

PATHWAY TO EXCELLENCE  
IN BASIC RESEARCH

30 years

Pushing the boundaries  
of human knowledge

Czech Science Foundation

[www.GACR.cz](http://www.GACR.cz)

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# FOREWORD



## Dear readers,

The main mission of the Czech Science Foundation ("GACR") is to support excellent basic research projects across all scientific fields.

Thanks to GACR, scientists working at Czech scientific institutions and their teams get the opportunity to fund their projects. GACR's role in funding science in the Czech Republic is crucial: we currently fund over 2,000 scientific projects worth approximately CZK 4.7 billion (EUR 194 million) a year. GACR is also an important actor in promoting global trends in Czech science, such as open science, increasing fairness in evaluation or balancing family and scientific life.

Last but not least, each year GACR gives thousands of young people - students and recent graduates - the opportunity to participate in excellent scientific projects at home and abroad: female and male students, postdocs and postdoctoral fellows make up 49% of the members of the research teams of the grant projects. There are also three specific grant schemes for early-career scientists which help them to gain international experience, establish themselves in Czech research institutions or set up a new research group.

The Czech Science Foundation was established 30 years ago. On the occasion of this anniversary comes the publication you are holding in your hands. It is intended both as a presentation of GACR's 30-year journey and a glimpse into its present and future, and also an introduction to some of the grant recipients and their projects - i.e. specific examples of the results of the funding.

GACR was modelled on the US National Science Foundation (NSF) and later on the European Research Council (ERC) when it was founded, which quickly brought GACR into line with other global agencies with which it later partnered. The inspiration by the ERC was particularly important in the design of the evaluation process - our evaluation system follows the principles of the ERC evaluation process, which allows for a fair selection of the most excellent projects.

And what are our plans for the future at GACR? We are moving on for example, by preparing new types of grant schemes, working on expanding international cooperation, getting involved at European and global level, and we also plan to implement innovations in the management of scientific projects so that our funding will continue to lead to the successful development of Czech science in the future.

I hope you enjoy reading this publication.

Prof. RNDr. **Petr Baldrian**, Ph.D.  
President, Czech Science Foundation

# BASIC RESEARCH

The purpose of basic research is to understand phenomena and principles, and **to deepen scientific knowledge**. It represents the cornerstone of science, extends the stock of human knowledge, and provides information which is so necessary for further research and discovery.

Basic research is **a key part of progress**, although its contribution is usually significant in the longer term. Investing in basic research ensures that humanity will continue to make new discoveries that lead to new technologies or treatments, for example.

Basic research **helps to respond to challenges** we face as a society - for example, the possession of knowledge of mRNA vaccines facilitated the development of a vaccine against covid-19 in record time.

Basic research **contributes to the quality of people's lives** because it leads to increased competition of economy and better environment, and it also focuses on social and other important issues.

Funding basic research is an **investment for future generations**.

“

*Basic research is an essential ingredient in the recipe for scientific progress and is the spark that will ignite the fire of scientific breakthroughs.*

”

- Marie Curie Skłodowska -

# MISSION

## FUNDING FOR RESEARCH

Thanks to science and research, the boundaries of human knowledge are expanding, i.e. we know more about the world, but also about ourselves. We can then use this knowledge to improve our lives. Supporting research financially is therefore an essential part of all knowledge-based societies.

## FUNDING FOR ALL FIELDS OF SCIENCE

Scientists choose their own topics and methods - project funding is determined solely by the scientific quality of the projects and the ability of the scientists to carry it out. This ensures that excellent projects in all fields of basic research are funded.

## IMPLEMENTATION OF EUROPEAN AND WORLDWIDE TRENDS IN RESEARCH

GACR plays a leading role in the Czech Republic in the implementation of current trends such as open science, especially with emphasis on open data and open publishing, fairness of science evaluation, and the promotion of the gender dimension in research.

## INTERNATIONAL COOPERATION AND MOBILITY

GACR promotes international collaboration between scientists by funding their joint projects and supporting the mobility of early-career researchers. These activities lead to sharing knowledge and experience, to establishing contacts and to facilitating cooperation and the scientific environment as a whole.

## ASSESSING RESEARCH QUALITY AND EXCELLENCE

Reviews focus on the expertise of the applicants, the quality of the project, innovative approach, and the expected contribution to science. This way we support the standards of the research environment and strengthen the quality of scientific research.

## SUPPORT FOR THE DEVELOPMENT OF INFRASTRUCTURE AND RESEARCH FACILITIES

Grant money also goes to investments into new instruments and other equipment necessary for scientific projects. However, this equipment remains at the institution after the grant ends, and is used for further research. This way GACR helps to improve equipment availability at research facilities.

# FUNDING FOR EXCELLENT RESEARCH

## PROMOTING THE INDEPENDENCE OF SCIENTIFIC RESEARCH

The project proposals submitted to the tenders go through an independent review process - and this way virtually anyone who submits an excellent research project, regardless of their institution, is eligible for funding. Scientific projects by individuals are also eligible for funding - institutional sponsorship is not a requirement for all grant schemes.

## CREATING AN ATTRACTIVE ENVIRONMENT

Thanks to the good design of grant schemes, GACR manages to take full advantage of the potential of Czech researchers and to attract outstanding foreign scientists. Grant types meet the specific needs of male and female researchers at all stages of their careers. We also promote equal opportunities and balancing work and family life.

## INCREASING RESEARCH EFFICIENCY

GACR funds the best research grown at Czech institutions and, as a result, increases the effectiveness of Czech science.

## FUNDING YOUNG SCIENTISTS AND EARLY-STAGE RESEARCH GROUPS

The future of Czech science depends on young scientists. GACR enables them to gain scientific experience not only as team members, but also through grants tailor-made for them. These grants allow them to obtain experience abroad (and vice-versa, to come to a Czech institution), thanks to the extraordinary funding. The best of the best can even start a scientific group using our grants.

# GACR PRESIDENTS



Prof. Ing. **Karel Štulík**, DrSc.

1992–2000

For the first President, the establishment of GACR meant building an entire institution - from setting up the administrative structures, preparing tenders and selecting project proposals to evaluating their implementation. Very quickly, we managed to build a world-class agency.



Prof. MUDr. **Josef Syka**, DrSc.

2000–2008

Professor Syka was instrumental in the first internationalisation of GACR - during his tenure, collaborations with German, South Korean and Taiwanese grant providers began, and they continue to this day. It was also during this period that GACR began to present awards for excellent achievements of the projects it funded.



Prof. PhDr. **Petr Matějů**, Ph.D.

2008–2014

During Professor Matějů's tenure, the GRIS grant information system was introduced, which greatly facilitated the submission and management of scientific projects. GACR was also at the inception of the multinational organizations of grant providers - Science Europe and Global Research Council.



Prof. RNDr. **Ivan Netuka**, DrSc.

2014–2016

Professor Netuka was involved in the preparation and implementation of the current project evaluation system, which is inspired by the ERC evaluation process. During his tenure, he managed to increase project funding significantly.



RNDr. **Alice Valkárová**, DrSc.

2016–2020

During her tenure, the first female President of GACR was particularly instrumental in expanding international cooperation, including the establishment of the CEUS and Weave initiatives. During her tenure, the highly selective EXPRO and JUNIOR STAR schemes also began to receive funding.



Prof. RNDr. **Jaroslav Koča**, DrSc.

2020–2021

Professor Koča used the experience of CEITEC development in his work at GACR to improve the scientific culture and environment. He contributed significantly to the preparation of new types of grants tailored toward different stages of scientists careers and to support the balancing of work and family life.



Prof. RNDr. **Petr Baldrian**, Ph.D.

2021–

The current President's priorities include supporting early-career scientists, open science, and facilitating the transition between basic and applied research. He is also committed to improving the quality of the evaluation of project proposals and the wider communication of scientific results.

# MILESTONES

## 1993 FIRST GRANT SCHEMES ANNOUNCED

The first grant scheme was launched after the Government passed GACR's Charter on 22 April 1993. A total of 1,838 project proposals were submitted.

GACR was able to establish Discipline Committees, design the entire process of evaluating project proposals, and negotiate the first two rounds of grant calls in a single year.

## 2005 FIRST INTERNATIONAL COOPERATION

GACR continues establishing partnerships with grant providers in other countries. The year 2005 saw the establishment of partnerships with German and South Korean providers, with which GACR still cooperates today.

International Projects 

## 2011 NEW HQ IN PRAGUE-DEJVICE

Due to the increase in the number of projects funded and the resulting higher staffing requirements, it was necessary in 2009 to move GACR from the premises of the Czech Academy of Sciences on Národní třída, where the Office had been located since 1993, to larger premises in Prague-Dejvice.



## 2012 GRIS APPLICATION LAUNCHED

In 2012, the GRIS grant information system was introduced, which enables the electronic submission and management of project proposals. GRIS provides scientists with quick, clear, and easy access to their proposals and projects and significantly reduces the costs of project administration.

GRIS

## 2013 FIRST LEAD-AGENCY PROJECTS FUNDED

In order to reduce the administrative burden, GACR started to cooperate on Lead Agency basis with grant providers abroad in 2013. Under this concept, only one of the agencies involved evaluates the project proposal, and the other agency takes over the evaluation. This evaluation system is based on mutual trust between partner agencies.

International Projects   
LEAD AGENCY

## 2020 WEAVE IS BORN

At the end of 2020, twelve European agencies, including GACR, launched the WEAVE initiative. Its aim is to enable joint scientific projects between scientists from participating countries. The evaluation of project proposals is based on the Lead Agency principle, and the initiative enables trilateral projects.



## 2003 FIRST GACR PRESIDENT'S AWARDS

The prizes are awarded annually for excellent results in research projects in each of the five fields of basic research. Projects completed in the previous calendar year are awarded. Over 20 years, 90 outstanding scientists have received awards.

## 2009 TRANSITION TO A PANEL REVIEW SYSTEM

In 2009, the panel evaluation process was introduced, working on the principle of expert panels responsible for narrowly defined expert areas within a given scientific field. Panel members are selected from among experts.

## 2011 SCIENCE EUROPE

GACR is a founding member of Science Europe, which aims to coordinate the practices and strategies of European organisations funding and conducting research. The activities of Science Europe, which brings together 41 organisations from 30 European countries, aim to increase the competitiveness of European science and research at a global level.



## 2012 GLOBAL RESEARCH COUNCIL

The motivation for the establishment of the Global Research Council (GRC), whose founding members include GACR, was the creation of a platform for national providers supporting basic research to promote common interests and the principles of funding basic research across continents. The GRC brings together national providers from Europe, Asia, Africa, North and South America.



## 2018 GACR GOES DIGITAL

In 2018, the agency went completely digital - everything, including contract signing, can be handled digitally. This way, GACR has contributed to the introduction of e-government in its area of operation.

## 2023 30<sup>th</sup> ANNIVERSARY OF GACR



# GACR GOVERNANCE



## PRESIDIUM

The Presidium of GACR is appointed by the Government of the Czech Republic on the basis of nomination by the Council for Research, Development, and Innovation. It is composed of five members representing five basic scientific disciplines - technical sciences, physical sciences, medical and biological sciences, social sciences and humanities, and agricultural and biological-environmental sciences. The term in office of the members of the Presidium is four years, with a maximum of two consecutive terms. The Presidium:

- approves the launch of public tenders and calls for proposals
- decides on the provision of funding for grant projects
- submits the draft Charter of GACR and amendments thereto to the Government for approval
- drafts the budget of GACR
- coordinates the activities of GACR advisory bodies that review and evaluate project proposals
- approves the evaluation of project proposals, the progress of projects and the results of completed projects



## OFFICE

The Office performs professional, financial, supervisory, organizational and administrative tasks resulting from the activities of GACR. The activities of the Office are governed by the Organizational Regulations. The Office is headed by a Director, who is appointed and removed by the President. The Office:

- prepares documents for meetings
- draws up the draft budget of GACR
- administers the approved budget following the President's instructions
- collects grant project proposals
- creates and manages the database of projects and reviewers
- organises the cooperation of GACR with partner organisations
- informs the public about the activities of GACR



## SCIENTIFIC ADVISORY BOARD

The Scientific Advisory Board is the conceptual body of GACR. It has twelve members appointed by the Government from among experts nominated by the Council for Research, Development, and Innovation. The term in office of its members is four years, with a maximum of two consecutive terms. The Board:

- proposes the establishment and focus of the Discipline Committees
- proposes groups of grant schemes
- evaluates the contribution of GACR to the development and quality of basic research in the Czech Republic
- discusses and submits proposals for solving problems related to GACR activities
- gives its opinion on other matters referred to it by the President, the Presidium, the Supervisory Board, or the Council for Research, Development, and Innovation
- comments on the content of the panels
- comments on and contributes to the development of GACR's international cooperation



## SUPERVISORY BOARD

The Supervisory Board is the supervisory body of GACR. It has ten members, appointed from among experts proposed by the Chamber of Deputies of the Parliament of the Czech Republic from among nominations by legal entities engaged in research and development, with a maximum of two consecutive terms. The Board:

