 2022, the Global Change Research Institute plans on innovating the website and adding the most current information based on IPCC reports and the Institute's own research.

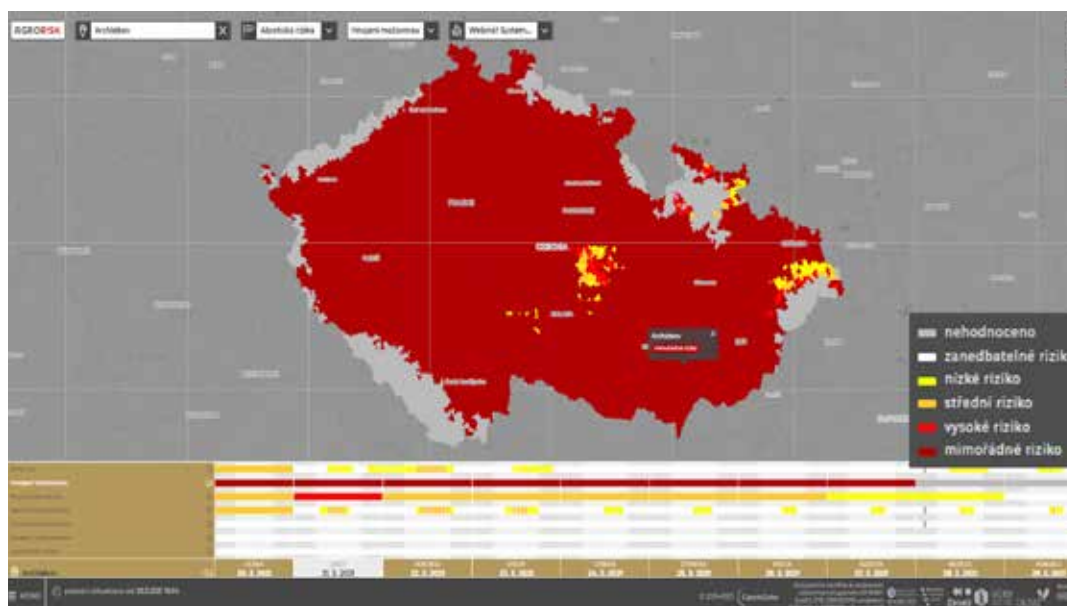
The www.vynosy-plodin.cz website is intended mainly for farmers, providing timely prediction of crop yields, information about possible additional optimisation supplementary agrotechnical interventions, optimisation of fertiliser and pesticide application and strategic planning.

The website www.agrorisk.cz provides a nine-day early warning system focusing on weather-dependent abiotic factors (e.g. frost-heaving, spring frosts, strong winds, high temperatures) and biotic factors (diseases and pests) that threaten crop yields. It also targets farmers. In 2022, the weather forecast system will be upgraded to enable risk factor forecasting and addition of another 10 disease and pest risks.

Within the Strategy AV21 programme, scientists look for the most genetically suitable farming crops, which are less susceptible to ongoing climatic changes, and also experimentally verify the characteristics of such crops in specially designed greenhouses, called open tops, which have a controlled atmosphere (temperature, CO₂ level), rainfall or drought and UV radiation intensity. The research results are used primarily for calibration and validation of abiotic risk impacts on field crop cultivation.

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In the Milovice-Mladá former military training area, collaborative efforts between the CAS Biology Centre and the NGO České Krajiný enable management of a large part of the area’s biologically valuable forestless terrain through natural large cattle grazing.



A detail of two variations of winter wheat cultivation in the Global Change Research Institute’s open tops (CzechGlobe) located in Domaníněk near Bystřice nad Pernštejnem. This experiment studies the impacts of abiotic factors as well as differing amounts of fertilizer and other agrotechnical interventions that affect the growth and development of the tested crops.





16



Educational Activities

Educating young scientists and improving the quality of the national education system at all levels are crucial elements of CAS' mission in society and an integral part of research at the Czech Academy of Sciences. CAS' educational efforts are based on cooperation with universities, with par-

ticular attention to educating students in doctoral programmes. CAS employees are also directly and extensively 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 an agreement between the Czech Academy of Sciences and the relevant university on cooperation on implementation of the given doctoral programme. The Academy Council has drawn up a model agreement and it 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. The agreements have already been signed with sixteen universities and negotiations with others are continuing in an atmosphere of mutual trust and collaboration.

In 2021, an agreement on cooperation between the CAS and the Silesian University in Opava was officially signed, and a contract on establishment of a joint institute between the CAS Astronomical Institute and the Silesian University in Opava is being prepared. Despite delays caused by the covid-19 pandemic, work continues on preparation of an agreement between the CAS and INSA Lyon university in France. A CAS delegation trip to France is planned for 2022 to follow on the INSA Lyon management's visit to Prague in November 2019. A new collaborative Czech-German effort was initiated with the Leibniz Institute for the History and Culture of Eastern Europe (GWZO), which also envisions future joint education of post-graduate students. The CAS continues to actively look for other opportunities to expand collaboration with universities throughout the Central European region.

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The educational efforts of the CAS are based on cooperation with universities, secondary schools, and primary schools, with particular attention given to educating students in doctoral programmes.

Relations between the CAS and universities are monitored and coordinated by the CAS Council for Higher Education and Researchers Training Cooperation, which is an advisory body to the CAS management. The Council, with a new composition of members, was appointed for the 2021-2025 term and newly elected Academy Council member Jan Vondráček became its Chair. The Council held two meetings: an inaugural meeting on 1 October 2021, which was also attended by Tomáš Kašparovský, Vice President of the Council of Higher Education Institutions, who gave the members a detailed presentation of the proposed doctoral programme funding reform according to the Strategic for Universities white paper. The second meeting of the Council took place online on 22 November 2021, where the main topics of discussion included the current curriculum of doctoral courses run by the CAS in Prague and Brno.

CAS institutes and employees participate extensively in student education at both public and private universities. Last year, despite the problems caused by the pandemic, CAS employees provided more than 6,100 semestral series of lectures, practicals or seminars with a total scope of more than 70,000 hours. CAS institutes thus contribute significantly to student education and supervision of students' qualification work. In 2021, employees of CAS institutes trained 2,312 doctoral students and also participated in the supervision of bachelor and master programme students. A total of 228 doctoral students trained at CAS institutes successfully completed their studies in 2021, which is an annual increase of more than 20%.

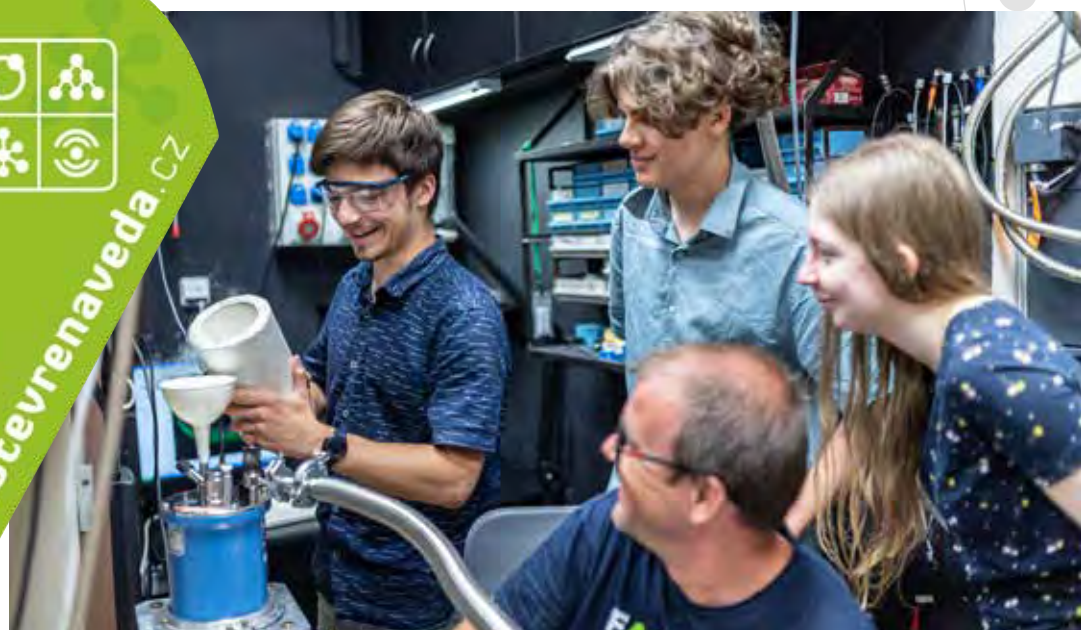
The CAS has supported the education of doctoral students for many years through its successful and sought-after week-long Course on the fundamentals of research work, which is intended for doctoral students in various fields and aims to cultivate the skills students need to succeed in the competitive international environment. Courses are held regularly both in Prague and in Brno. In 2021, online and hybrid courses were held and 90 students in Prague and 254 students in Brno took part in them. Students trained outside of CAS institutes also actively enrol in the courses. The lecturers are renowned and experienced experts, mainly CAS employees, and lecture topics are chosen so as to be useful to doctoral students across all disciplines. The main subjects included scientific methodology, ethical principles in scientific work and bioethics, evaluation of scientific work, scientific communication and its written forms, suitable presentation of research results, editorial aspects of publishing in journals, scientific writing techniques, rhetoric and the culture of the spoken word, lecturing skills, current information resources for science, research and education, research funding, project development, intellectual property rights and commercialisation, technology and knowledge transfer, professional writing skills in English, and more. Most of the lectures were conducted remotely in 2021 due to the current anti-pandemic measures. The significance of these courses is confirmed by student feedback received by the CAS.