- supervises the legitimacy and regularity of the distribution of GACR funds
- supervises the management of GACR
- discusses complaints about GACR's procedure for evaluating grant proposals
- submits binding opinions to GACR's Office in important cases

# GACR IN NUMBERS

Established  
**1993**

**7** grant schemes  
in 2023

**39** expert panels  
+  
**8** international discipline committees

**500+** project reviewers annually



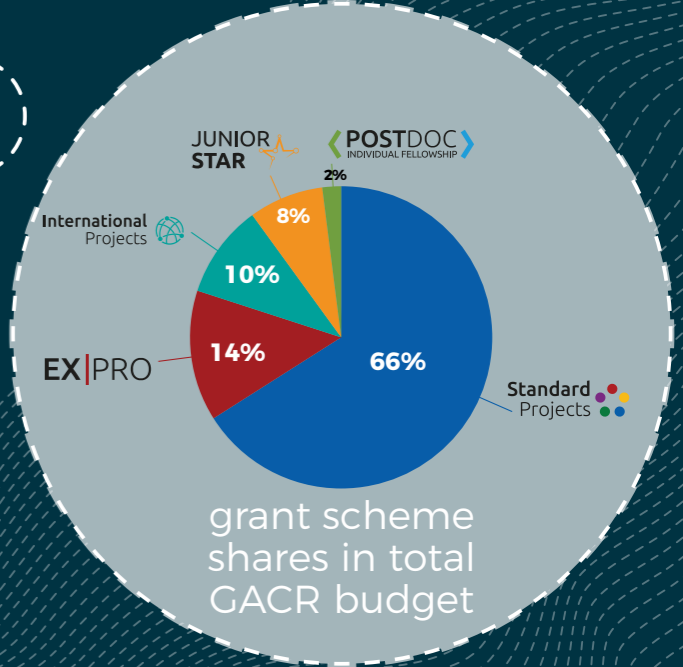
**386** beneficiary institutions



**€193 mil.**  
GACR budget

**12%**  
of Government funds towards R&D and Innovation

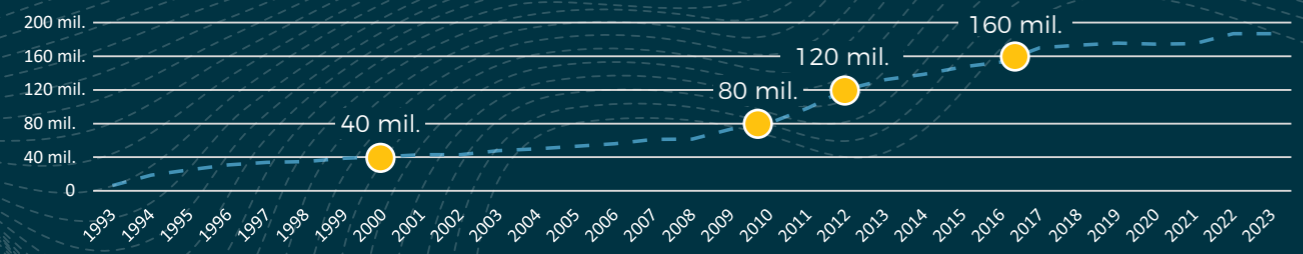
**29%**  
project proposals selected



**20,195** projects funded



GACR budget



# TAILOR-MADE GRANT SCHEMES

## Standard Projects

**"The most frequent grant scheme for both the experienced and beginners"**

Standard projects have been the cornerstone of research grant funding in the Czech Republic since 1993. They usually last three years and are open to scientists at all stages of their careers. Each year GACR evaluates several thousand research projects submitted to this grant scheme. However, only a few hundred of the best ones succeed. Thus, despite the name "Standard Projects", it is a very selective grant scheme.

## International Projects

**"Cross-border cooperation helps share experience and interlink themes"**

GACR enables bilateral or trilateral research projects between scientists from the Czech Republic and the countries where partner agencies operate. Calls are published irregularly depending on the agreement with the partner agency. GACR currently cooperates with 11 agencies abroad - three on a bilateral basis and the remaining eight on a Lead Agency basis. By 2025, GACR will establish cooperation with other European agencies through the Weave initiative.

## EX|PRO

**"Projects that can make a major breakthrough"**

EXPRO grants will only be awarded to applicants who have the potential to significantly advance scientific knowledge. Project proposals are evaluated by international panels and grant recipients can draw funds of up to CZK 50 mil. (approx. €2 mil.) over five years. The EXPRO grant scheme is intended for experienced and seasoned scientists, and is only open in even-numbered years. One of the obligations of the project investigators is to submit an application to the prestigious European grant call made by the ERC.

## JUNIOR STAR

**"Superior conditions for the best early-career scientists"**

The aim of the JUNIOR STAR grant projects is to support young excellent scientists and enable them to achieve scientific independence, to focus on their research topics, and create their own scientific teams. This grant scheme, starting in 2020, is exclusively for excellent scientists with significant international experience who have completed their PhDs no more than eight years ago. JUNIOR STAR projects have a five-year duration and the investigator can receive up to CZK 25 mil. (approx. €1 mil.)

## POSTDOC INDIVIDUAL FELLOWSHIP incoming

**"Launching the careers of international early-career scientists in the Czech Republic"**

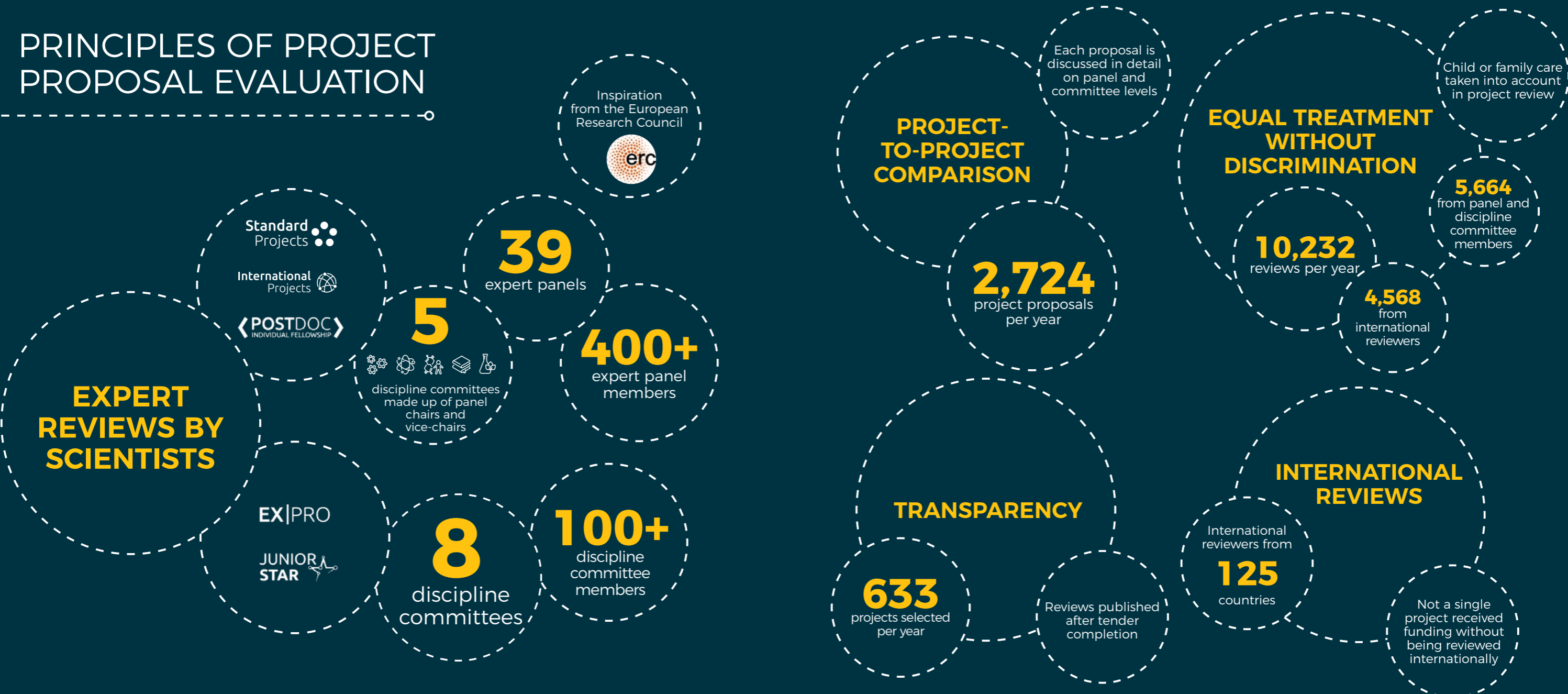
The annual POSTDOC INDIVIDUAL FELLOWSHIP - INCOMING scheme is aimed at supporting outstanding researchers who have spent at least two of the last three years at an institution abroad and completed their PhDs less than four years ago. This type of project is therefore suitable for Czech scientists after completing doctoral or post-doctoral programmes abroad who wish to return to the Czech Republic, and also for scientists from abroad who want to start their careers in the Czech Republic. The PIF INCOMING projects, first launched in 2021, are three-year projects.

## POSTDOC INDIVIDUAL FELLOWSHIP outgoing

**"Gaining experience at an institution abroad"**

The second POSTDOC INDIVIDUAL FELLOWSHIP scheme, OUTGOING, allows scientists to travel and pursue their research at a prestigious institution abroad. Outside the country, the researcher spends two years, and the third year at his/her home institution in the Czech Republic. The grants are intended for excellent scientists who have completed their PhDs no more than four years ago. The call has been made annually since 2021, and the project takes three years to complete.

# PRINCIPLES OF PROJECT PROPOSAL EVALUATION

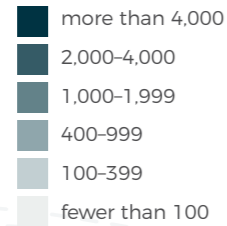


Data for 2013-2022

# INTERNATIONAL REVIEWERS IN 2012-2022

All the projects funded by GACR have gone through international reviews. Where from?

Country	Number
United States	6,376
Germany	4,430
United Kingdom	3,750
France	2,769
Italy	2,538
Spain	2,089
Poland	1,674
Canada	1,279
Austria	1,265
Australia	1,226



Japan	932	Croatia	159
China	913	Hong Kong	143
Netherlands	892	Bulgaria	139
Belgium	847	Mexico	129
Switzerland	743	Serbia	129
Portugal	675	South Africa	119
Sweden	660	Chile	103
India	594	Lithuania	102
Hungary	555	Malaysia	92
Finland	508	Estonia	77
Greece	438	Ukraine	77
Brazil	436	Egypt	51
Russia	433	Thailand	51
Denmark	341	Luxembourg	46
Norway	299	Iran	30
Israel	298	Latvia	29
Republic of Korea	253	Slovakia	27
Slovenia	251	Pakistan	25
Turkey	251	Cyprus	23
Ireland	242	Uruguay	23
Romania	215	Saudi Arabia	21
Singapore	191	Belarus	16
New Zealand	179	Georgia	16
Taiwan	169	Iceland	15
Argentina	161	Colombia	15
		Malta	15

**40,750**  
international  
reviewers

United Arab Emirates	11
Lebanon	10
Vietnam	10
Qatar	9
Macao	9
Tunisia	9
Puerto Rico	7
Bangladesh	6
Kenya	6
Macedonia	6
Nigeria	6

Algeria	5
Philippines	5
Indonesia	5
Kazakhstan	5
Cuba	5
Vatican City	5
Azerbaijan	4
Ethiopia	4
Falkland Islands	4
Ghana	4

Oman	4
Uzbekistan	4
Jordan	3
Morocco	3
Palestine	3
Swaziland	3
Armenia	2
Benin	2
Bosnia and Herzegovina	2
Montenegro	2

Ecuador	2
French Guyana	2
Guatemala	2
Iraq	2
Kuwait	2
Moldova	2
Panama	2
Sierra Leone	2
Sudan	2
Uganda	2
Afghanistan	1

Aruba	1
Bolivia	1
British Virgin Islands	1
French Polynesia	1
Jersey	1
Cayman Islands	1
Kosovo	1
Costa Rica	1
Kyrgyzstan	1
Libya	1
Liechtenstein	1

Maldives	1
Mauritius	1
Peru	1
Reunion	1
Samoa	1
San Marino	1
Saint Bartholomew	1
Sri Lanka	1
Tajikistan	1
Tanzania	1
Venezuela	1

# INTERNATIONAL CO-OPERATION



International collaboration among scientists brings about experience-sharing and interlinking of teams and topics. That is why GACR is working continuously to expand it. Currently, Czech scientists are already collaborating with scientists from four continents. The joint GACR-funded projects also motivate Czech scientists to collaborate with partners from abroad on EU-funded projects.

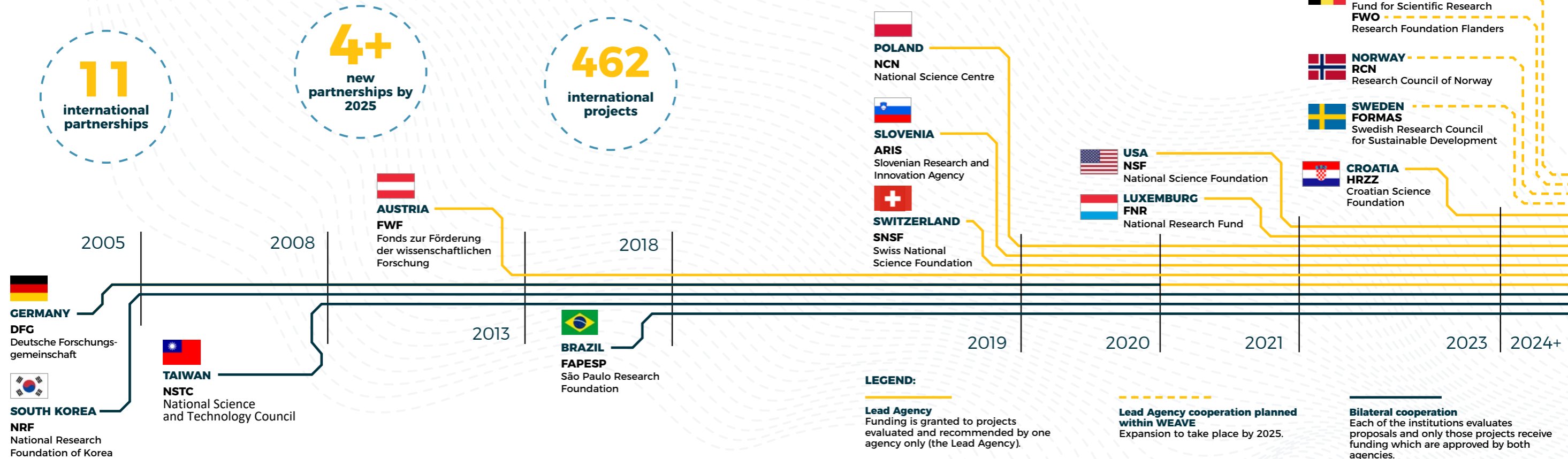
Established in 2012, the organisation brings together national providers of funding for basic research from Europe, Asia, Africa, Latin America and the USA. It serves as a platform for communication and cooperation between agencies, promoting common interests and principles of basic research funding.



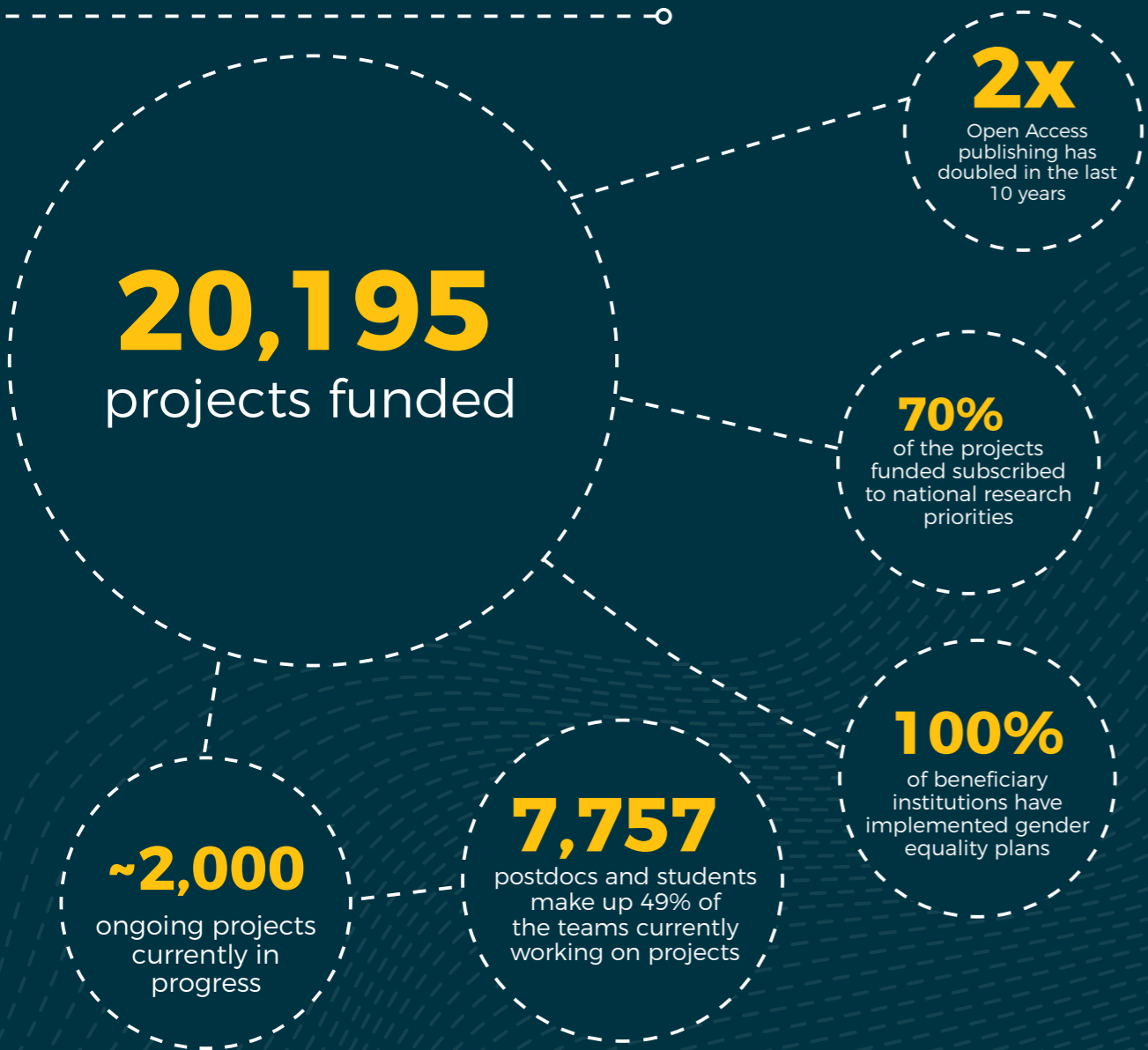
Science Europe brings together over 41 organisations from 30 European countries, both those that fund European research and those that carry out research directly. Alongside those, it works with the European Commission, universities, scientific organisations and national governments, for example. It contributes significantly to the development of the European Research Area (ERA).



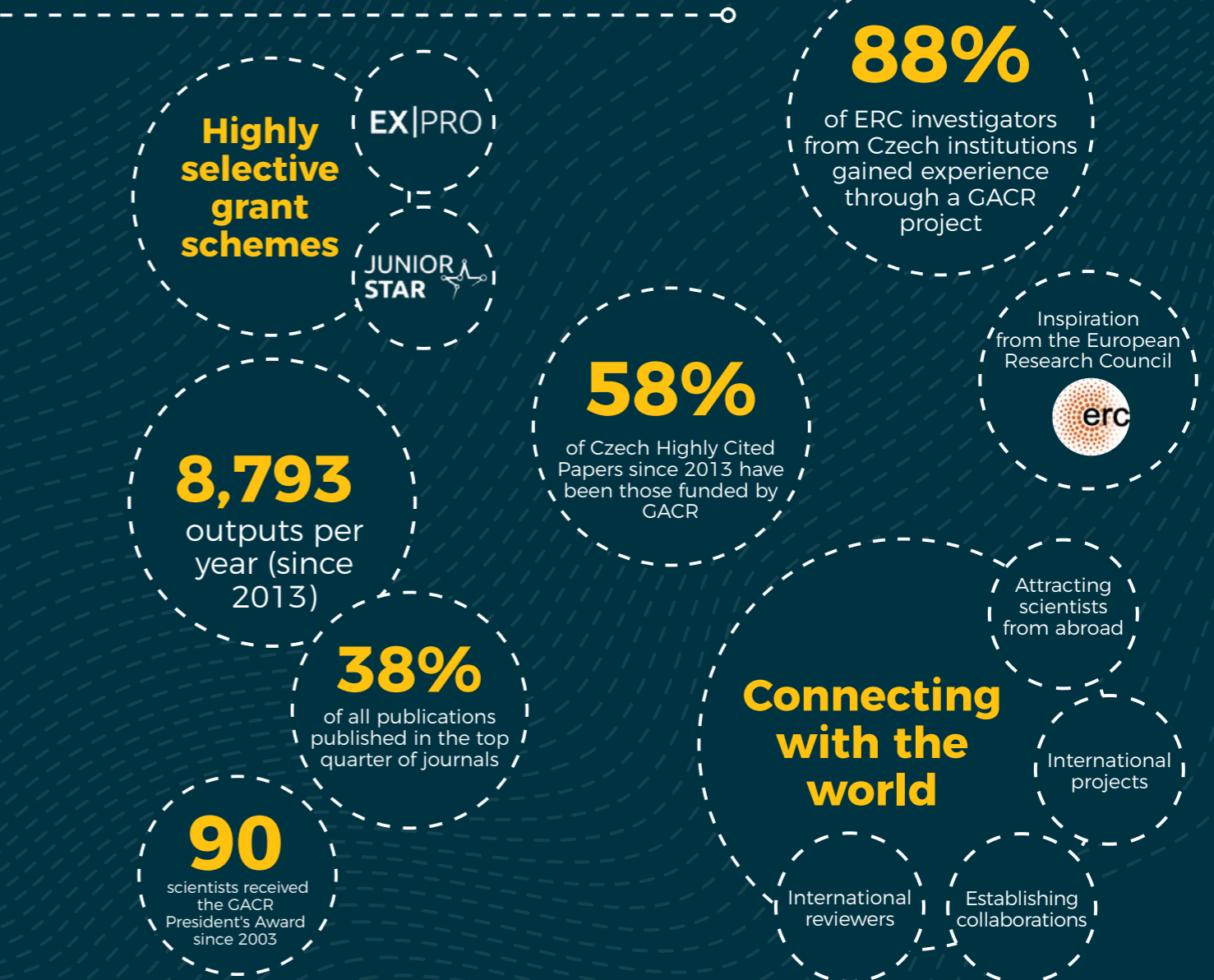
The European Weave Initiative, of which GACR is a founding member, was established in cooperation with Science Europe. The aim of this initiative is to connect 12 European institutions on the Lead Agency principle. This allows scientific teams from up to three countries to work together. More institutions are likely to join in the future.



## PROJECTS IN NUMBERS



## PROMOTING EXCELLENCE



# TECHNICAL SCIENCES

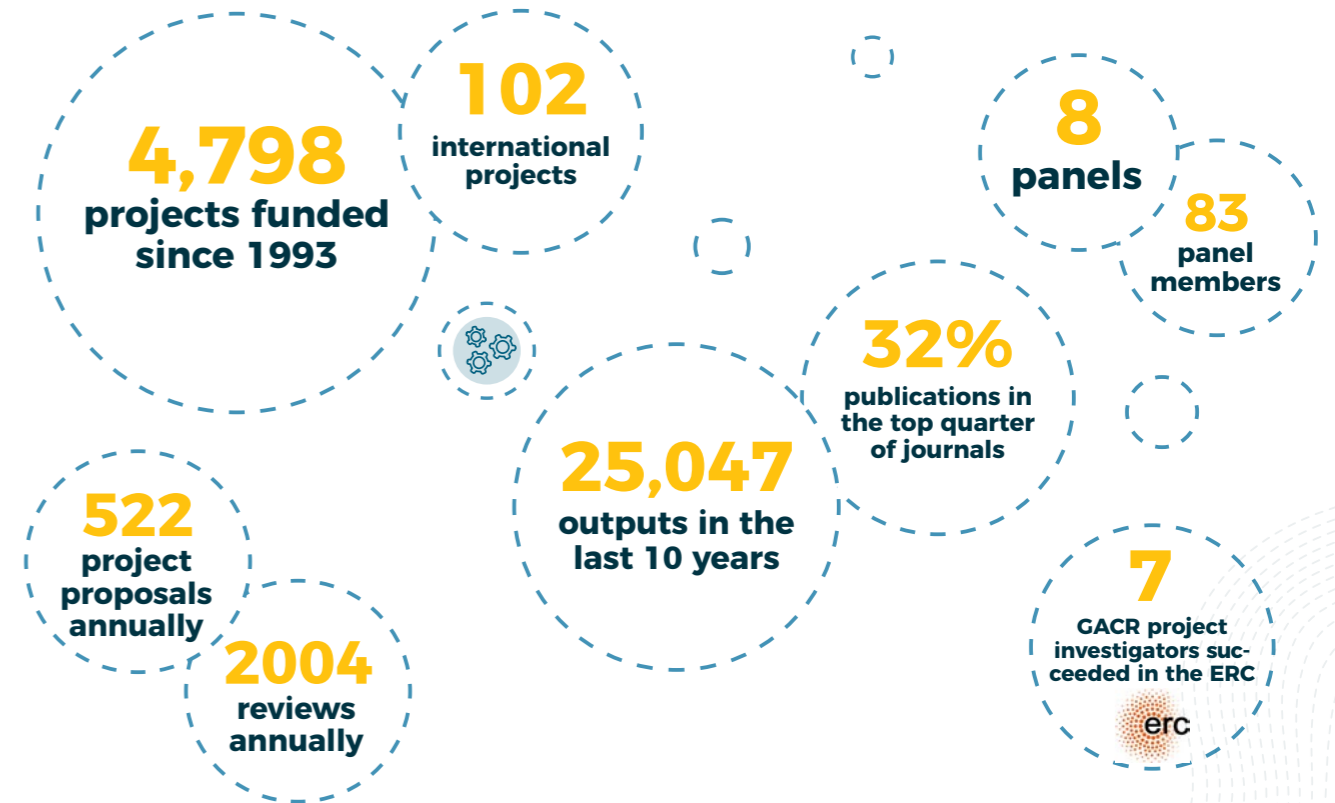
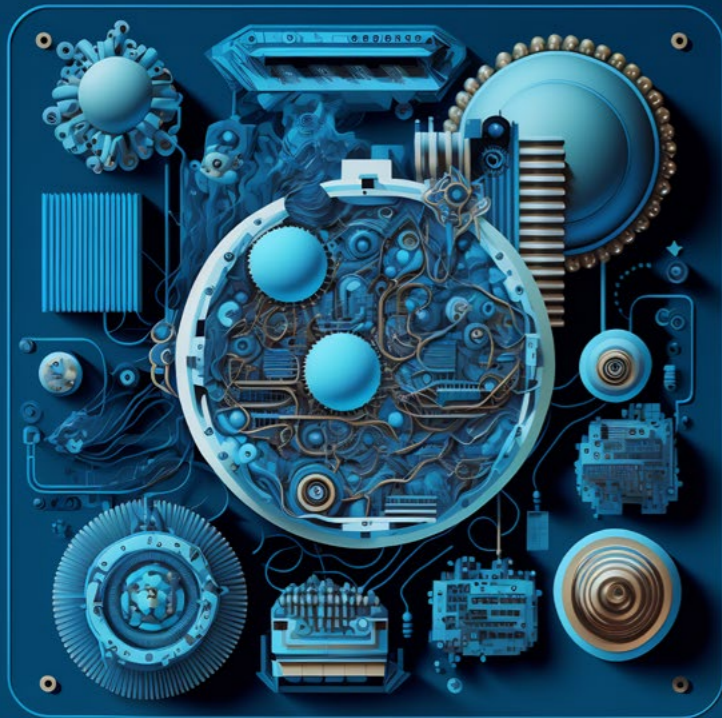