Table 9: Overview of the most significant forms of cooperation with universities

	2015	2016	2017	2018	2019	2020	2021
Doctoral students trained at CAS institutes	2,091	2,019	2,175	1,995	2,046	2,161	2,312
Newly accepted doctoral students	376	348	323	376	384	427	395
Number of doctoral dissertations completed	264	263	260	264	242	181	228
Number of semestral series of lectures, seminars and practical courses	4,246	5,547	4,949	5,247	6,909	6,479	6,101
Number of hours lectured	76,348	75,978	76,423	71,335	73,086	69,518	68,176

OPEN SCIENCE PROJECT

The CAS offers students of secondary, higher vocational and higher education institutions an opportunity to participate in scientific work through one-year internships at a CAS institute under the guidance of experienced supervisors. Open Science student internships have been running since 2005 and they 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. In 2021, 196 secondary school students tried out scientific practice at 31 CAS institutes. For 2022, 125 topics have been announced which cover a wide range of scientific fields and disciplines in all three of the Czech Academy of Sciences' research areas.



ENGAGEMENT AT SECONDARY AND PRIMARY SCHOOLS

CAS' engagement in secondary and primary school education centres around teaching and a broad array of lectures. Through the Open Science project the CAS also offers summer science camps for secondary and primary school natural science teachers, and the School of the Czech language and literature for pedagogists.



Summer science camp in Čtyřkoly



17



Media Communications

and Promotion

In line with the CAS Communication Strategy Concept, ongoing, regular and systematic popularisation of research and scientific results among the broadest public through all communication channels is an integral part of the CAS' work. CAS scientific results have the potential to leave an indelible imprint on the Czech media landscape and beyond. CAS employees endeavour to bring science closer

to non-scientists as best as possible, capture their interest in research findings across disciplines and present research institutes and staff at work on specific research projects. They strive to spark interest in scientific work among the lay public, pupils and students as well as young children.

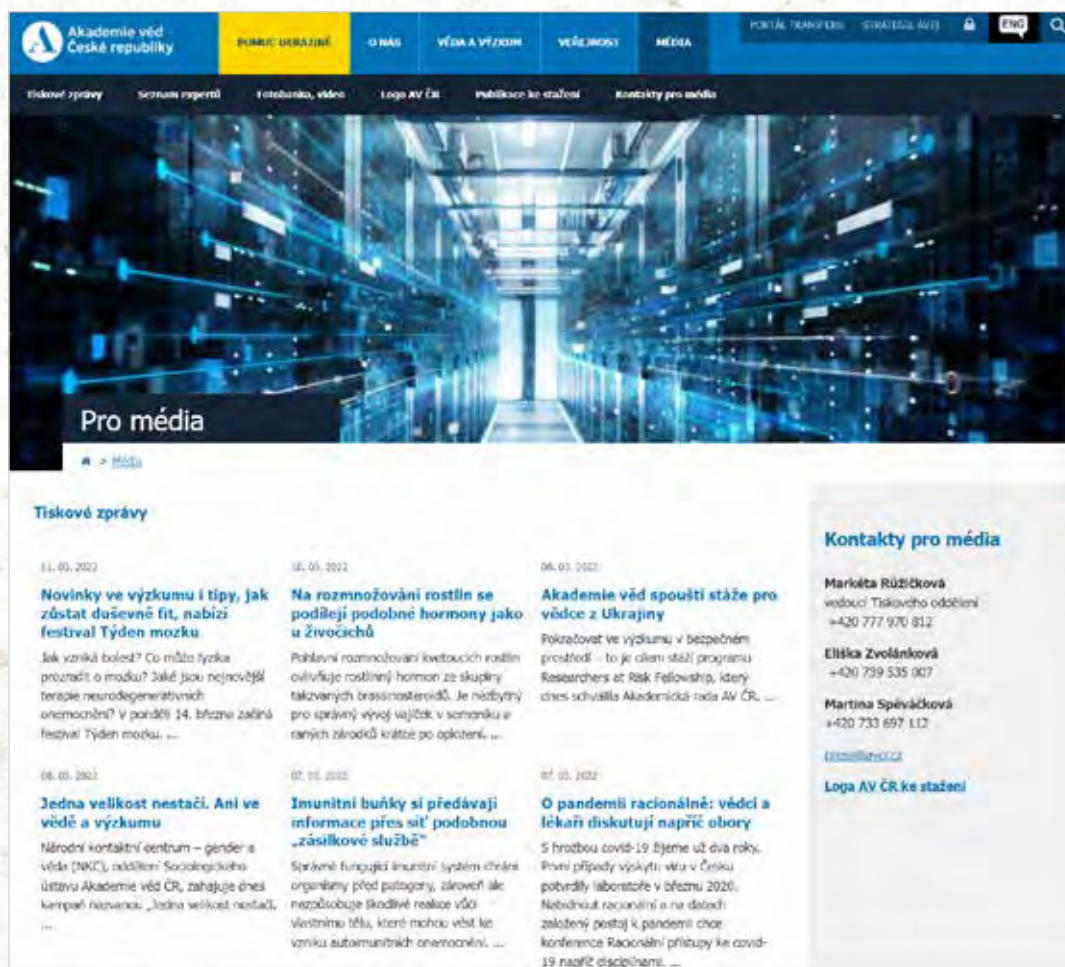
THE CZECH ACADEMY OF SCIENCES AS A MEDIA PARTNER

An essential part of CAS media communications involves working with public service media: Czech Television, Czech Radio and the Czech Press Agency, which devote extensive and regular attention to science and research. The CAS also communicates with dozens of other national and regional media.

In 2021, there were 31,797 media outputs mentioning the CAS and variations of its name, 65% of which were on the internet, 23% in printed media, 5% in Czech Press Agency news desks which other media use as a source, 5% in television news and 3% in radio. According to Newton Media, the keyword Academy of Sciences appeared in the monitored media an average of 2,650 times per month. The vast majority of media reporting about the CAS had a positive overtone. CAS President Eva Zažímalová was quoted or mentioned over 1,000 times in 2021.

The ongoing covid-19 pandemic continued to be one of the key media communication themes in 2021. CAS scientists were regularly invited to take part in broadcasting and asked for interviews to clarify current topics associated with the SARS-CoV-2 virus variants, testing, vaccination, setting of measures, etc. Journalists and the public see experts such as Václav Hořejší, Libor Grubhoffer, Jan Konvalinka or Jan Pačes as a trustworthy source of verified information from the fields of virology, immunology, biochemistry or molecular genetics. Aside from these scientists, other experts from the Institute of Molecular Genetics, Institute of Inorganic Chemistry and Biochemistry, Biology Centre, BIOCEV, etc. made frequent appearances in the media. Many provided opinions and explanations to the media, such as those specialising in the physical aspects of virus dissemination (Vladimír Ždímal and Jakub Ondráček of the Institute of Chemical Processes), mathematical modelling of the spread of infection (Martin Šmíd from the Institute of Information Theory and Automation, René Levínský from CERGE-EI, and others), the ethics of health care provision or compulsory vaccination (David Černý from the

The Czech Academy of Sciences has always dedicated great effort to communicating with the public through the media. In 2021, there were 31,797 media outputs about the CAS in monitored media.



Institute of State and Law), the economic impacts on society, particularly on families and education (Daniel Münich and Filip Pertold from the Economics Institute) and how the pandemic has influenced the Czech language (Markéta Pravdová, Michaela Lišková and others from the Czech Language Institute).

The work of the CAS, across all of its scientific disciplines and not only in relation to the covid-19 pandemic, figured prominently in the media in 2021 and consequently only a few brief examples of the pronounced impact of CAS media communications can be shared below.

CAS research topics in the media

The CAS' representation at the World EXPO 2020 in Dubai, which was postponed until 1 October 2021, was a great success. There were 1,337 media outputs about the CAS presentation at the exposition. The main exhibit at the Czech pavilion was the S.A.W.E.R. system, which produces



water from dry desert air using only solar energy. The **Institute of Botany** took part in developing the device. The **Institute of Microbiology** was represented by the *Alga Oasis* structure. The tall, glowing glass palm tree, created by Michal Kohút, a graduate of the Academy of Arts, Architecture and Design in Prague, is an artistic model of a functional photobioreactor for growing algae. In February 2022, as part of the *Energy the Smart Way* rotating exhibition, the CAS will present four separate interactive exhibits which demonstrate four concepts for working with energy: a flywheel for energy storage, tokamak - the heart of a fusion reactor, battery storage with a hybrid power plant, and a ship that converts plastic waste into fuel oil and desalinated water.

Astronomical phenomena always elicit great interest among journalists and the public. The Czech media was literally flooded with information about the pink super full moon on 26 April 2021, a partial eclipse of the Sun that was visible on 10 June, and the regular Perseid summer meteor shower. Pavel Suchan and other scientists from the **Astronomical Institute** indefatigably explained to the public where and how to watch the night sky.

Topics related to biomedicine and the therapeutic potential of research have always been well received in the media. In 2021, information about collaboration between Czech and Swiss scientists on the testing of a double antibody against covid-19 resonated in the media. Virologist Daniel Růžek from the **Biology Centre**, who led the pre-clinical testing of the antibody on mice, explained the work to the media. A report by researchers from two laboratories of the **Institute of Biotechnology** who developed an anticancer substance called mitoDFO which targets mitochondrial iron metabolism also received broad media attention.

Journalists paid great attention to two discoveries by an international team led by Pavel Jungwirth from the **Institute of Organic Chemistry and Biochemistry**: the first study confirmed that heavy water tastes sweet in contrast to regular water, despite the fact that the two waters' chemical composition is practically identical. The second research result, which was widely reported in the media, concerned preparation of metallic water in terrestrial conditions, which was achieved by CAS scientists in collaboration with researchers at the University of Southern California, Fritz Haber Institute and other institutions.

A report about the results of large-scale testing for the presence of covid-19 in the Prague public transport system appeared extensively in the media. The testing was initiated by the Prague city public transport company and implemented by scientists from the **Institute of Physics** in collaboration with the **Biology Centre** and the University of South Bohemia in April 2021. No virus was detected through the testing, which relied on PCR methods and newly developed biosensor

technology. Both methods demonstrated similar sensitivity, and thus confirmed the reliability of the biosensor testing method.

The record-breaking work of the HiLASE laser centre at the **Institute of Physics** also received notable media attention. The HiLASE team first broke its own record from 2016, achieving an energy level of 145 J and a maximum of 146.5 J in a 10 ns pulse at a repetition rate of 10 Hz on a wavelength of 1030 nm. Later, in a pilot experiment with British partners, the team generat-



ed pulses on second harmonic frequency on the BIVOL laser (515 nm) with energy greater than 68 J at a repetition rate of 10 Hz. The HiLASE research centre also achieved a nanostructuring speed record – 1,909 cm²/min 2,601 beams on 40 x 40 mm of stainless steel.