Prof. Ing. **Martin Hartl**, Ph.D.

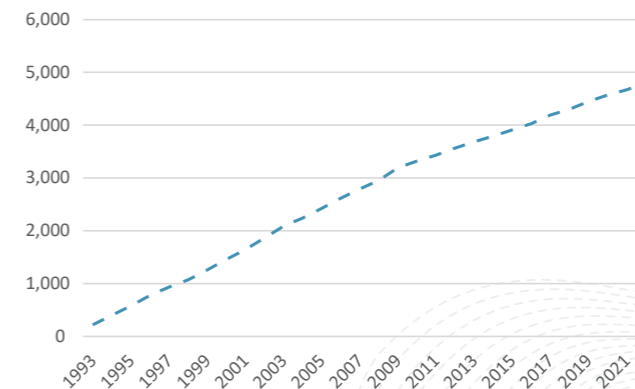
Presidium Member for  
TECHNICAL SCIENCES



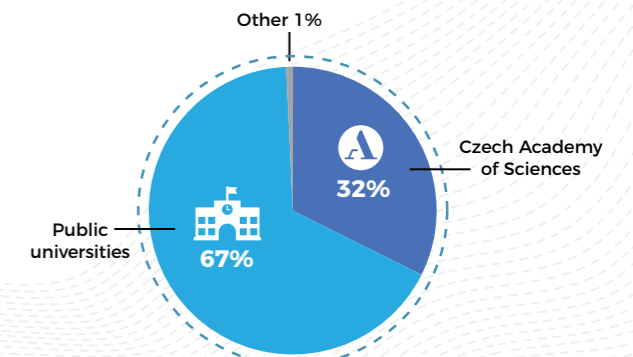
Technical sciences not only explore our world, but – more importantly – change this world. Their mission is to provide engineers with the scientific knowledge to develop new or improve existing products and services. Engineering sciences cover many areas of technology, from mechanical and civil engineering through electrical and computer engineering to chemistry and materials science.



Total number of projects funded



Support by beneficiary institution





# GENOME AS AN ECG RECORD



Ing. **Helena Škutková**, Ph.D.

Department of Biomedical Engineering, Faculty of Electrical Engineering and Communication, Brno University of Technology



One day our software could be in a small device that determines right in the field what type of bacteria infected the patient.



**Helena Škutková of the Electrical Engineering Faculty in Brno explores genetic code effectively written in the form of an electric signal. This procedure enables the rapid detection of dangerous bacteria and viruses and will help prevent the spread of antibiotic resistance and prevent pandemics in the future.**

Common bacteria have around five million base pairs in its DNA that code for its properties. "Even computers have a hard time working with that," says Dr. Škutková. And she started wondering how to display that amount more easily.

During her doctoral studies at the Institute of Biomedical Engineering in Brno, she focused on the possibility of recognizing the relatedness of organisms by comparing their genomes. She was inspired by the electrocardiogram – a graphical record of the electrical activity of the heart. It is a graphic analysis of the electrogram from the electrocardiograph that an expert can read easily through a single glance.

## Genetic code recorded like an electrical signal is easier to work with

Dr. Škutková dealt with methods in which the genome is plotted as a curve. From its shape, an expert can see what the genome looks like and where it differs from the genomes of other organisms. First, she created the DNA curve by assigning numbers to each base pair. Today, the required signals are produced directly by miniature

DNA sequencers that measure the nucleic acid like electric current. The data is processed simultaneously by the computer, easier and faster than if it were working with the original sequence of genetic bases.

The grant allowed Dr. Škutková to continue to work on the development of the procedure after completing her Ph.D. The focus was on bacterial genomes. "We were describing the essential features that distinguish the closest strains of the

same bacterial species to be able to identify them quickly, to determine their origin and identify the dangerous ones," she says.

Her research group already has a second GACR grant. "Thanks to this grant, we are improving the method, investigating which genes influence which bacteria functions, and looking for ways to tell from the bacteria's genome whether it is resistant to antibiotics already during the sequencing," she adds.

In clinical practice, antibiotic resistance is tested for several days by cultivating the bacteria in a laboratory. "In basic research, it takes time for the results to be put into practice in some form," Dr. Škutková says, adding: "But I imagine that one day the software we developed could be part of a miniature sequencer the size of a computer mouse that can determine from a sample in the field what bacterial strain the patient has contracted."



# NEW MATERIALS SUITABLE FOR THE ENERGY INDUSTRY AND MORE



Prof. Ing. **Zdeněk Sofer**, Ph.D.

Department of Inorganic Chemistry,  
University of Chemical Technology in  
Prague



Sodium or potassium embedded in layered materials could replace the deficient lithium in batteries. They are cheap and available everywhere.



Two-dimensional materials and the structures made from them may one day serve as catalysts for electrochemical reactions or improve energy storage, says Zdeněk Sofer of the University of Chemical Technology in Prague.

These substances are called two-dimensional because they are made up of individual planes - layers that can be separated from each other to produce a material one or a few atoms thick. Mica and graphite are examples. A single layer of carbon atoms separated from graphite is called graphene. Graphene is strong, ex-

tremely light and conducts electricity very well, and is therefore considered a future material for electronics, composites and other applications. Prof. Sofer became interested in it after completing his PhD.

In an earlier project funded by the Czech Science Foundation, he synthesised absolutely pure graphene without the presence of metal impurities, this way demonstrating their fundamental influence on the electrocatalytic properties of graphene. By applying radiation to graphene

and other layered materials with high-energy ion beams from a linear accelerator, his team is able to induce changes in the material, thereby controllably altering its properties. For his results, Prof. Sofer received the 2019 GACR President's Award.

He and his team are also investigating other two-dimensional materials and structures made from them. They are based on elements such as molybdenum, tungsten, chromium and other metals in conjunction with

non-metals such as sulphur, selenium, chlorine, or bromine. "Sodium or potassium embedded in layered materials could replace scarce lithium in batteries. Unlike lithium, they are cheap and available everywhere. Other materials, such as layered carbides and chalcogenides, have huge surfaces, and could act as catalysts in the

electrolytic decomposition of water to produce hydrogen for energy use," says Zdeněk Sofer.

**The team's research has resulted in one of the largest databases of layered compounds used by dozens of scientific groups around the world**

Based on Prof. Sofer's research, his team has created one of the largest collections of single crystals from layered compounds, which are used in experiments by dozens of scientific groups around the world for a wide range of applications, from

energy storage and conversion to the development of new quantum technologies.

In addition to GACR funding, Professor Sofer has been awarded two prestigious ERC-CZ projects. His results have been published in top journals such as Nature, Nature Communications and Angewandte Chemie.



# TAILOR-MADE CATALYTIC CONVERTERS ASSEMBLED LIKE LEGO



Prof. Ing. **Jiří Čejka**, DrSc.

Faculty of Science,  
Charles University in Prague



Normally, the preparation of new zeolites is done by trial and error. Our procedure can be used to prepare minerals with pores as required.



We create synthetic minerals with new properties, explains Jiří Čejka from the Faculty of Science at Charles University in Prague. Their substances have potential for the chemical industry, for example as catalysts.

Zeolites are natural minerals or synthetic analogues of silicon and aluminium that can also be produced industrially. The structure of zeolites contains a network of microporous channels in which gas and liquid molecules can bind. As a result, zeolites are used, for example, as filters for emission gases

or for wastewater treatment. In particular, however, they serve as catalysts that enable the targeted conversion of organic molecules. The chemical industry uses solid catalysts in about ninety percent of all production processes, and about half of these catalysts are zeolites.

"Normally, the preparation of new zeolites is done by trial and error. Scientists only find out after the fact how

big the channels of the new zeolite are, how big the molecules trapped in them are, and what it can be useful for," says Prof. Čejka.

## Half of the catalysts in the chemical industry are zeolites, which are the focus of this research

However, he noted that zeolites containing germanium are unstable in water. This element is water-sensitive, so the bonds that connect the layers of the material are broken in water.

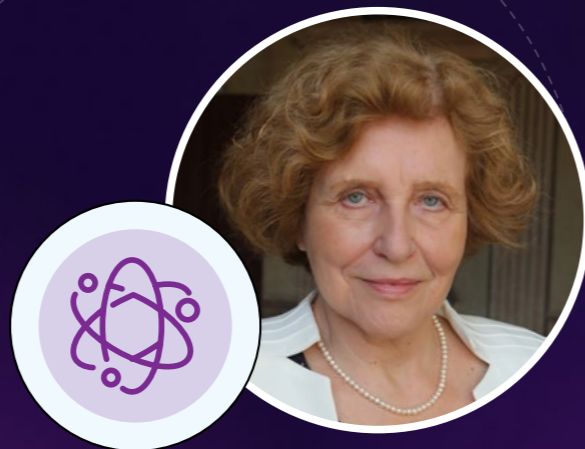
The researchers were able to exploit what looked like a problem. Thanks to this insight, Jiří Čejka and his colleagues devised a new method for synthesising zeolites, which they called ADOR (Assembly-Disassembly-Organization-Reassembly). It can be compared to working with the bricks of a child's Lego set.

Scientists will use zeolite, in whose microscopic structure solid layers

of matter are connected by atoms of germanium. This element is then intentionally removed in water, leaving only loose layers. These are then shifted by the researchers by mixing in different organic molecules and rejoining them. Prof. Čejka's team has gradually refined the method for materials structured with more complexity, and has already created fourteen new zeolites. The researchers are adapting the process so that it can be used to prepare new zeolites with the exact pores required.

The team has already published their results in prestigious journals such as *Angewandte Chemie*, *Journal of the American Chemical Society* and *Nature Chemistry*. Professor Čejka accolades include the GACR President's Award and the Cronstedt Prize awarded by the Federation of European Zeolite Associations (FEZA).

# PHYSICAL SCIENCES



RNDr. **Alice Valkárová**, DrSc.

Presidium Member for  
PHYSICAL SCIENCES



Research in the field of inanimate nature covers a wide range of areas, from mathematics, physics, chemistry, and earth sciences. It is difficult to imagine any progress in the development of society that is not related to discoveries that have been or will be made in these fields.