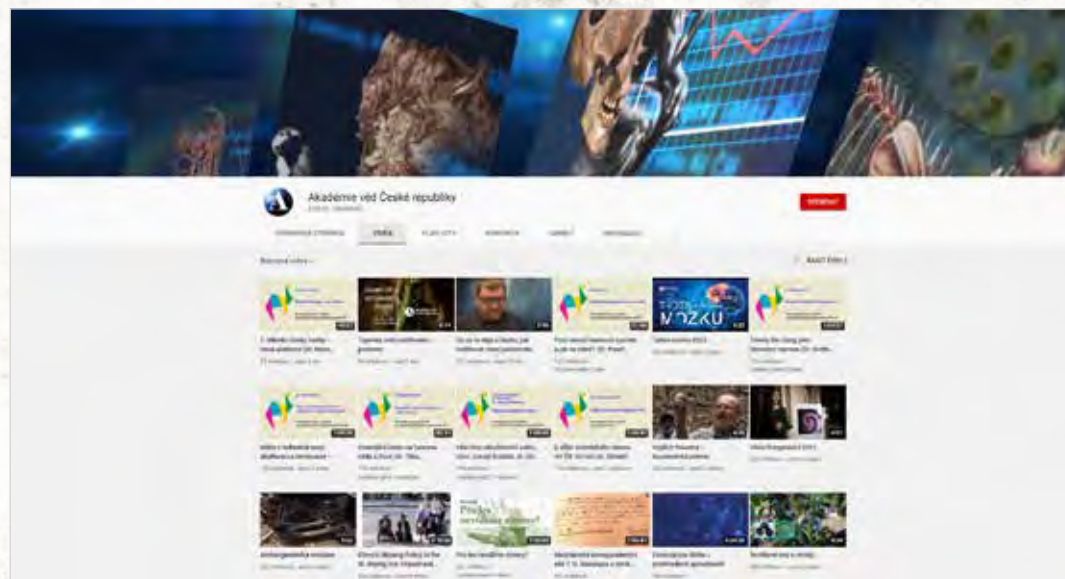
Biological and ecological themes tend to draw considerable media attention and thus it was no surprise that a report about a confirmed wildcat finding in the Dobříš region and the discovery of a new genus of reed frog living in the forests of central Congo were broadly disseminated. **Institute of Vertebrate Biology** scientists were responsible for both discoveries. The media was also fascinated by reports that all of the edible frogs (*Pelophylax esculentus*) in the Oder River basin are males, which scientists at the **Institute of Animal Physiology and Genetics** and the

University of Ostrava proved after two decades of monitoring frog populations. The media also reported widely on a research project led by **Biology Centre** hydrobiologists and their Norwegian counterparts predicting the future difficulty of treating drinking water, especially to purify it from natural organic matter, and on the deciphering of the genetic code of rye by scientists at the **Institute of Experimental Botany**.

Research outcomes from the historical sciences also typically draw considerable media attention. In 2021, a report from researchers at the **Institute of History** and the CTU Faculty of Civil Engineering in Prague about a new website titled *Czech Historical Atlas* was well received, as was an announcement about the event *Archaeological Summer*, which was prepared jointly by the **Institute of Archaeology, Brno** and **Institute of Archaeology, Prague** and fifty other scientific, museum and regional entities to encourage the public to visit 90 interesting sites with a selection of more than 250 guided tours across the entire country. The media also reported extensively on a study that revealed the origins of contemporary domestic horses, which was compiled by an international team including the **Institute of Archaeology, Prague**. Another popular news story concerned the experimental reconstruction of several ancient Greek-Egyptian perfumes, which Sean Coughlin from the **Institute of Philosophy** plans on renewing through his project *Alchemies of Scent*.

CAS in current news

Many media took note of the upcoming collaboration between scientists from the CAS and the Massachusetts Institute of Technology (MIT) through the newly established *MIT-Czech Republic Seed Fund*. The Fund was set up by MIT, the CAS and the **Institute of Organic Chemistry and Biochemistry**. The CAS was also mentioned in relation to a new investment fund, i&i Bio, established to support development of pharmaceuticals and diagnostic methods. The fund was set up by the European Investment Fund and the transfer company i&i Prague at the **Institute of Organic Chemistry and Biochemistry**.



The end of Angela Merkel's term as German Chancellor was heavily reported, with mention of her former teacher and later CAS President Rudolf Zahradník, her studies in the 1980s in Prague and her friendships with Czech scientists, including current CAS Vice President Zdeněk Havlas.

As already mentioned, CAS scientists regularly appear in the media, where they explain, analyse and comment on current events or important historical anniversaries. For instance, planetologist Petr Brož from the **Institute of Geophysics** commented on the landing of the Perseverance probe on Mars. Sociologist Tomáš Kostecký spoke on the dramatic transfer of power in the USA and polarisation of American society as well as the social aspects of Jan Palach's heroic act. Jaroslav Šebek from the **Institute of History** commented on the Pope's trip to Iraq. Alena Sumová of the **Institute of Physiology** explained how daylight savings time affects human health. Scientists from the **Institute of History** and the **Institute of Contemporary History** analysed the centennial of the founding of the Communist Party, the May uprising against the Nazi occupation, the end of World War II and the destruction of Lidice in revenge for the assassination of the Acting Reich Protector of Bohemia and Moravia Reinhard Heydrich. The awarding of the Nobel Prize in Physics drew comments from researchers from the **Institute of Physics**, **Global Change Research Institute - Czech Globe** and **Institute**

of Thermomechanics. Institute of Physiology scientists commented on the newly announced Nobel Prizes in Physiology and Medicine.

An investigation into cyanide fish poisoning in the Bečva River also drew considerable media attention. Experiments led by hydrochemist Jakub Hruška from the **Global Change Research Institute - Czech Globe** focused media attention on the CAS statement about the issue. Although the experiment with salt was his private initiative, the CAS supported him and expressed dissatisfaction with the current state of the investigation.

New communication format: videos

In response to myths and disinformation about vaccination and its effects circulating on social media and elsewhere, the Division of External Relations of the Centre of Administration and Operations developed a 7-part series of short popularisation videos. The videos explained the benefits and possible drawbacks of vaccination to the public in an easy to understand, visually appealing format at the height of the pandemic. The videos also covered the principle of herd immunity, vaccination approval process, myths around vaccination, reasons behind fears of vaccination and economic impacts of the pandemic. The CAS posted the first video on Facebook on 7 January 2021 under the hashtag **#Na minutu**. Approximately 150,000 people viewed the series.

Short videos featuring a scientist speaking on a current issue or about a new press release became a new way of introducing CAS themes in 2021. Three-minute videos produced by the Division of External Relations press department were posted to social media and sent as background information to journalists. Media editorial offices then either used the videos directly in their broadcasts or news reports or prepared their own text or video with the help of the respondent. The media made broad use of videos about compulsory vaccination (David Černý from the Institute of

Video also showed itself to be an excellent information source for the media about the topic of Advent and Christmas. Three brief videos featuring CAS historian Eva Doležalová from the Institute of History and Martin Franc from the Masaryk Institute and Archives focused on favourite folk and holiday traditions and their historical roots. Journalists used the videos extensively to prepare articles and audiovisual stories and they were also posted on the CAS' social media.

Strategy AV21 and AVex expert opinions

Strategy AV21 remains the flagship of CAS communications. In 2021, Strategy AV21 was comprised of 20 complex research programmes which focused on fundamental societal issues in the spirit of the motto "Top research in the pub-

lic interest". This mission was and is essential to gradually changing politicians' and the broad public's view of the most important Czech research institution.

AVex expert opinions, which were conceived based on a request from the Parliament of the Czech Republic, were published for the second year in a row. They provide lawmakers, selected ambassadors and Members of the European Parliament with independent and apolitical expert information about concrete, current societal problems and potential solutions. AVex opinions strengthen the image of the CAS as an apolitical expert institution and synergistically contribute to the practical fulfilment of Strategy AV21's main motto. Applicable CAS institutes act as guarantors for development of expert opinion content. In 2021, three opinions were prepared: *Invasive species: a risk for the landscape and human quality of life* (published in May, the Institute of Botany was the guarantor), *Plant viruses and viroids: a real hazard and biotechnological potential for development* (published in June, the Biology Centre and the Institute of Experimental Botany were the guarantors), and *Impacts of mining in the Ostrava and Karvina regions* (published in September, the Institute of Geonics was the guarantor).



State and Law), reasons behind the severe epidemic, benefits of booster vaccination shots (Jan Pačes from the Institute of Molecular Genetics), prediction of infection rates (Roman Neruda from the Institute of Computer Science) and the socio-economic impacts of the pandemic (Filip Perlejšak from the Economics Institute). A video featuring Hana Lisalova explaining how biosensors detect the SARS-CoV-2 virus was also popular in the media and on social networks. The video was part of a press release about the publication of research results in the prestigious scientific journal *ACS Applied Materials and Interfaces*.



SCIENCE PROMOTION

through the CAS Centre of Administration and Operations

The CAS service office, the Centre of Administration and Operations, has always played an important role in systematic promotion of CAS research results. It manages a diverse spectrum of promotional activities through the Division of External Relations. In 2021, however, these activities were affected by further waves of the covid-19 pandemic and subsequent anti-pandemic measures which made it impossible to hold some events.



Brain Week, a unique festival about the latest discoveries and trends in brain research and neuroscience that is part of Brain Awareness week, a global campaign to raise public awareness about the achievements and benefits of brain research, was held online under the auspices of the CAS. The 22nd annual Brain Week was held on 15-21 March 2021 and included 61 events: 13 lectures by prominent Czech neuroscientists and 48 accompanying events (lectures, discussion meetings, online quizzes, film screenings, etc.).

In 2021, the CAS continued with its prestigious lecture series called **CAS: Top research in the**

The popularisation of research and scientific results among the broadest public is an integral part of the CAS’ mission.

public interest, in which leading Czech scientists share views on current issues and themes. On 26 April 2021, the ninth gala lecture titled “New approaches to cancer treatment: Focus on mitochondria” by Jiří Neužil, head of the molecular therapy laboratory of the Institute of Biotechnology, was held. Due to the adverse epidemiological situation the lecture took place in the CAS Library courtyard and was broadcast online to the public via Czech Television and CAS social networks.

In 2021, the CAS’ science promotion activities were once again significantly impacted. The annual **Science Fair** planned for June had to be cancelled again. An educational outdoor game called **Following in the Footsteps of the Science Fair** was developed as an alternative method of engaging the public with science and its history at the CAS. The experiential learning game was designed for the general public, with a focus on families with children, primary and secondary school children and other people interested in science



and knowledge. The game took place in the greater Prague metropolitan area and included three routes of varying difficulty. Players learned about the missions of different CAS institutes as they made their way through the city and completed tasks.

During the CAS’ traditional **Summer Science Camp**, teachers added to their pedagogical knowledge and skills through workshops, lectures and discussions geared towards enhancing lessons. Experiments were selected with a view to keeping costs low for schools and to their inclusion in the Framework educational programmes for the relevant school level. Two courses were held in the summer: one for physics and mathematics teachers and a second for chemistry and biology teachers. In the fall, the Centre of Administration and Operations, Institute for the Czech Language and Institute for Czech Literature collaboratively organised the 9th annual **School of the Czech language and literature for pedagogists**. The aim of this course is to introduce interesting themes and current findings from various areas of Czech language and literature that teachers can use in their secondary school practice.

On 24 April 2021, **Researchers’ Night**, a research promotion event for the general public, was held. Six online science promotion lectures by CAS institute scientists were broadcast from the CAS main building in Prague. The debut of the online programme was available on the day of the event and subsequently as a YouTube recording. Ten CAS institutes offered in-person events

in many places across the Czech Republic: Prague, Brno, České Budějovice, Ostrava, Liběchov, Řež and Dolní Břežany. The 2021 universal event theme was "Time".

On 20 October 2021 a **commemorative event** took place to pay tribute to Rudolf Zahradník, CAS President Emeritus and pioneer in quantum chemistry. The first part of the event, which was attended by Czech and international guests including high-ranking government officials, colleagues and students of Prof. Zahradník and the CAS leadership, was held in the CAS library courtyard. Moderator Daniel Stach from Czech Television led the event using audiovisual excerpts from programmes in which Prof. Zahradník had appeared. The day of tribute continued at Slavín Cemetery at Vyšehrad with a farewell to Milena and Rudolf Zahradník.

Unlike the previous year, in 2021 it was possible to hold ceremonies presenting medals in different disciplines and grant awards to promising scientists, albeit under strict epidemiological measures and with restricted numbers of guests. The presentation of three *Academic Premium Awards* to world-class scientists and six *Lumina Quaeruntur Fellowships* to talented mid-career scientists was folded into the CAS Week, which was based on the original CAS Week of Science and Technology. The Otto Wichterle Award was presented to

24 young scientists in late June. The presentation of "Research Professor" Degree to nine scientists took place in late September. All of these events earned a deserved spotlight in the media.

The first annual **CAS Week festival** held on 1-7 November 2021 followed on the 20-year tradition of the largest science festival, the CAS Week of Science and Technology. The festival presented important and recent achievements by CAS scientists through lectures, workshops, exhibitions, film screenings with discussions, and above all presentation of CAS institutes through an open doors day. In regard to the ongoing epidemiological situation, part of the programme took place online once again. During the festival, which attracted almost 35,000 visitors/viewers, almost 400 events were held and along with 46 CAS institutes another eight science partners from universities and other entities also took part. The CAS Week resulted in more than 100 media outputs, confirming that it remains popular despite the adverse conditions caused by the multiple waves of the covid-19 pandemic.

The CAS has also traditionally promoted science by holding exhibitions featuring scientific projects and achievements. The **Gallery of Science and Art**, the main venue for CAS exhibitions, hosted three exhibitions in 2021. All were well received in the media and by visitors.



The Institute of Archaeology, Prague held an exhibition titled *Saint Ludmila: A Woman on the Interface of the Ages* (20 May 2021 – 30 July 2021) that paid tribute to this saint on the 1100th anniversary of her murder by highlighting several selected aspects of her persona.

The Institute of Philosophy and Hollar Prague Association of Czech Graphic Artists organised the exhibition *Aphrodite Today* (3 September 2021 – 22 October 2021) presenting some of the most famous statues of Aphrodite, as well as contemporary works by leading Czech artists including a monumental statuary entitled "The Birth of Venus".

The Institute of Inorganic Chemistry and the Academy of Fine Arts in Prague held an exhibition called *Copies and Forgeries in Portrait Miniature* (1 November 2021 – 14 January 2022), which unpacked the story of the artistic development of miniatures, from masterful originals through period and later copies to imitations and fakes. The exhibition illustrated how various new scientific tools can be used to determine how a work of art was created and presented both real works of art and information panels with photographs.



The eighth annual **Photogenic Science** photo competition for CAS employees attracted 66 employees from 28 CAS institutes. A total of 239 photos were submitted in three categories: Photogenic Science, Muses in Science and Scientists and Housework. Selected photos were used to create an official CAS calendar as well as a travelling exhibition called Photogenic Science that was accessible until the end of 2021 on the first floor of the CAS building on Národní třída. The competition attracted unprecedented media attention, with reports in regional and major daily newspapers and internet portals. Most of the articles were accompanied by selected photos from the competition.

These exhibitions were complemented by attractive **travelling exhibitions**, which truly travelled all around the Czech Republic, making stops at e.g. Šlapanice, Jindřichův Hradec, Sušice, Sedlčany, Damborice and Frenštát pod Radhoštěm. The exhibitions *Czech Scientists and Their Inventions* and *Czech Female Scientists and Their Contributions to Czech Science and Beyond* featured caricatures of male and female Czech scientists

and their most famous discoveries. The exhibition mainly targeted the younger generation with the aim of presenting Czech scientists, inventors and discoverers in an unusual and entertaining way. Another travelling exhibition, *The Superheroes Around Us*, depicts scientists from CAS institutes as comic book superheroes from various branches of science: biology, geology, chemistry, physics, linguistics, mathematics and technology. With humour and hyperbole, the exhibition presents “superheroes of science” whom you might meet on the street, tram or in a shop, and who advocate new discoveries and breakthroughs in science and research to make life easier for the rest of us on Earth.



Four issues of the magazine **A / Science and Research** were published in 2021. The main theme of the March issue was allergies (*A 1/2021*), the June issue addressed gender issues (*A 2/2021*), the September issue focused on mushrooms (*A 3/2021*) and the December issue explored weather (*A 4/2021*). Due to the covid-19 pandemic only one issue of the popular science magazine **AΩ / Science for Everyone** was published in 2021; the main theme was Olympic sports. The magazine won an award for best external printed magazine in the 19th annual Zlatý Středník competition, which recognises the best corporate media and communication projects in the Czech and Slovak Republics. The magazine **A / Science and Research** was recognised with the highest rating in the same category and the magazine **Science at Home**, which shone on the CAS Facebook page after the pandemic broke out in spring 2020, was recognized in the “low budget” category. There were also 10 issues of the internal electronic newsletter **AB / Academic Bulletin**, which is intended for CAS employees, in 2021.

Current events at the CAS and its institutes are promoted through the main CAS **websites and social networks**. Visits to the website increased in the fourth quarter of 2021 in relation to public interest in topics around covid-19 (mutations, Omicron, vaccination), growing to 411,000 (compared to 294,000 in the same period in 2020).



Total visits to the website grew year-on-year by more than 30% from 1.131 million (2020) to 1.482 million (2021). Science promotion on social networks also showed growth in the number of followers. Facebook remained the most frequented social network with 53,352 followers, followed by Instagram (17,785) and Twitter (9,768).

In 2021, the CAS prepared two series of **podcasts** – unusual audio conversations from the scientific world called *Science within Reach*. The spring series comprised 14 episodes and the autumn series had nine. They are available for listening on all major podcast platforms and on the host web Anchor.

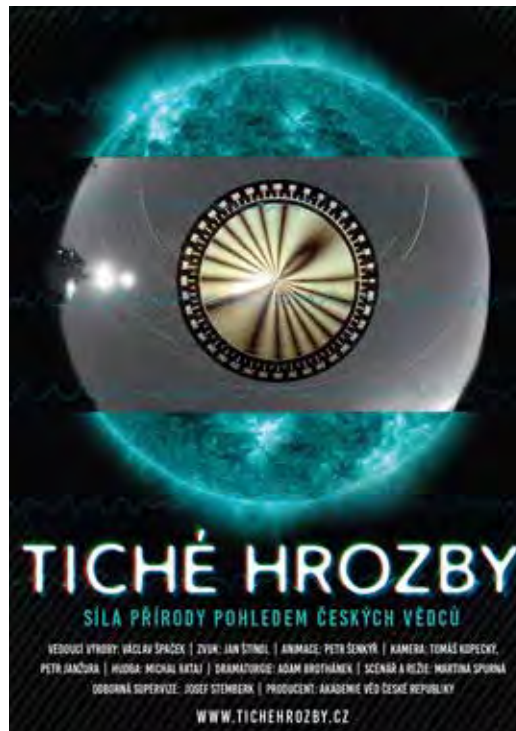
The Czech Academy of Sciences also continuously popularises science through its **audiovisual works**. After a large part of the CAS' activities were shifted to online environments, the Audiovisual Technology Department of the Centre of Administration and Operations provided streaming and technical operations for important events – from individual appearances and lectures to hybrid and streamed conferences. The department also produced presentation videos on scientific achievements and important anniversaries as well as short biographies of significant contemporary Czech scientists.

In June, another episode of the documentary series *Silent Threats* called *Disappearing Soil* was

shown at the Ponrepo cinema. It shows various aspects of causes and consequences of soil erosion in the Czech Republic. Czech Television filmed a conversation with Václav Moravec about this episode (as it had with previous episodes). The film and conversation were shown on CT24 in December along with reruns of earlier episodes of *Silent Threats*. The series had almost 1 million views in all and is available for watching on Czech Television's i-broadcast site.