**5,772**  
projects funded  
since 1993

**196**  
international  
projects

**9**  
panels

**94**  
panel  
members

**41%**  
publications in  
the top quarter  
of journals

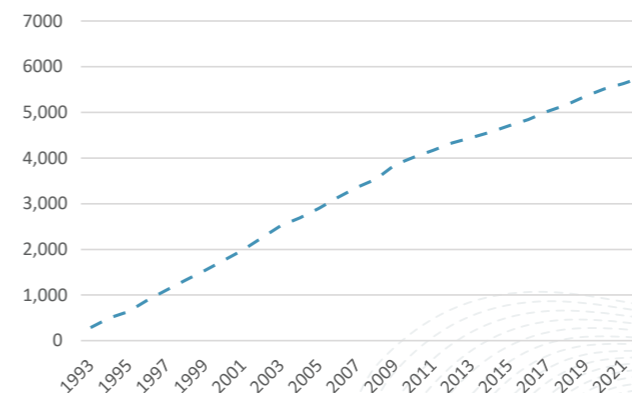
**23,024**  
outputs in the  
last 10 years

**27**  
GACR project  
investigators  
succeeded in the ERC

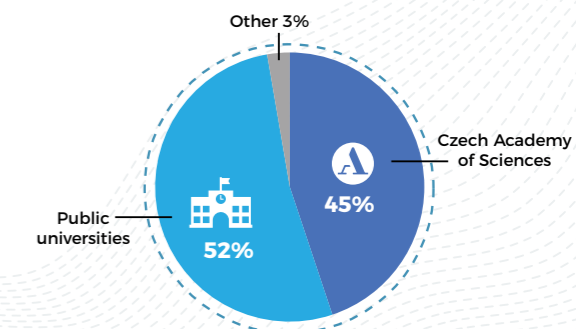
**579**  
project  
proposals  
annually

**2,378**  
reviews  
annually

Total number of projects funded



Support by beneficiary institution





# NEW QUANTUM PHENOMENA IN THE COLDEST PLACES OF THE CZECH REPUBLIC



Prof. Mgr. **Radim Filip**, Ph.D.

Faculty of Science,  
Palacký University in Olomouc



We are exploring a microworld that we cannot see directly and that behaves strangely, but we can make its diversity work for us.



The world is undergoing a second quantum revolution, and we all have a chance to be part of it, says Radim Filip from the Faculty of Science of Palacký University in Olomouc.

Quantum mechanics typically describes the microworld of atoms. The period since the beginning of the last century, when its foundations were laid, is called the first quantum revolution. It gave us nuclear magnetic resonance in hospitals and modern computing and telecommunications technology everywhere. The second quantum

revolution is happening right now. "It is much more complex, but it has already enabled the development of the first versions of small quantum computers," notes Prof. Filip. With his team, he studies the phenomena of quantum non-Gaussian coherence, which is used to describe new wave properties of photon clusters, the motion of atoms, and now also the nonlin-

**The second quantum revolution has already enabled the development of the first versions of small quantum computers**

ear behaviour of macroscopic superconducting oscillators. Non-Gaussian coherence is an essential tool of the second quantum revolution, making it possible to measure the motion of atoms with less error or to generate successful correction codes for quantum communications and computers.

Within the project funded by the Czech Science Foundation, Radim Filip's international team cooperates with a number of research institutes at home and abroad. Very important for him is the cooperation with the Institute of Instrumentation Technology of the Academy of Sciences in Brno. "In Olomouc we are a theoretical and, thanks to our younger colleague Lukáš Slodička, experimental facility in the field of modern atomic physics; the institute

in Brno supplies key physics and engineering methods."

Scientists explore an environment that can't be drawn like a picture, can't be videotaped and only specially developed tools provide information about it. One such quantum technology tool captures calcium ions using a clever combination of electric fields in a vacuum chamber at very low pressures. The laser beams then nearly stop the movement of the ions to make their temperature drop to absolute zero. "This way

in both Olomouc and Brno we have two of the coldest places in the Czech Republic where we can jointly test quantum vibrations and atomic emissions showing these new unexplored coherence phenomena and build on them for future research and applications," summarises Prof. Filip. "We are getting to know a microworld that we cannot see directly and which behaves strangely, but we can make its diversity work for us."

**EX|PRO**



# THE CATCH-AND-RELEASE METHOD FOR SWITCHES THAT CAN CONTROL REACTIONS IN LIVING ORGANISMS



RNDr. **Tomáš Slanina**, Ph.D.

Institute of Organic Chemistry and Biochemistry, Czech Academy of Sciences

“

Using light, we are able to release the drug exactly where it is needed, for example in a tumour and its surroundings. On the contrary, in other tissues where side effects of the drug can occur, we block the drug with light by merging it into a harmless complex.

”

Light, a seemingly elusive element, can control chemical processes in the human body. For example, the targeted delivery of a drug to the desired location in the human body, says Tomáš Slanina from the Institute of Organic Chemistry and Biochemistry of the Czech Academy of Sciences.

With colleagues in his research group, Tomáš Slanina uses what is called a “click chemistry” reaction (which earned its discoverers the Nobel Prize in 2022). Those reactions effec-

tively join molecular blocks together because they have reactive groups on themselves that fit together well (“click”), i.e. form a strong bond.

Tomáš Slanina and his colleagues are investigating “click” reactions that can take place in cell cultures and in the bodies of laboratory mice. “We induce the formation of bonds with light, such as red light, which penetrates tissues best,” he explains. With other light, he tries to release the bonds again. He calls the process “catch and release”. It

creates switches that repeatedly connect and disconnect molecular blocks as needed. This method can be used to regulate, for example, blood clotting. “We add a substance to the blood which causes it to clot when illuminated. With a different kind of light, we try to dissolve the clots again,” says Tomáš Slanina. This way, the scientists are verifying that such reactions are possible. However, they are still far from being used, for example, to remove dangerous blood clots in the human body.

However, Tomáš Slanina and his team are heading towards medical applications. “Imagine introducing an anti-cancer agent into the bloodstream of a cancer patient, embedded in a complex that is not dangerous to the body,” he says. “Using light, we are able to release the drug exactly where it is needed, for example in the tumour and its immediate surround-

ings. In other tissues, where there may be side effects of the drug used, we use light to block it by combining it into a harmless complex.”

**The process allows the creation of switches that connect and disconnect molecular blocks in living tissues as needed**

Tomáš Slanina is using a similar catch-and-release strategy based on bidirectional photochemical reactions in his research in a completely different field - organic solar panels, which can make better use of solar energy.

It was the funding from the Czech Science Foundation that enabled him to start his research. Now he has a prestigious grant from the European Research Council (ERC) and at the same time he received a JUNIOR STAR grant from GACR. “I have already turned down the GACR grant politely, it was impossible to draw funding from both grants,” says Dr. Slanina. “I hope the Czech grant made someone else happy.”

Standard  
Projects



# LUMINESCENT SILICON COULD CHANGE ELECTRONICS



RNDr. **Kateřina Kůsová**, Ph.D.

Institute of Physics, Czech Academy of Sciences

“

Luminescent silicon nanocrystals could, for example, transmit data by light in a computer, i.e. without the energy loss that occurs when electricity passes through the chip arrays.

”

**Small particles of silicon can emit light better than experts expected, found Kateřina Kůsová from the Institute of Physics of the Czech Academy of Sciences in Prague. And this finding could find application in computers.**

Thanks to a phenomenon called luminescence, some materials can absorb energy and then radiate it back as light. Silicon is not one of them – but it can be if it takes the form of tiny nanocrystals of only about five hundred or a thousand atoms.

“We discovered this essentially by accident, by attaching different molecules to the surface of silicon nanocrystals and seeing how this changed the properties of the silicon. Suddenly, it turned out that the nanocrystals to which we attached methyl groups started absorbing and emitting radiation much better. And we didn't know why,” says Dr. Kůsová.

She found the answer in further research funded by a junior grant from the Czech Science Foundation, and even won the GACR President's Award in 2016.

She demonstrated that the methyl group molecule bonds to silicon atoms. This stretches the nanocrystal and slightly rearranges the atoms. When a light pulse or electric current is applied, the electrons rise to a higher energy band. When they return, the 'stretched' nanocrystal is able to radiate the energy in the form of photons.

Kateřina Kůsová followed up on her previous research with additional funding from the Czech Science Foundation. “Thanks to GACR, we were able

to find new ways of attaching molecules to the surface of a silicon nanocrystal,” she says. “The original procedure was more laborious, these new ones are simpler but produce only little luminescence. So we still need to find a way to combine both properties.”

**For applications in microelectronics, there would be no need to revolutionise manufacturing processes, silicon has been used here for a long time**

It is not just about understanding the properties of substances in the nanoworld. “Luminescent silicon nanocrystals could, for example, transmit data by light in a computer, i.e. without the energy loss that occurs when electricity passes through the chip's connections. Or, if we added such a silicon crystal to a drug in pharmaceutical research, we could see exact-

ly where the drug was acting in the body of an experimental animal,” says Dr. Kusová.

She would particularly like to see applications in computing. It would not require revolutionary changes to existing manufacturing processes, as silicon has long been used in microelectronics.



# MEDICAL AND BIOLOGICAL SCIENCES

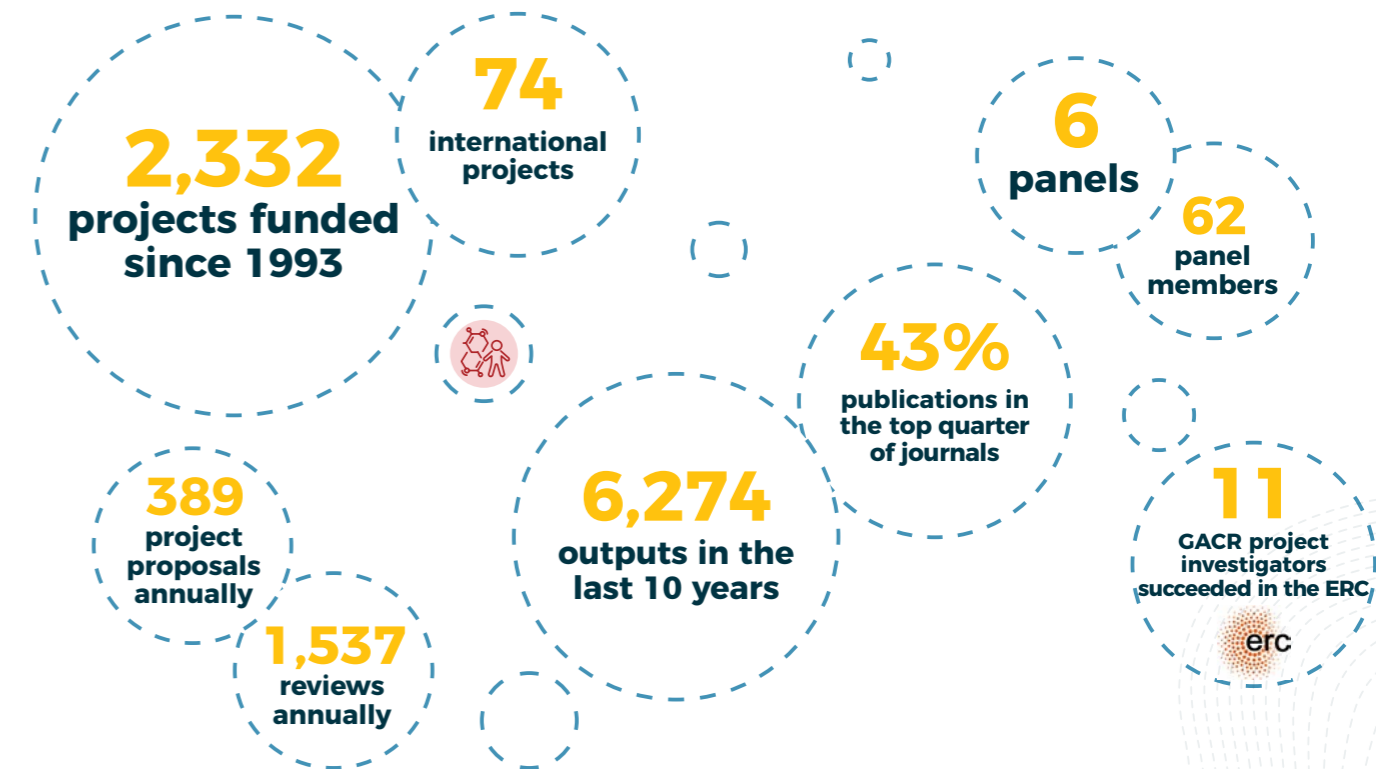


Prof. MUDr. Mgr. **Milan Jirsa**, CSc.

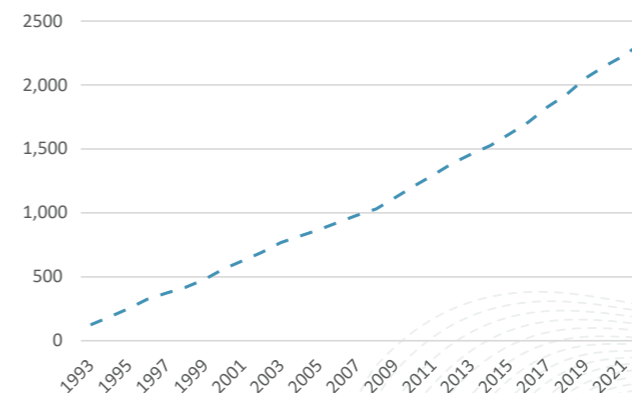
Presidium Member for  
MEDICAL AND BIOLOGICAL SCIENCES



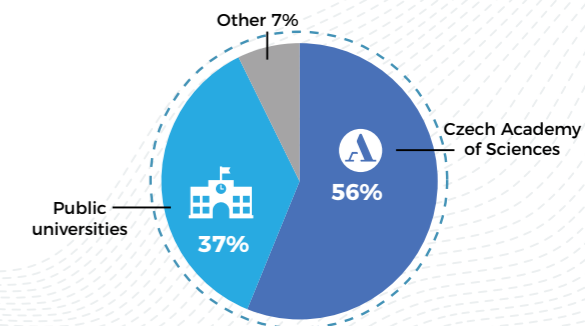
Biological and medical sciences are key to understanding the causes and mechanisms of human disease. The knowledge obtained in basic biomedical research is a prerequisite for the successful development of tools to diagnose, treat, prevent or replace missing physiological functions.