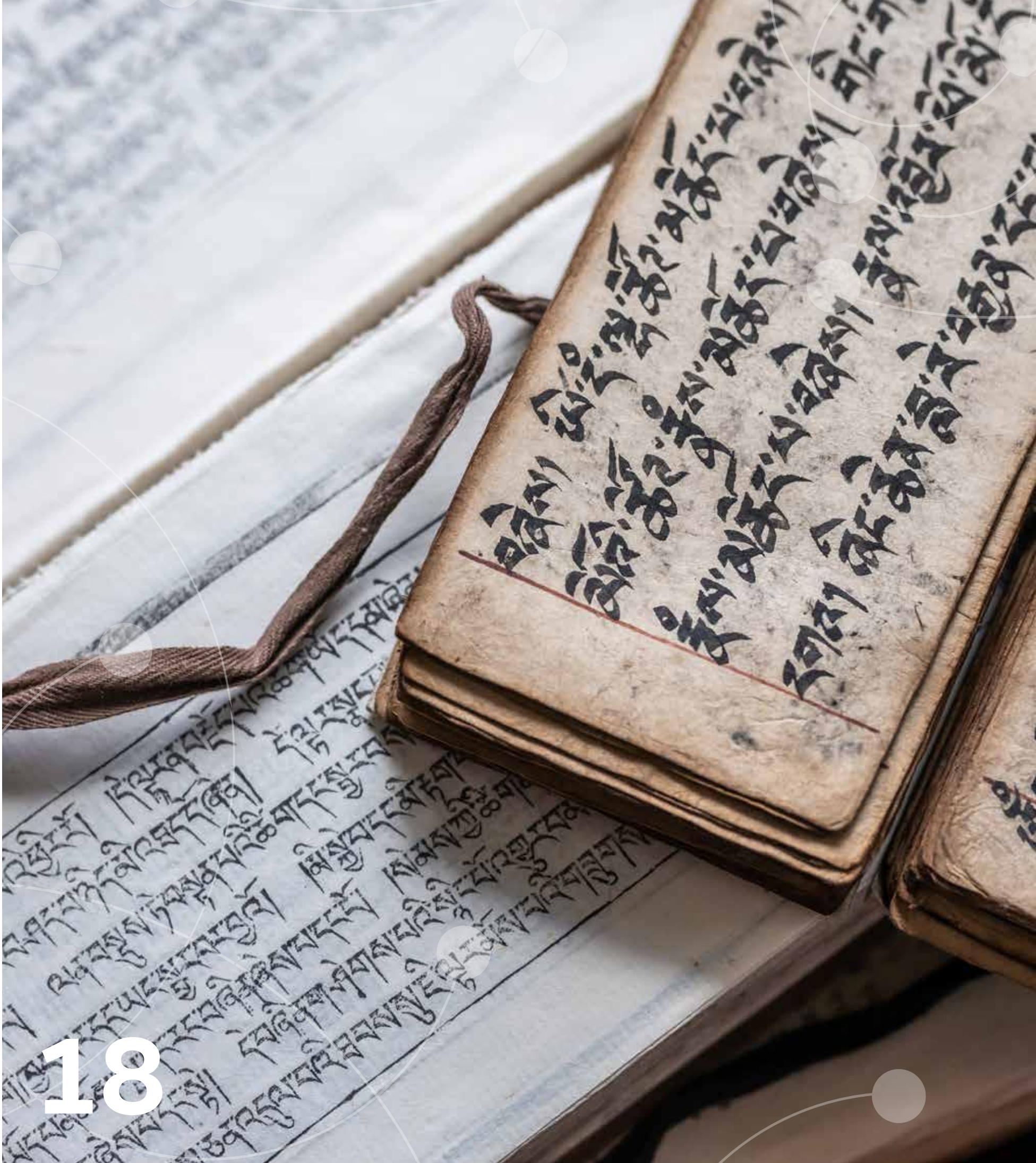
In the fall, *The Search for a Painful Christ*, a documentary film created in collaboration with the Institute of Art History, had its premiere at the Ponrepo cinema. It is about an unknown painting by Rudolphine painter Hans von Aachen that was found in the Břevnov Monastery by art historian Štěpán Vácha. The film will be sent to international film festivals.

Work continued on the science promotion project Scout with new episodes for YouTube and a TV version in collaboration with Czech Television. The TV show *Scout*, created especially for the CT:D programme, was broadcast in September 2021 and was so popular among viewers that Czech Television will collaborate with the CAS in 2022 to produce five more episodes.



The **Open Science** project afforded another year of science internships for secondary school students from across the entire country in 2021. A total of 725 secondary school students sent in a record 1,711 applications. Although the range of possible internship topics covered all three research areas, the most applications were received for internships in biology, chemistry and the medical sciences. 196 students were selected to take part in 103 scientific internships under the guidance of 85 instructors from 31 CAS institutes. The internships culminated in the **2021 Open Science Student Science Conference**, which took place under extraordinary anti-pandemic measures on 18 – 19 November 2021 at the Institute of Molecular Genetics.

2021 saw the completion of the latest (seventh) part of the **Undistorted Science** series, which draws its themes from Strategy AV21 research programmes. The episode topics included e.g. particle accelerators, supercomputers, black holes, ecosystems, climate change and contemporary Czech history. Scientists from the Czech Academy of Sciences serves as content guarantors. Czech and English subtitles on Undistorted Science videos make them accessible to the hearing impaired and international viewers. In September 2021, a book based on the videos was published; it carries the same name as the video series and contains the most popular episodes of the first five parts. On this occasion, the authors posted 54 teacher guidance papers with accompanying questions, quizzes and riddles on the Open Science website. The fact that the series has almost 7,750,000 views on YouTube is evidence of its popularity.





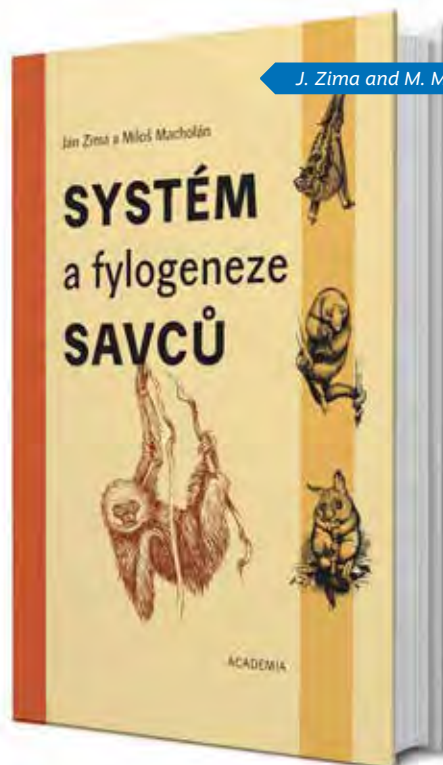
Publications

The Czech Academy of Sciences supports publication of selected scientific and popular science publications from all of the scientific disciplines through the Academia publishing house, which is part of the Centre of Administration and Op-

erations, and other CAS institutes. Books by CAS authors are also published by other Czech and prominent international publishing houses. In 2021, CAS institute employees authored or co-authored a total of 47 books published abroad.

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The CAS supports publication of high-quality publicly accessible scientific and popular science publications, by which it helps disseminate scientific research results and advance knowledge.



J. Zima and M. Macholán: *System and Phylogeny of Mammals*

Institute and Archives, Institute of Art History (Artefactum Publishing House), Institute of Czech Literature, Institute of Contemporary History, Institute of State and Law, Institute of Slavonic Studies and Centre of Administration and Operations (Academia Publishing House).

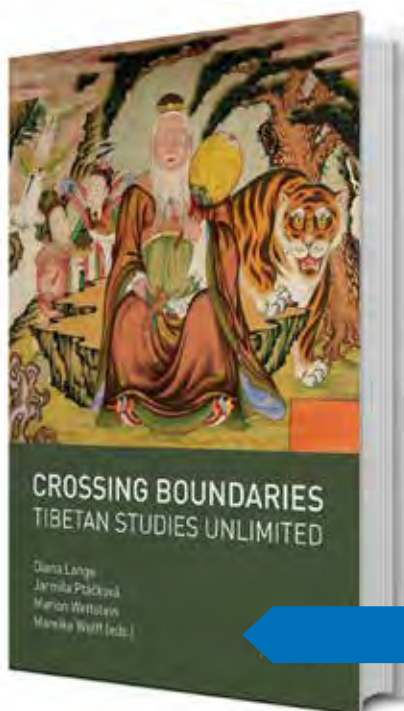
This support of almost CZK 18 million enabled the publication of 100 books, of which 40 were published by Academia Publishing House and 60 by CAS institutes – and another 121 books are in the publication preparation phase.



J. Žďárek: *Insect Threat? Unusual Encounters after 40 Years*

In compliance with Guideline No. 13/2018 on Support of Publication Activities, the CAS supports proposals for publication of original scientific work, critical editions of important sources and significant monuments, translations of important scientific or popular science works, and popular science works encompassing original research results as a major component.

In 2021, through the Publishing Support Programme, and based on recommendations from the CAS Editorial Board and its successor body, the Committee for Support of CAS Publishing Activities, the Czech Academy of Sciences supported publishing at the following 11 CAS institutes: the Institute of Archaeology, Brno, Institute of Archaeology, Prague, Institute of Philosophy (Filosofia Publishing House and Oikoymenh Publishing House), Institute of History, Masaryk



D. Lange, J. Ptáčková, M. Wettstein, M. Wulff (eds.): *Crossing Boundaries. Tibetan Studies Unlimited*

Some of the noteworthy works that were published with Publishing Support Programme funding in 2021 include the following original scientific works: an extensive work by Jan Zima and Miloš Macholán titled *System and Phylogeny of Mammals* (Academia), a popular science – educational monograph by Jan Žďárek called *Insect Threat? Unusual Encounters after 40 Years* (Academia), the monumental book by Diane Lange, Jarmila Ptáčková, Marion Wettstein and Mareike Wulff (eds.) *Crossing Boundaries. Tibetan Studies Unlimited* (Academia), a two-volume work by Bohumil Samek and Kateřina Dolejší (eds.) titled *Artistic Monuments of Moravia and Silesia. O-P* (Academia), an extensive anthology by Lenka Jungmannová



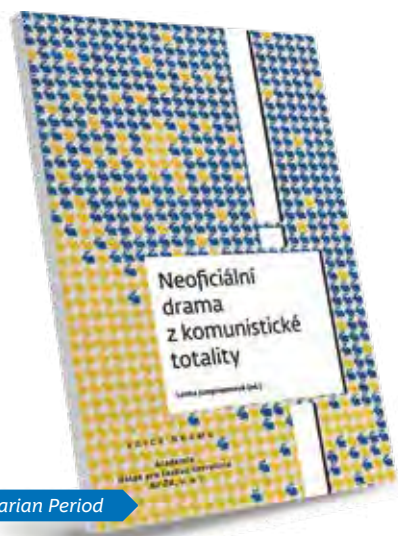
B. Samek and K. Dolejší (eds.): *Artistic Monuments of Moravia and Silesia. O-P*

The largest CAS publishing house is the Academia Publishing House, which is a leader among Czech publishers. In its editions programme it publishes works from all scientific disciplines - original scientific monographs and works by Czech scientists, classic scientific works, translations of foreign books, popular-educational literature,

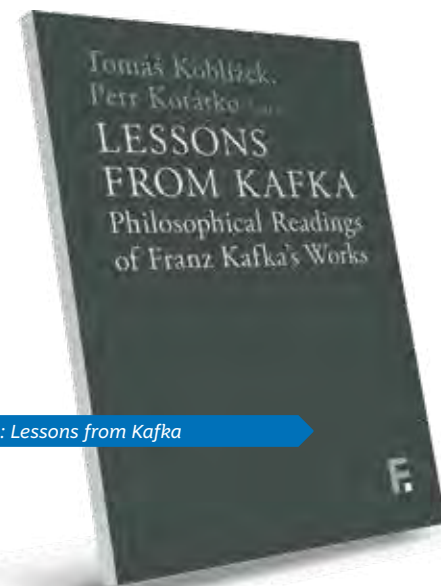


Eva Janáčková (ed.): *Images of Resentment. Visual Manifestations of Anti-Judaism and Anti-Semitism in the Czech Lands*

(ed.) called *Unofficial Drama from the Communist Totalitarian Period* (Academia, Institute for Czech Literature), a remarkable monograph by Tomáš Koblížek and Petr Koťátko (eds.) titled *Lessons from Kafka. Philosophical Readings of Franz Kafka's World* (Filosofia), a richly illustrated publication by Eva Janáčková (ed.) titled *Images of Resentment. Visual Manifestations of Anti-Judaism and Anti-Semitism in the Czech Lands* (Artefactum) and a unique book by Martina Hrabová called *Le Corbusier's Galaxy* (Artefactum).



L. Jungmannová (ed.): *Unofficial Drama from the Communist Totalitarian Period*



T. Koblížek and P. Koťátko (eds.): *Lessons from Kafka*

non-fiction literature, encyclopaedias, dictionaries, language textbooks, manuals and university textbooks, the popular-educational magazine *Živa* and high-quality Czech and translated foreign fiction.



M. Hrabová: *Le Corbusier's Galaxy*

In 2021, the Academia Publishing House published a total of 93 books, 10 new Science Around Us brochures and two new brochures in the Strategy AV21 series. Five monographs were published under the Strategy AV21 research programmes.





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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. Many scientific societies are interdisciplinary in nature

and some focus on specific disciplines that are not represented in academic or other scientific institutions. Most of the societies are members of international associations in their field that operate on a global or European level. In 2021, the CAS supported 142 projects in collaboration with the Council of Scientific Societies.

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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. In 2021, the CAS supported 142 projects in collaboration with the Council of Scientific Societies.

The CAS provides systematic, long-term support to scientific societies associated in the **Council of Scientific Societies of the Czech Republic**. 2021 was the Council's third year of operation as an independently registered association, affiliated with the CAS Academy Council through the Committee for Cooperation with Scientific Societies. The Council of Scientific Societies of the Czech Republic currently associates 87 scientific societies with more than 28,800 members. Two new members were accepted in 2021: the Society for Monument Protection Technology and the Czech Society for the Properties of Water and Steam.

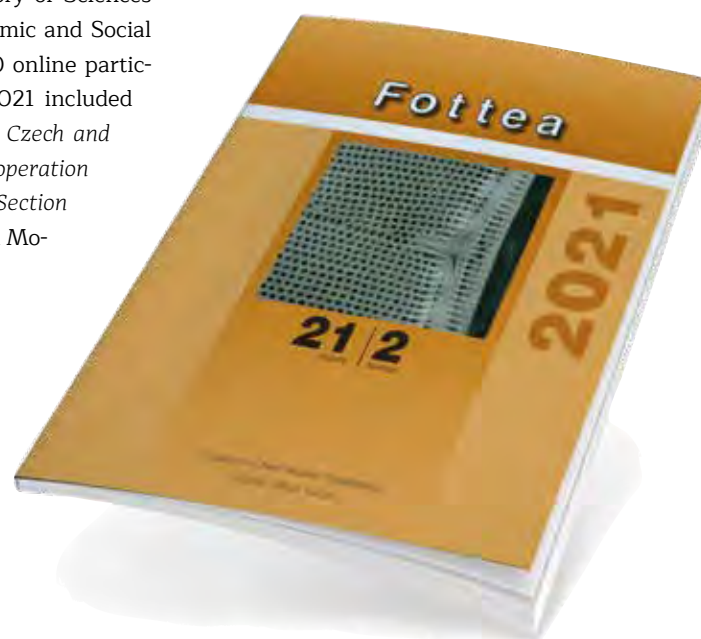
In 2021, the societies published a total of 31 internationally noted journals, six of which had an impact factor, e.g. *Preslia* (Czech Botanical Society – IF 4.17), *Fottea* (Czech Phycological Society – IF 3.24), *Journal of Geosciences* (Czech Geological Society – IF 1.52) and *Plant Protection Science* (Czech Society for Plant Pathology – IF 1.46); the IF increased for all of these journals last year. The societies also published 38 national professional journals, 25 internet journals and 39 newsletters.

Books and collections were also important publication platforms for scientific societies; in 2021, they published a total of 32 books and 54 collections (predominantly conference proceedings). Noteworthy publications on current topics include e.g. an extensive monograph by R. Vlček et al. called *Non-freedom, Despotism and Totalitarianism in Culture and Cultural History* (Czech Society for Slavonic, Balkan and Byzantine Studies) and *Biotrophic Fungi and Peronosporae of Wild Plants* by M. Sedlářová et al. (Czech Society for Plant Pathology), and an original expert manual on fungal diseases for agriculture and forestry.

There was an increase in publishing and conferences compared to 2020, the year of covid-19. Despite all of the complications associated with the continuing pandemic, a total of 309 international, Czechoslovak and national events took place. The societies held most of them remotely or in hybrid format. The largest, typically multi-day events included e.g. the *25th Assembly and Congress of the International Union of Crystallography* (Czech and Slovak Crystallographic Association; Congress Centre; 1,640 participants, of which more than 1,000 were online) and the *EUGEO Congress of the Geography* (Czech Geographical Society; 113 participants, 244 online), which is held biannually in a European country. There were also fully online congresses such as the *International Congress of Psychology – ICP 2020+* (Czech-Moravian Psychological Society; 6-day, online, 3,840 participants from 107 countries, 6,800 contributions) and the *26th International Congress of History of Science and Technology* (ICHST), which is co-organised by two societies (Society for the History of Sciences and Technology, Society for Economic and Social History of the Czech Republic; 900 online participants). In-person congresses in 2021 included e.g. the *XXVI. Annual Congress of Czech and Slovak Biochemical Societies with Cooperation of Austrian and German Biochemical Section* (Czech Society for Biochemistry and Molecular Biology, 280 participants).

Scientific societies actively supported elementary, secondary and university education through a total of 69 events such as mathematics, chemistry, geography, natural science or astronomy knowledge competitions and

specialised field courses for secondary school and university students and teachers, which often also included members of the public. There were both central and regional events, such as e.g. *Chemistry at the Silesian-Ostrava Castle* (Czech Chemical Society; 1,500 participants in-person), as well as online events such as the *Olomouc Physics Kaleidoscope* (Union of Czech Mathematicians and Physicists; 1,000 registered participants). There is also an educational focus to some of the periodicals published by societies; the Union of Czech Mathematicians and Physicists, for example, is a long-standing publisher of several periodicals for pupils and teachers (*Maths Teacher*, *Mathematics-Physics Perspectives*, *Advancements in Mathematics, Physics and Astronomy*). One-third of the societies also present awards for excellent master's theses and doctoral dissertations in their given field. More than 100 events for schools were organised overall.





Most scientific societies also usually offer lectures, science promotion and other club activities. In 2021, there were 338 lectures, 84 excursions and 11 exhibitions. The online *Major Invertebrate Exhibition* (Czech Entomological Society) was hugely popular, drawing over 10,000 visitors. There was a slight increase in the number of media outputs, through which societies comment on current issues in science, education and life in society (261). Of the many websites that societies operate for the public, www.astro.cz (Czech Astronomical Society) continues to draw the most attention, recording 3.1 million visits in 2021.

All of the societies' activities may be found in the rvs.paleontologie.cz database.

The **Learned Society of the Czech Republic** (hereinafter the "Society") connects prominent scientists from all disciplines. Its goals are to encourage freedom in the 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, help improve

educational quality and support development of a creative, rational and humanely responsible environment in Czech society. The Society had 95 regular fellows, 50 international fellows and 19 emeritus fellows at the end of 2021.