Total number of projects funded



Support by beneficiary institution





# WINE CELLAR FOR RESEARCH PURPOSES



Prof. Mgr. **Petr Svoboda**, Ph.D.  
Institute of Molecular Genetics,  
Czech Academy of Sciences

It is interesting to improve our understanding of the potential of RNA interference and to test whether it could be used, once again, as an addition to our immune system in defence against viruses.



When a biological mechanism ceases to exist during evolution, it is not necessarily written off. Petr Svoboda, Institute of Molecular Genetics, Czech Academy of Sciences examines the body's defences against viruses, which vertebrates have abandoned but which might now come in handy.

The process he is interested in is called RNA interference (RNAi). In it, a special enzyme called Dicer "dices" ribonucleic acid (RNA). This way, the activity of genes is blocked in a targeted way. In plants or insects, RNAi

also has a defensive function - it destroys the RNA of a dangerous virus, thereby killing it. This function has been lost in the course of evolution; vertebrates no longer use it.

"However, in mouse eggs, for example, there is still a variant of Dicer that could dice viral RNA. But it has a completely different role in the egg. That's what intrigued me. I thought it would be interesting to understand the potential of RNA interference better and see if it could be used as an old supplement to our immune sys-

tem to defend against viruses," says Prof. Svoboda.

He has received funding from the Czech Science Foundation and a grant from the European Research Council (ERC). And gradually, he and his colleagues were able to use genetic modifications to create a Dicer variant in mouse body cells that can induce "defensive" RNAi.

"When journalists asked me when this could be a cure for viruses, I made the

mistake of saying - it will definitely take at least ten years. Now ten years have passed, we have published a lot of important scientific findings about the action of RNAi over those years. But we have also found that induced defence is not universal, it works against some viruses but not others. And the enzyme that controls it must be neither too little nor too much," says Petr Svo-

**The team included slugs in the research; they are much cheaper than mice and easy to care for**

boda. "This is simply basic research. You never know in advance what will come out of it and when."

Now, Professor Svoboda's team has included slugs in the research - the properties of their RNAi will give clues to the direction of RNAi evolution in vertebrates. Moreover, these snails are much cheaper than mice and easy to

care for. "We've already bought two wine-making tanks for the lab where we keep them. I had to swear and sign that we have them for research purposes only. Thanks to this unique living organism, we are going to learn more again," says Petr Svoboda.

**EX | PRO**



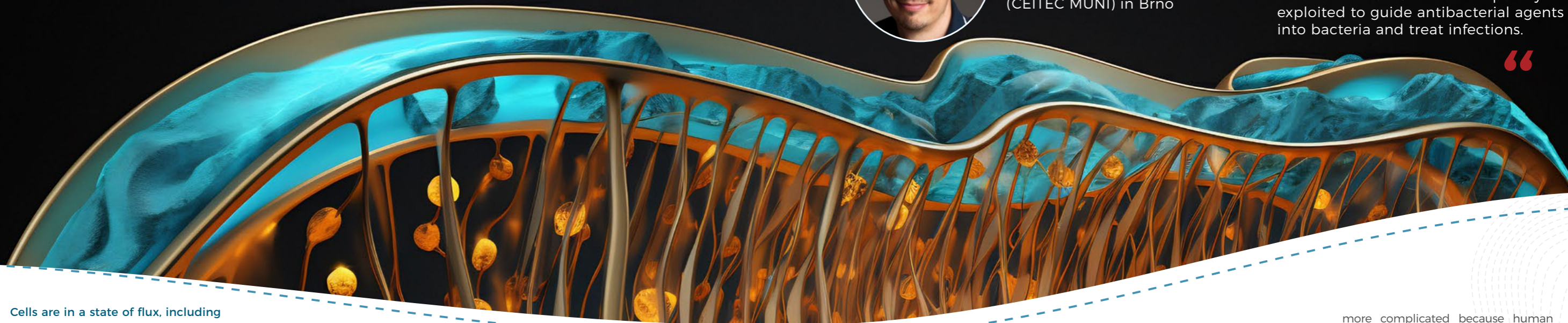
# TRAFFIC NAVIGATION INSIDE THE CELL



Prof. RNDr. **Robert Vácha**, Ph.D.

Central European Institute of Technology, Masaryk University (CEITEC MUNI) in Brno

“ There are major differences between the membranes of human cells and those of bacteria. This can hopefully be exploited to guide antibacterial agents into bacteria and treat infections. ”



Cells are in a state of flux, including the movement of proteins, which are the main tools of cells. Robert Vácha from the Central European Institute of Technology, Masaryk University in Brno, explores how they find their purpose in this environment.

“Proteins use specific interactions for targeting, including interactions with lipid membranes on the surface of individual organelles. Organelles are the internal structures of a cell that, like any cell, are surrounded by a membrane. The membranes have a characteristic composition and shape that

can be targeted by the navigation proteins (peptides),” says Professor Vácha. “We are investigating how this navigation works in the cell. One of our more distant goals is to use this knowledge to target drugs to dangerous bacteria and perhaps even viruses.”

The basis of the work of Robert Vácha and his team is computer simulations. GACR funding has helped them set up a laboratory where they verify the calculated results directly by experiment. The internal environment of a cell is

extremely complex, so they also create simplified models. One of those models is a lipid vesicle surrounded by a membrane composed of the most abundant lipids of a given organelle.

“In computer simulations, we investigate why some proteins bind to the membrane and others do not. We then design new proteins based on our understanding of such binding. We validate the results in the lab, where we measure whether the new

protein binds to model membranes and behaves the same way as in the simulations. If the experiments confirm the results of the simulations, we proceed with more complex models and cells. Of course, we also check for any toxicity of the artificially prepared navigation peptides,” emphasizes Prof. Vácha.

### Simulation results are verified on site by experiments in the laboratory

The result of the research is a deeper understanding of what is happening in cells. But Robert Vácha has more plans. “There are big differences between the membranes of human cells and those of bacteria. This can hopefully be exploited to guide antibacterial substances into bacteria to treat infections,” he contemplates. “Maybe something like this will work for viruses, too. But for those, the situation is

more complicated because human viruses are covered with membranes from human cells. So the composition of the membranes is very similar and it will be much more difficult to target the guided antivirals without compromising the surrounding cells.”

Robert Vácha is currently working on this research as part of a European Research Council (ERC) project.



## HER SCIENCE CAREER GOT A ROCKET START IN ELEMENTARY SCHOOL

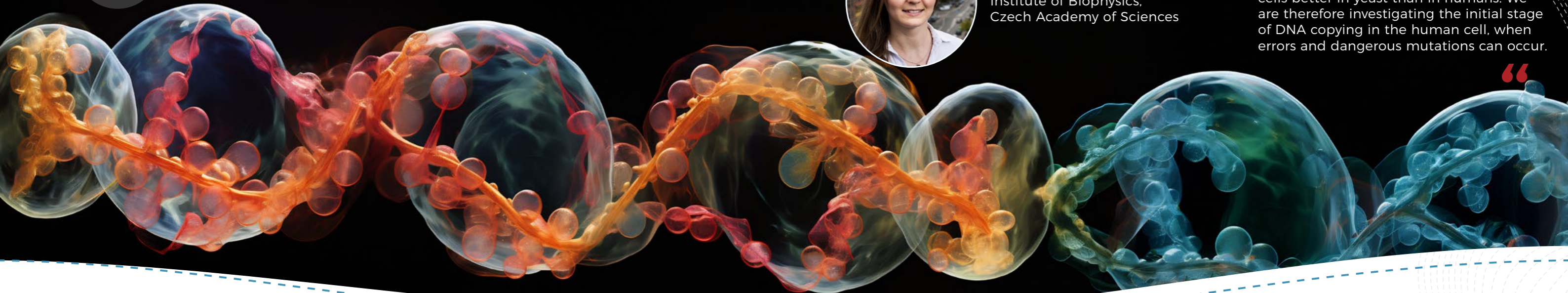


Mgr. **Hana Polášek-Sedláčková**, Ph.D.

Institute of Biophysics,  
Czech Academy of Sciences



We know how DNA is copied into new cells better in yeast than in humans. We are therefore investigating the initial stage of DNA copying in the human cell, when errors and dangerous mutations can occur.



When a cell divides, its genetic material is copied into the two newly formed cells. If this doesn't work perfectly, problems can arise, such as a tumour. Hana Polášek-Sedláčková investigates the little-known initial stages of cell division and the copying of genetic information.

She entered the world of science like a rocket. She comes from the village of Svatobořice-Mistřín, where her teacher in the science club got her excited about biology. She set up a laboratory in her basement. She participated in biology olympics and secondary school science activities.

During her studies, she investigated the properties of a protein that enhances the development of an unpleasant hereditary disease: the Rothmund-Thomson syndrome. The Hodonín secondary school allowed her an individual plan of study, which allowed her to spend a lot of time in the laboratory of Masaryk University in Brno, where she commuted.

"Science olympics and secondary school science activities are organised in the Czech Republic very well. They helped me find a scientific ca-

reer which is exciting for me," she says.

As a secondary school student, she won the Czech Youngster Brain Award (awarded by the Czech Brain project to support scientific and technical intelligence). At Masaryk University, she continued her research on the Rothmund-Thomson syndrome, wrote her bachelor's thesis on it and received the golden medal in the global competition "The Undergraduate Awards".

Her Master's diploma was followed by a scholarship at the University of Copenhagen, where she received her Ph.D. four years later. Another two years later, thanks to GACR funding, she was able to create her own research group at the Institute of Biophysics of the Czech Academy of Sciences.

Meanwhile, she moved from one

particular protein to investigating the place where proteins are made and act – the cell. "It's an incredibly complex environment that is largely governed by the genetic information in DNA. But we know how DNA is copied into new cells better in yeast than in humans. My colleagues and I are therefore investigating the initial stage of DNA copying in the human cell, where errors and dangerous mutations can

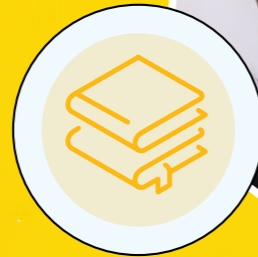
**Science olympics and secondary school vocational activities helped her find a scientific career**

occur. We've discovered new proteins that allow DNA to be copied flawlessly. And now we are studying how their properties could be used to treat cancer," explains Dr. Polášek-Sedláčková.

She has published in the most prestigious scientific journals Nature and Science and has further scientific plans ahead of her, for which she has recently received a European Research Area (ERA) grant.

**JUNIOR STAR** 

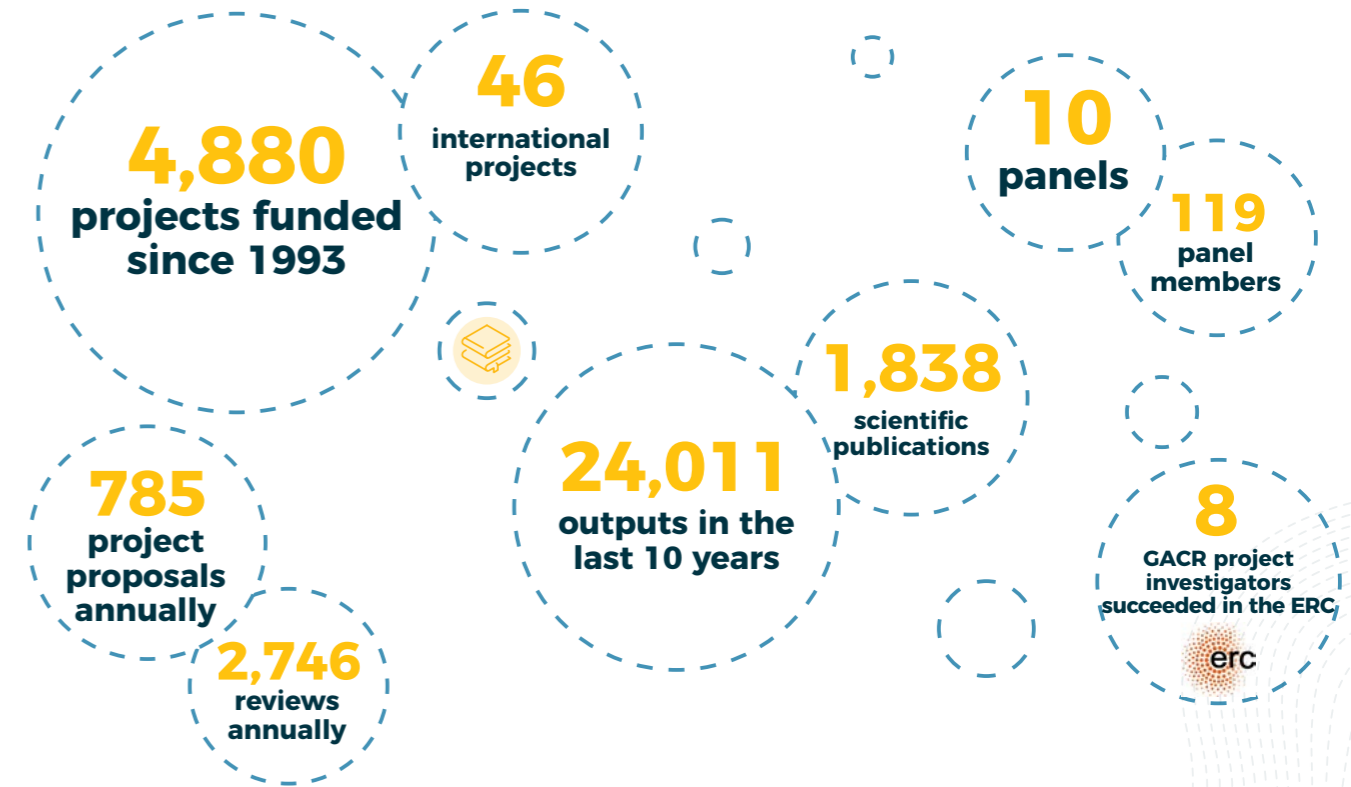
# SOCIAL SCIENCES AND HUMANITIES



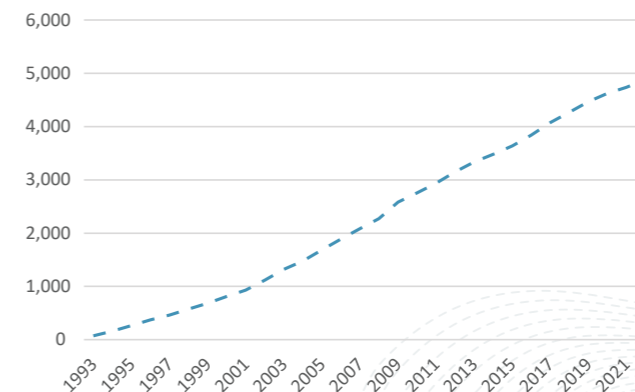
Assoc. Prof. PhDr. **Martina Hřebíčková**, DSc.

Presidium Member for  
**SOCIAL SCIENCES  
AND HUMANITIES**

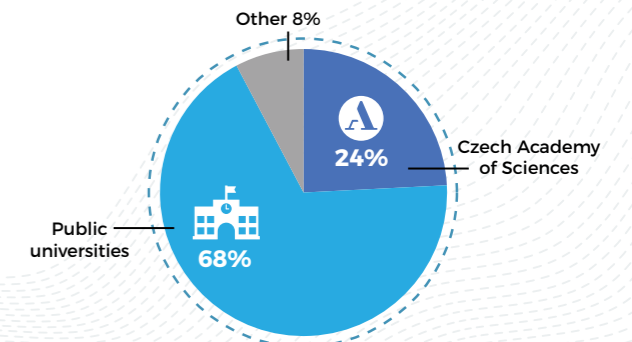
“ The findings of basic research in the diverse disciplines of the social sciences and humanities help us understand ourselves, know and explain the functioning of our society and other civilizations. Humanities bring out lessons from the past and hints for addressing key issues of the present, such as various crises, security and migration. The intensive development of these disciplines and the translation of findings from basic research into education and public life have a direct impact on individuals and the society as a whole. ”



**Total number of projects funded**



**Support by beneficiary institution**





# LACK OF ATTENTION MAY EVEN BE USEFUL FOR LIFE



Prof. RNDr. **Filip Matějka**, M.A., Ph.D.

CERGE-EI, a joint institute of Charles University and the Czech Academy of Sciences

“

I look for patterns that cause people to make less than ideal decisions. For example, I try to determine what happens if a law is changed – will it be more rational, more understandable, will people make fewer mistakes or more mistakes?

”

It is impossible for us to pay attention to everything that is happening around us. “I can’t spend four hours today studying inflation in Egypt, I’ll use the time for something more important to me now,” says Filip Matějka of the CERGE-EI economic research institute. This approach is called “rational inattention”.

By “rational inattention” we mean that one makes a deliberate decision not to pay attention to something. Despite its seemingly simple nature, this approach has far-reaching consequences for individuals and society.

Often people don’t act rationally, they don’t pay attention to the essentials and therefore make bad decisions. Whether it is about the direction of investment or about voting for a political party whose agenda goes against the interests of those who vote for it.

Rational and irrational decisions are among Prof. Matějka’s research interests. “I look for patterns that cause people not to make ideal decisions. For example, I try to determine what happens when a law is changed - is it

more rational, more understandable, will people make fewer mistakes or more mistakes?”, he explains.

Filip Matějka originally studied physics at Charles University. He also enrolled at the University of Economics, but left to study economics at Princeton University in the U.S., from where he returned with a Ph.D. in applied mathematics. “When I lecture at the University of Economics nowadays, I say I wrote a paper with a Nobel Prize winner in macroeconomics, but

I got a C in macroeconomics at the University of Economics,” he laughs.

The Nobel Prize winner is Christopher Sims. Filip Matějka worked with him at Princeton, where he was interested in macroeconomic research. After returning to the Czech Republic, he ran a consulting firm for a few years

**People often don't pay attention to what really matters, and make bad decisions as a result**

and prepared logistics plans for large companies, but science attracted him back anyway. He was able to return

to it thanks to a GACR grant, and he also received another two grants from the European Research Council (ERC).

In the first year of the covid pandemic he was a member of the Central Crisis Council. “My

two children, my wife and I all had to stay at home. I had a corner in my bedroom where I put my computer on the ironing board and prepared proposals with other economists for government economic measures and for reducing the uncertainty of business and ordinary people. Some of the recommendations took hold, others did not. Even in basic economic research, it takes time for findings to translate into mainstream practice,” he sums up laconically.



# STUDENTS WHO SPEAK UP IN CLASS DO BETTER WITH THEIR GRADES



Prof. Mgr. **Klára Šed'ová**, Ph.D.  
Faculty of Arts,  
Masaryk University in Brno



A student's performance often reflects the socio-economic status of their family. However, if a student is actively involved in communicating in the classroom, this link is broken and educational outcomes tend to improve.



Students who engage with their teachers and classmates during lessons generally achieve better academic results and make up for the disadvantages of a less supportive family background, as established by Klára Šed'ová from the Faculty of Arts of Masaryk University.

"When we present the conclusions at teacher seminars, they sound simple. A lot of teachers think they can communicate with students, and if someone does not engage in class, it is due to their inability or unwillingness. But engaging students productively and proportionately is not

easy, yet any teacher can do it," Prof. Šed'ová concludes.

Teaching is all about communication. Klára Šed'ová's team investigated how effective it is. In more than three dozen classes 5-9 of primary schools in the South Moravian and Olomouc Regions, observers used tablets with special software to record how active students were in class, how they responded to teachers' questions, whether they used arguments, voiced their own opinions, and followed up on what others had said.

Subsequently, the researchers monitored four school classrooms with video cameras for a long period of time, and the recordings allowed for a more detailed analysis of the lessons. "We tried not to make the observations too distracting, so that the students could get used to them and start ignoring them," notes Klára Šed'ová.

The researchers supplemented the observational data with data on the student's school performance and

data from questionnaires and interviews about their attitudes to school or homework.

"This allowed us to confirm the hypothesis that those who talk more and argue more in class also learn more. And we have discovered other important patterns," says Prof. Šed'ová as she presents her study, which is also unique

internationally and has been cited abroad. "It is known worldwide that a student's performance often reflects the socio-economic status of their family. Our study has shown that if a student is actively involved

**Teaching is all about communication. Researchers examined how effective communication was in class**

in communication during class instruction, this pattern breaks down and their educational results tend to be better than those of students with similar family backgrounds who remain silent in class."

At present Klára Šed'ová's team is working on a follow-up project. "We are coaching teachers to create situations allowing more students to speak up in class than the same two or three ones," she concludes.

Professor Šed'ová has been able to develop her education research thanks to the GACR grant – since 2001 she has been the principal investigator or co-investigator of six GACR projects. In 2021 she received the GACR President's Award. Her work was the first education research project to receive this award.



# RACISM AND XENOPHOBIA THREATEN THE HEALTH OF SOCIETY



Mgr. **Kateřina Čapková**, Ph.D.

Institute for Contemporary  
History, Czech Academy of  
Sciences



The project shows that it is still necessary to fight any form of xenophobia and racism. Not all communities have a fair status and representation in public life.



**Kateřina Čapková from the Institute for Contemporary History of the Czech Academy of Sciences in Prague examines the history and present of two communities, Jews and Roma, affected by racial persecution during the Second World War.**

While studying history, she became interested in the history of Jews in Central Europe. "I also studied German and learned Yiddish," she says. Later, she noticed how few scholars dealt with Romani history. "Academic disinterest mirrors the ignorance and

discrimination that Roma face on a daily basis," she says, explaining why she expanded her professional focus.

In 2016 she founded the academic platform Prague Forum for Romani History. "Within its framework, experts from around the world share research results and plan research projects. The key is to give dignity back to Roma and to support Romani researchers," Kateřina Čapková says. In her third project funded by the Czech Science Foundation, she combines research on Jewish and Roma history. Togeth-

er with her colleagues, she is investigating how their communities in former Czechoslovakia were affected by the genocide during the occupation and the migration waves of Jews and Roma that ensued in the wake of the war. "These marginalised communities are different in their traditions and languages. However, it's a fact that the Nazi regime subjected both of them to racial persecution with the connivance and often with the help of the local majority population," she says.

Thanks to extensive archival research and the testimonies of Jews and Roma, Kateřina Čapková's team also found other interlinked experience of both communities. For example, in the camps in which Roma were imprisoned, Jewish doctors were brought in. In the Auschwitz II extermination camp Birkenau was close to what was called the "family camp", in which the

**Academic disinterest mirrors the ignorance and discrimination that Roma face on a daily basis**

majority were Jews from the Protectorate, and what was called the Gypsy camp, where thousands of Czech Roma and Sinti were interned. In eastern Slovakia, relations between Jews and Roma were more intertwined. Often the Roma chose Jews as godparents for their children, and Jews employed Roma neighbours in the household to work on the Sabbath. Many Roma and Jews also met as members of partisan groups or

directly as soldiers in Svoboda's army. One of the outputs of the project is a globally unique database [www.sve-dectviromu.cz](http://www.sve-dectviromu.cz) (Romani Testimonies).

The project also analyses anti-Romani and anti-Jewish politics in post-war Czechoslovakia. "It proves that it is still necessary to fight any form of xenophobia and racism," concludes Dr. Čapková. "Not all communities have a fair status and representation in public life, and that's not good for the health of our society."

**EX | PRO**

# AGRICULTURAL AND BIOLOGICAL-ENVIRONMENTAL SCIENCES

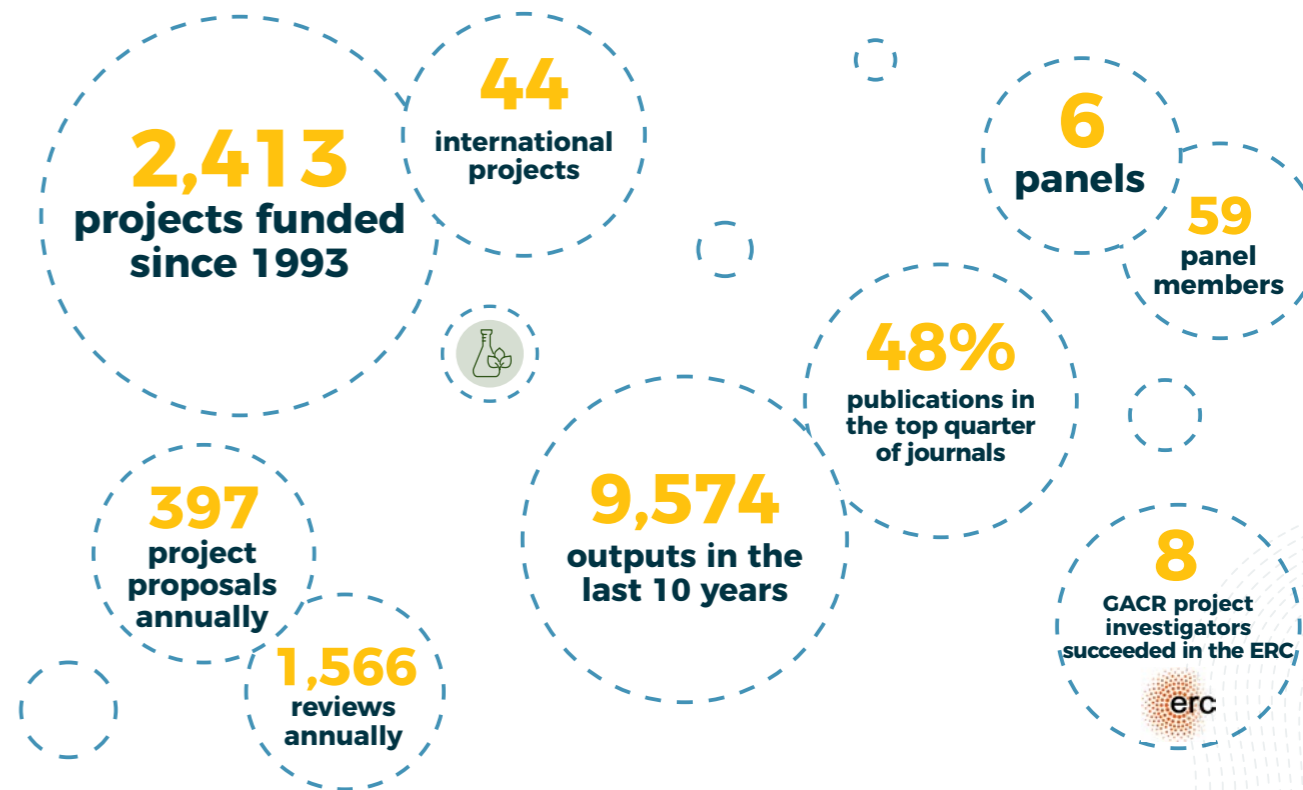


Prof. RNDr. **Petr Baldrian**, Ph.D.