The Society organised a number of lectures on current scientific and educational issues, including eight lectures and one discussion session (with five lecturers) at plenary sessions open to the public, a discussion forum titled *Biodiversity Crisis* as part of an extraordinary lecture and six lectures at the XXVII. General Assembly. In light of anti-pandemic measures introduced to prevent the spread of covid-19, the Society also organised meetings, lectures and other events online, which helped maintain continuity in the Society's operations and tasks during this difficult time, including active collaboration with international experts. As part of the Bernard Bolzano lecture series, Prof. Lord Martin Rees gave a lecture. Several podcasts were also produced. The Society organised a competition for secondary school students and awarded 10 students, and presented one Learned Society award

in the scientific researcher category and two prizes in the junior scientific researcher category. It also recognised one teacher for promoting interest in science and research in secondary schools, creating conditions for individual student work and outstanding student work in competitions. The awards are funded by the Science Support Foundation of the Learned Society of the Czech Republic, which is led by Prof. Martin Loebel. The most significant prizes that the Society awarded in 2021 were four medals of the Learned Society of the Czech Republic, Societas Scientiarum Bohemica, Ad Laudem et Honorem, for merit in the development of science.

The Society and the United Nations Information Centre in Prague jointly awarded the Communication about climate change prize, which was presented at an extraordinary Learned Society lecture; there were also several contributions on ecological themes at the event. A professional excursion to western Bohemia was organised. The Society published several statements on current public affairs. It sent an open letter to the Minister of Education requesting preservation of "EMBO Installation Grant" funding, an open letter to the Prime Minister to (not) prolong the state of emergency, supported the statement of the CAS Environmental Committee on decreasing coal use, issued an opinion of the Learned Society Committee on scientific and technological issues around covid-19 - production of a Czech vaccine, commented on the situation in connection with the explosion in Vrbětice and issued a statement on covid-19 vaccinations, etc.

The Society's website at www.learned.cz and its Facebook and Twitter accounts provide information about the Society's activities and its members. Lectures or presentations from lectures are also published on the website. The Society collaborated with the CAS, the UN Information Centre Prague, Charles University, Faculty of Science of Masaryk University, Institute of Chemical Technology in Prague, Experientia Foundation and other organisations.



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Awards

bestowed by the CAS

Each year the Czech Academy of Sciences recognises leading scientists for excellent research results that focus on societal priorities, have strengthened the international prestige of Czech science and were first published or implemented during the past five years. In 2021, the results of the scientific and popularisation work of CAS

researchers were recognised with many specific prizes, medals, honours and other awards. CAS scientists received prizes not only from the CAS but also from other Czech and international 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 2021:

The Award of the Czech Academy of Sciences for outstanding results of research, experimental development and innovations, achieved in the following research projects:

Team of authors nominated by the Astronomical Institute, Institute of Atmospheric Physics and Institute of Plasma Physics, composed of:

Prof. RNDr. Petr Heinzel, DrSc.,
RNDr. František Fárník, CSc.,
Dr. Ing. Štěpán Štverák,
Prof. Dr. Arkadiusz Berlicki,
Dr. Ing. Pavel Trávníček,
Ing. Zdeněk Kozáček and Ing. Jan Břínek (all AI),
Ing. Jan Souček, Ph.D., RNDr. David Piša, Ph.D.,
Ing. Ivana Kolmašová, Ph.D.,
Prof. RNDr. Ondřej Santolík, Dr.,
Ing. Luděk Uhlíř,
Ing. Radek Lán and Ing. Jiří Baše (all IAP),
Mgr. Radek Melich, Ph.D., Ing. František Procháška, Ph.D., and Ing. Jan Václavík (all IPP)

for the scientific work *Solar Orbiter: participation of CAS institutes in the cutting-edge ESA space mission to the Sun*

Team of authors nominated by the Institute of Experimental Medicine composed of:

Mgr. Soňa Vodenková, Ph.D. (IEM),
Doc. MUDr. Tomáš Büchler, Ph.D. (Oncology Clinic of the 1st Faculty of Medicine of Charles University and Thomayer University Hospital),
Mgr. Klára Červená (IEM),
MUDr. Veronika Veškrnová (Oncology Clinic of the 1st Faculty of Medicine of Charles University and Thomayer University Hospital),
MUDr. Pavel Vodička, CSc. (IEM),
Ing. Veronika Vymetálková, Ph.D. (IEM)
for the scientific work *5-fluorouracil and other fluoropyrimidines in colorectal cancer: past, present and future*

Mgr. Dušan Coufal, Th.D., nominated by the Institute of Philosophy for the scientific work *Faith Tournament. Controversy over the chalice at the Basel Council 1431-1433*



The Award of the Czech Academy of Sciences 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 presented to:

Mgr. Jan Geletič, Ph.D., from the Institute of Computer Science for the scientific result *Local climate zones: specification, definition, validation and application of the concept*

RNDr. Alena Sucháčková, Ph.D., and **RNDr. Jana Marešová** from the Biology Centre for the scientific result *Butterfly areas of the Northern Hemisphere under the influence of Quaternary climate change*

RNDr. Martin Palus, Ph.D., from the Biology Centre for the following scientific results:
- *Bi-specific antibodies neutralize SARS-CoV-2 variants and prevent mutations in mice*
- *Human broad-spectrum antibodies protect against development flavivirus-borne tick-borne disease*

The Award of the President of the Czech Academy of Sciences for promotion or popularisation of research, experimental development and innovations was presented to:

Mgr. Roman Neruda, CSc.,
Institute of Computer Science
Mgr. Miloslav Jirků, Ph.D.,
Biology Centre
PhDr. Eva Doležalová, Ph.D.,
Institute of History

Honorary medals awarded to Czech and foreign researchers in 2021

The CAS Honorary Medal “De scientia et humanitate optime meritis”
prof. Ing. Jiří Kopáček, Ph.D.,
Biology Centre



The Ernst Mach Honorary Medal for Merit in the Physical Sciences

Prof. RNDr. Miroslav Hrabovský, DrSc.,
Joint Laboratory of Optics, Palacký University and the Institute of Physics
Ing. Pavel Novák, CSc., DSc.,
Institute of Physics
Ing. Bedřich Rus, Ph.D.,
ELI Beamlines, Institute of Physics

The Gregor Johann Mendel Honorary Medal for Merit in the Biological Sciences

Doc. Ing. Josef Hejzlar, CSc.,
Biology Centre
PhDr. Helena Svitavská Svobodová, CSc.,
Institute of Botany

The František Palacký Honorary Medal for Merit in the Historical Sciences

Dr. hab. Piotr Maciej Majewski,
University of Warsaw, Poland

The Honorary Medal for Merit for the Czech Academy of Sciences

Doc. PhDr. Lydia Petráňová, CSc.,
Institute of Ethnology

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:

RNDr. Jiří Grygar, CSc.,
Institute of Physics
Prof. RNDr. Helena Illnerová, DrSc.,
Institute of Physiology

The Minister of Education, Youth and Sports Award for outstanding results in research, experimental development and innovation

was awarded to:
RNDr. Petr Ježek, DrSc.,
Institute of Physiology

The Minister of Foreign Affairs of the Czech Republic Medal for Merit in Diplomacy

was awarded to:
Doc. PhDr. Jan Němeček, DrSc.,
Institute of History
PhDr. Jindřich Dejmek, Dr., DSc.,
Institute of History



The Minister of Health Award for Medical Research and Development was awarded to:

Prof. RNDr. Daniel Růžek, Ph.D.,
Biology Centre

Ing. Prof. Veronika Vymetálková, Ph.D.,
Institute of Experimental Medicine

The Henri Becquerel Prize for Nuclear Research awarded by the French Embassy in the Czech Republic was awarded to:

RNDr. Lenka Kubičková, Ph.D.,
Institute of Physics

The Environment and Climate Research Make Our Planet Great Again Prize of the French Embassy in the Czech Republic was awarded to:

Mgr. Lenka Suchá, Ph.D.,
Global Change Research Institute

The Visegrad Group Academies Young Researcher Award was received by:

Mgr. Ivana Víšová, Ph.D.,
Institute of Physics

The AUGER Impact Award for Scientific Work for the Pierre Auger Observatory was awarded to:

Mgr. Vladimír Novotný, Ph.D.,
Institute of Physics

The Award of the Chairman of the Grant Agency of the Czech Republic was presented to:

RNDr. Zdeněk Lánský, Ph.D.,
Institute of Biotechnology

Doc. RNDr. Martin Pivokonský, Ph.D.,
Institute of Hydrodynamics

The Josef Hlávka Medal for Lifetime Achievement in the benefit of Czech science, which is awarded by the Josef, Marie and Zdeňka Hlávková Talent Foundation, was presented to:

RNDr. Jan Lastovička, DrSc.,
Institute of Atmospheric Physics

The Learned Society of the Czech Republic Award in the “scientific researcher” category

was presented to:

Doc. RNDr. Petr Baldrian, Ph.D.,

Institute of Microbiology,

and in the “junior researcher” category to:

Mgr. Jan Perner, Ph.D.,

Biology Centre

The Neuron Endowment Fund Lifetime Science Achievement Award was presented to:

RNDr. Václav Petříček, CSc.,

Institute of Physics

The Medal of Merit for the City from the Mayor of České Budějovice was received by:

prof. RNDr. Libor Grubhoffer, CSc., Hon.

D.Sc., dr. h. c.,

Biology Centre

The CTU Rector’s Medal for Extraordinary Performance During Crisis was received by:

Ing. Vladimír Ždímal, Dr.,

Institute of Chemical Process Fundamentals

The Masaryk University MUNI Scientist Award for Excellent Research Results and Long-term Research Quality was presented to:

Prof. RNDr. Mojmír Šob, DrSc.,

Institute of Physics of Materials

The František Nušl Award for Lifelong Scientific, Professional, Pedagogical, Popularisation or Organisational Work in Astronomy was

awarded in memoriam by the Czech Astronomical Society to

RNDr. Stanislav Štefl, CSc.,

Astronomical Institute

The Commemorative Medal of St. Anežka Česká for Lifelong Contribution to Building Bridges Between Science and Faith

was awarded by the Czech Episcopal Conference to:

RNDr. Jiří Grygar, CSc.,

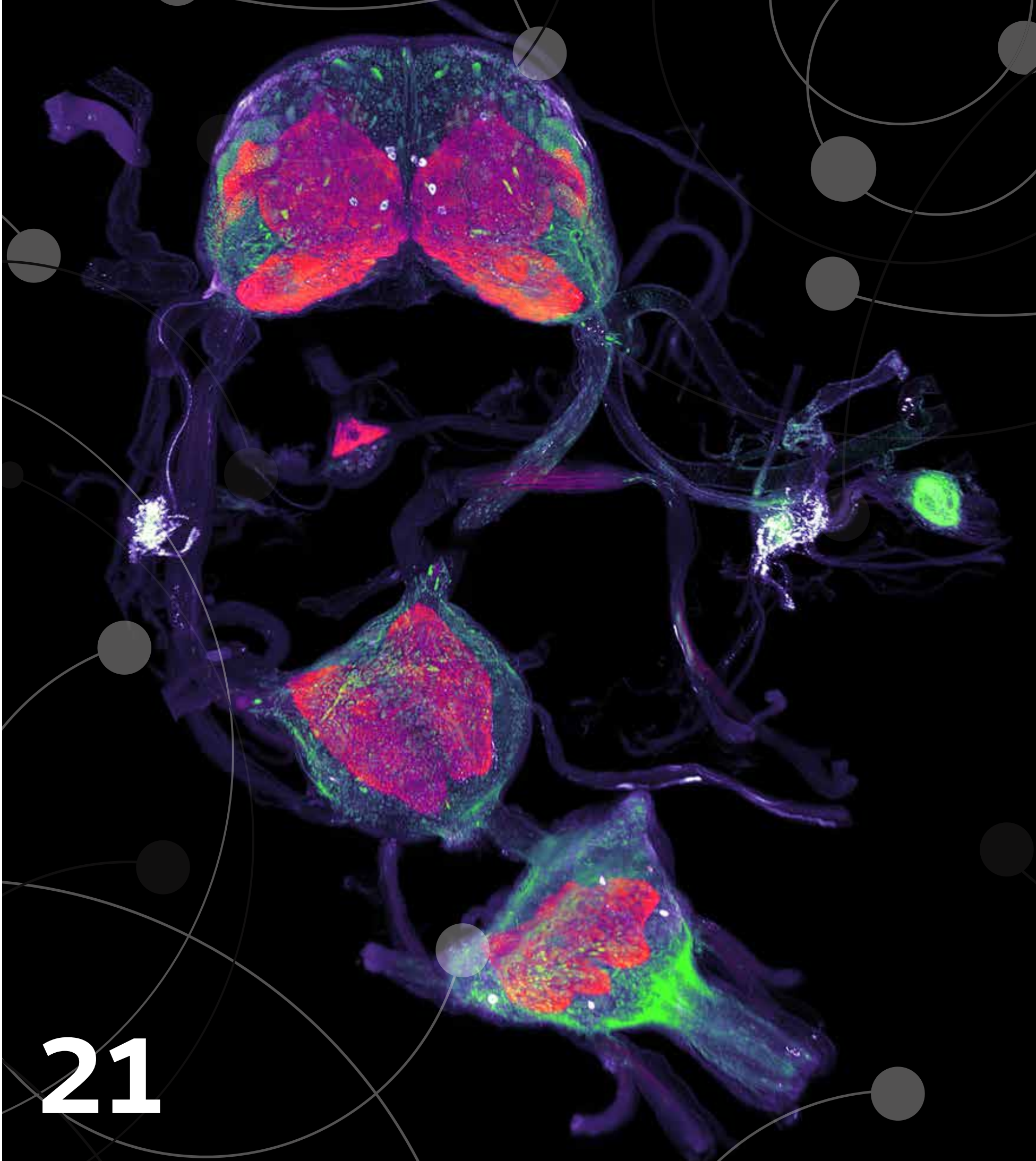
Institute of Physics

The 2021 Czech Head National Prize of the Government

The VEOLIA Award Doctorandus for Natural Science was bestowed upon:

Libor Šmejkal, Ph.D.,

Institute of Physics



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Granted “Research Professor”

Degrees

The scientific degree “Research Professor” was established by Decision XXI. at a session of the CAS 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 has adopted the Rules for Granting the “Research Professor” Degree by the Czech Academy of Sciences.

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

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

At its 11th session on 10 April 2003, the Science Council approved the structure of disciplines for defence commissions for the “Research Professor” Degree dissertations. There are currently 33 permanent commissions for disciplines in Research Areas I., II. and III. A total of 390 members have been appointed to defence commissions, of which 164 are from CAS institutes, 189 from universities and 37 from other institutions.

At its second session on 22 April 2021, the CAS Science Council appointed the following members to the Committee for the Research Professor Degree for the 2021-2025 term:

RNDr. Jiří Bek, CSc., DSc.

(Institute of Geology),

Prof. Ing. Zdeněk Bittnar, DrSc.

(Faculty of Civil Engineering CTU),

Doc. RNDr. Jiří Gabriel, DrSc.

(Institute of Microbiology),

Prof. Ing. Jiří Hanika, DrSc., Dr. h. c.

(Institute of Chemical Process Fundamentals),

Prof. RNDr. Jiří Horáček, DrSc.

(Faculty of Mathematics and Physics, Charles University),

RNDr. Pavel Kubáň, Ph.D., Res. Prof.

(Institute of Analytical Chemistry),

Prof. RNDr. Jaroslav Nešetřil, DrSc.

(Faculty of Mathematics and Physics, Charles University),

Doc. Mgr. Jiří Pittner, Dr. rer. nat., DSc.

(J. Heyrovský Institute of Physical Chemistry),

Prof. PhDr. Ing. Jan Royt, Ph.D., Res. Prof.

(Faculty of Arts, Charles University),

Prof. Ing. Václav Sklenička, DrSc.

(Institute of Physics of Materials),

Prof. MUDr. Anna Šedivá, DSc.

(2nd Faculty of Medicine, Charles University),

PhDr. Natalie Venclová, DrSc.

(Institute of Archaeology, Prague)

Prof. RNDr. Boris Vyskot, DrSc.

(Institute of Biophysics),

Prof. JUDr. PhDr. Michal Tomášek, DrSc.

(Faculty of Law, Charles University), was appointed Chair of the Committee for the Research Professor Degree. He concurrently holds the position of Vice President of the Science Council.

The Vice Chairs of the Committee for the Research Professor Degree were appointed as follows:

Prof. PhDr. Petr Sommer, CSc., DSc.

(Institute of Archaeology, Prague)

and **Prof. MUDr. Jiří Forejt, DrSc.**

(Institute of Molecular Genetics).

In 2021, the CAS Science Council granted the “Research Professor” Degree to the following researchers:

Mgr. Marek Taševský, Ph.D., Res. Prof.,

Institute of Physics

Dissertation: *High Energy Soft QCD and Diffraction*
Commission: Nuclear, Subnuclear and Mathematical Physics

Scientific degree granted: “Research Professor in Physico-Mathematical Sciences”

RNDr. Helena Štorchová, CSc., Res. Prof.,

Institute of Experimental Botany

Dissertation: *Mitochondrial genomes of the plant genus Silene in the context of the evolution of plant mitochondria*

Commission: Botany, Experimental and Ecological Biology

Scientific degree granted: “Research Professor in Biological-Ecological Sciences”

Prof. RNDr. Jiří Masojidek, CSc., Res. Prof.,

Institute of Microbiology

Dissertation: *Microalgae Culturing: from Laboratory to Large Scale Units*

Commission: Botany, Experimental and Ecological Biology

Scientific degree granted: “Research Professor in Biological-Ecological Sciences”



A ceremony to present “Research Professor” Degree took place at the CAS Library courtyard at Národní 3 in Prague on 29 September 2021.

Doc. RNDr. Jiří Kvaček, CSc., Res. Prof.,
National Museum Prague

Dissertation: *Study of Cretaceous plant diversity based on the anatomy of their reproductive structures*
Commission: Geological Sciences
Scientific degree granted: “Research Professor in Geophysico-Geological Sciences”

PhDr. Vladimír Liščák, CSc., Res. Prof.,
Oriental Institute

Dissertation: *Brother Odorik and his report on Eastern regions of the world: Relations between Europe and Mongolian China in the 13th and 14th centuries*
Commission: General and Czech History
Scientific degree granted: “Research Professor in Historical Sciences”

Doc. Mgr. Jaroslav Šebek, Ph.D., Res. Prof.,
Institute of History

Dissertation: *For God, nation and order*
Commission: General and Czech History
Scientific degree granted: “Research Professor in Historical Sciences”

Mgr. Jan Horáček, dr. és. sc., Res. Prof.,
Institute of Plasma Physics

Dissertation: *Heat transport in tokamak plasma boundary*
Commission: Plasma Physics and Optics
Scientific degree granted: “Research Professor in Physico-Mathematical Sciences”

Doc. Ing. Hanuš Seiner, Ph.D., Res. Prof.,
Institute of Thermomechanics

Dissertation: *Mechanical Properties of Advanced Metallic Materials Studied by Laser-Ultrasonic Methods*
Commission: Applied and Theoretical Mechanics
Scientific degree granted: “Research Professor in Technical Sciences”



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 2021

a)	Number of submitted requests for information	8
	Number of decisions rejecting a request	2
b)	Number of submitted appeals against a decision rejecting a request	0
c)	Number of court judgments examining the legality of a decision rejecting a request	0
d)	Number of exclusive licences granted	0
e)	Number of complaints submitted pursuant to Section 16a of the Act	2

List of Abbreviations Used

CAS	Czech Academy of Sciences
ERC	European Research Council
EU	European Union
GA CR	Grant Agency of the Czech Republic
TA CR	Technology Agency of the Czech republic
R&D	Research and Development
R&D&I	Research, Development and Innovation
R&D&I Council	Research, Development and Innovation Council
TTO	Technology Transfer Office of the CAS

2021 Annual Report on the Activities of the Czech Academy of Sciences

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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 at an international level, while respecting the current needs of Czech society and culture.

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

The CAS also develops collaboration 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.



Czech Academy
of Sciences

Czech Academy of Sciences
Národní 3, 117 20 Prague 1
ID: 60165171

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