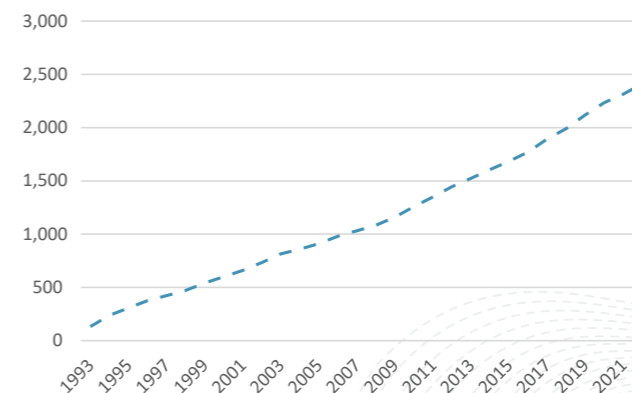
Presidium Member for AGRICULTURAL AND BIOLOGICAL-ENVIRONMENTAL SCIENCES



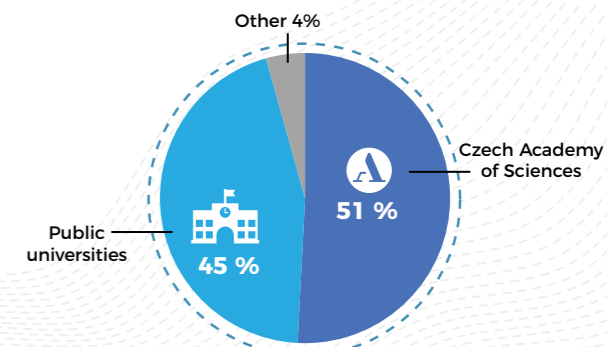
Research in biological and environmental disciplines is becoming increasingly relevant as it enables us to understand the functioning of ecosystems and individual organisms on which human society depends. This also applies to the problems of global change and environmental risks, where basic research helps find possible solutions.



**Total number of projects funded**



**Support by beneficiary institution**





## FUNGI IN LABORATORY CHAMBERS

“ We research mushrooms in the field, in the Czech Republic, and around the world. But in the natural environment, there are too many variables. Therefore, the controlled conditions in our laboratories are excellent for testing hypotheses about the possible future of fungi.



Mgr. **Petr Kohout**, Ph.D.  
Institute of Microbiology,  
Czech Academy of Sciences



The current climate change does not do well to the fungi beneficial to humans, but those that are pathogenic are affected considerably less. This is an observation being verified by Petr Kohout of the Institute of Microbiology of the Czech Academy of Sciences experimentally.

Some fungi live in symbiosis with their surroundings, their mycelium interconnects with the root systems of trees and they pass on essential nutrients to each other (this includes boleti, amanita, rossulas, or chanterelles). Other fungi (e.g. parasol mushrooms

or field mushrooms) obtain nutrients by decomposing dead organic matter, thereby removing it from the environment. And yet other fungi (such as smut fungi or rust) are pathogenic, destroying surrounding plants.

Researchers from the Institute of Microbiology have compiled a global online database of fungi freely acces-

**Change in Earth's average temperatures are likely to be unfavourable for 'beneficial' fungi, but may not bother pathogens**

sible to experts from around the world in an international collaboration. To identify fungi, they used sequencing of their genetic code. Specific fungi need a certain temperature range to live. And unfortunately, the database shows that those fungi that are useful to nature and mushroom pickers require a relatively narrow temperature

range. However, pathogenic fungi can cope with a wider temperature range.

In other words: the change in average temperatures will probably be unfavourable for "beneficial" fungi, but may not bother pathogens.

"We are trying to verify this unfavourable finding further. The more detailed data on the occurrence of fungi obtained through genetic analyses mostly come from the last 15 years or so. However, we can make up for the

lack of data with laboratory experiments," says Petr Kohout.

The institute has chambers in which they grow mushrooms. They set them at different temperatures and monitor how they are doing. "Of course, we also study mushrooms in the field, not only in the Czech Republic, but also in the world. But there are too many variables in the natural environment. That's why the controlled conditions in our laboratories are excellent for testing hypotheses about the possible future of fungi," he adds.

The Junior Star grant for this research is the first one he has received from the Czech Science Foundation. But as early as 2019, he already received the Neuron Award for Young Scientists for his research on the ecology of fungi.

Petr Kohout says he goes mushroom picking for food no more than twice a year. "I'd rather hike the mountains, go for a run or do other active sports than walk slowly in the forest."

**JUNIOR STAR**



# NATIVE VEGETATION IS MOST EASILY COMPETED WITH BY INVASIVE PLANTS THAT RESEMBLE IT



Assoc. Prof. RNDr. **Zdeňka Lososová**, Ph.D.

Department of Botany and Zoology,  
Faculty of Science, Masaryk University  
in Brno



We need to be especially careful of invasive species similar to native plants that use the same nutrient sources but are relatively larger, therefore have more sunlight, and reproduce well.



**Zdenka Lososová from the Institute of Botany and Zoology at the Faculty of Science of Masaryk University in Brno explores which plants can coexist in one place.**

Her research is aimed at understanding what happens to vegetation when the soil structure, climate or landscape management changes. In similar places we usually find similar vegetation. For example, in European steppe vegetation there is astragalus, centaurea or dianthus, which prefer dry climate and light. They would not

survive in the shade of a forest. And other plants have similar habitats.

"If we know which species thrive in which conditions, we can tell in advance how their composition will change under different conditions," says Assoc. Professor Lososová.

While natural landscapes left to themselves change only slowly, human interventions bring about change quickly. "All we have to do is mow meadows or lawns in cities

more often to change the structure of the vegetation. Another influence is the warming and the drought it causes," says Zdeňka Lososová.

More thermophilic weed species, which cannot be easily controlled by current agrochemical interventions, are beginning to spread in Czech fields. "For example, the poisonous datura has been with us for centuries, but it has never been as common as it is now. It is benefiting

from rising temperatures and also from a change in the management of the fields. There is no deep ploughing, some crops, such as maize, remain in the field for a long time, and among them the datura, which does not flower until late summer, thrives," explains Assoc. Professor Lososová.

**It is possible to predict how the species composition will change under new living conditions**

Thanks to the GACR grant, her team has also worked on exploring which plants introduced from other environments become invasive, i.e. dangerous to the environment in which they spread and oppress native species.

The basic question is whether an invasive species thrives because it is different and uses nutrient resources better than native plants, or because it resembles plants

already growing in the area. "Thanks to our research, we now know that invasive species are usually similar to native plants, using the same nutrient sources, but are relatively larger in comparison, and therefore enjoy more sunlight. In addition, they usually reproduce well, quickly produce seeds with good germination and have no specific requirements for pollinators," summarises Zdeňka Lososová. "It is precisely these introduced species that we need to watch out for."

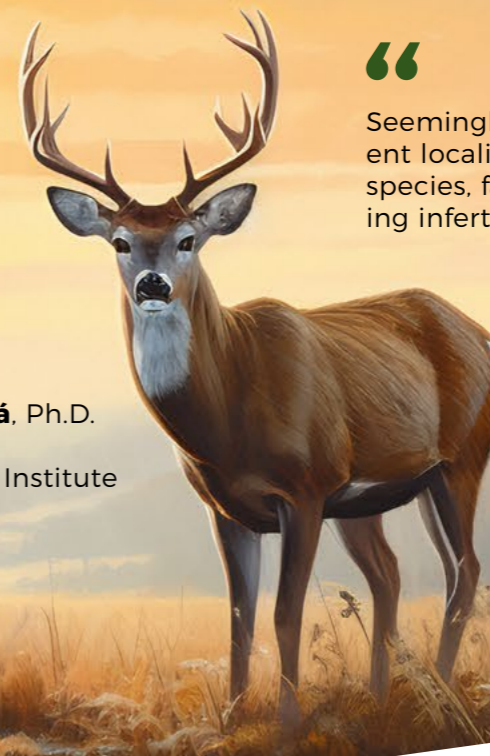


# CHROMOSOME RESEARCH SHOWS THAT NO TWO DEER ARE ALIKE



Mgr. **Miluše Vozdová**, Ph.D.

Veterinary Research Institute in Brno



“

Seemingly identical animals from different localities may actually be different species, failing to interbreed or producing infertile offspring.

”

Miluše Vozdová from the Veterinary Research Institute in Brno discovers new species of animals. Her research leads to a better understanding of the characteristics of seemingly well-known animals, to mapping their evolutionary development, and to their better protection.

Dr. Vozdová does not wade through unexplored wilderness. She finds new species in the genetics lab. These are animals in whose cells some chromosomes have fused during evolution, and the resulting individuals have become a new species that even an

expert cannot tell apart from their relatives. Miluše Vozdová and her colleagues began their original research on chromosomes in the bovidae, which includes not only economically important cattle, but also rupicapra and antelopes. Scientists observe their chromosomes during cell division, when they are clearly visible in the microscope. A pulse from an attached laser dissects the desired chromosome, which is then used for interspecies comparative analysis.

“In doing so, we find out that, for example, the antelope we are studying does not have 60 chromosomes like a cow, but only 46, because some of the chromosomes of their common ancestor have joined together in the course of evolution. We can therefore detect genetic differences between species that affect their characteristics,” says Dr. Vozdová.

By comparing the chromosomes, it is also possible to determine when in the past the species separated from each other and how they evolved further independently.

The researchers then applied the method to the deer family (cervidae). The international GACR-funded project enabled cooperation with the Brazilian Centre for Deer Research and Conser-

## New animal species discovered in a genetic lab

vation at the University of São Paulo. The cervids include not only our local deer, roe deer and fallow deer, but also American mazamas, Asian muntjacs, and others.

Researchers have confirmed that seemingly identical animals thought to be the same species can have a different number of chromosomes due to diverse evolution. Therefore, what the microscope reveals are new species.

“This is important for the protection of endangered species,” emphasises Miluše Vozdová. “Seemingly identical animals from different localities may in fact be different species, so they fail to interbreed, or they produce infertile offspring. This can complicate our efforts to save them from extinction.”

# RESPONSIBLE RESEARCH

## ETHICS

GACR is committed to fostering an ethical environment both in science and in the selection of projects for funding. Investigators are bound by a Code of Ethics that sets out the principles of research work, the relationship with colleagues, and also addresses publication ethics. In addition to their own Code of Ethics, GACR reviewers are contractually committed to objectivity, transparency, confidentiality and the avoidance of conflicts of interest; the latter is also checked by an automated information system.

## OPEN SCIENCE

An open approach in science leads to improved quality and reliability of results. GACR allows investigators to cover the cost of publications in Open Access format - the number of publications in this format has more than doubled in the last ten years. Open Data is an essential part of Open Science - not only the open publication of results, but also the sharing of original data with the scientific community and the public.

## FAIR EVALUATION OF RESEARCH

In 2022, GACR joined the Agreement on Reforming Research Assessment (ARRA) and also joined the newly formed Coalition for Advancing Research Assessment Reform (CoARA), joining another 360 organizations from around the world. The aim of the CoARA is to promote the quality, impact and effectiveness of the research system through experimentation and the development of new research assessment criteria, methods and tools. The purpose of this reform is to provide a platform for collaboration, sharing best practices and mutual learning.

## SCIENTIFIC AND FAMILY LIFE BALANCE

GACR has long been committed to fostering the combination of scientific careers and parenthood for investigators of the grant projects, but also for the development of human resources at institutions and grant beneficiaries. Measures include, for example, the possibility of including child care costs in the eligible costs of a project, extending relevant deadlines and time limits, reducing the workload commitment of a researcher or investigator, or even a project break. Also, a GACR initiative has contributed to the implementation of gender equality plans at 100% of the beneficiary institutions.



# THE FUTURE OF GACR

**Transfer  
of results**

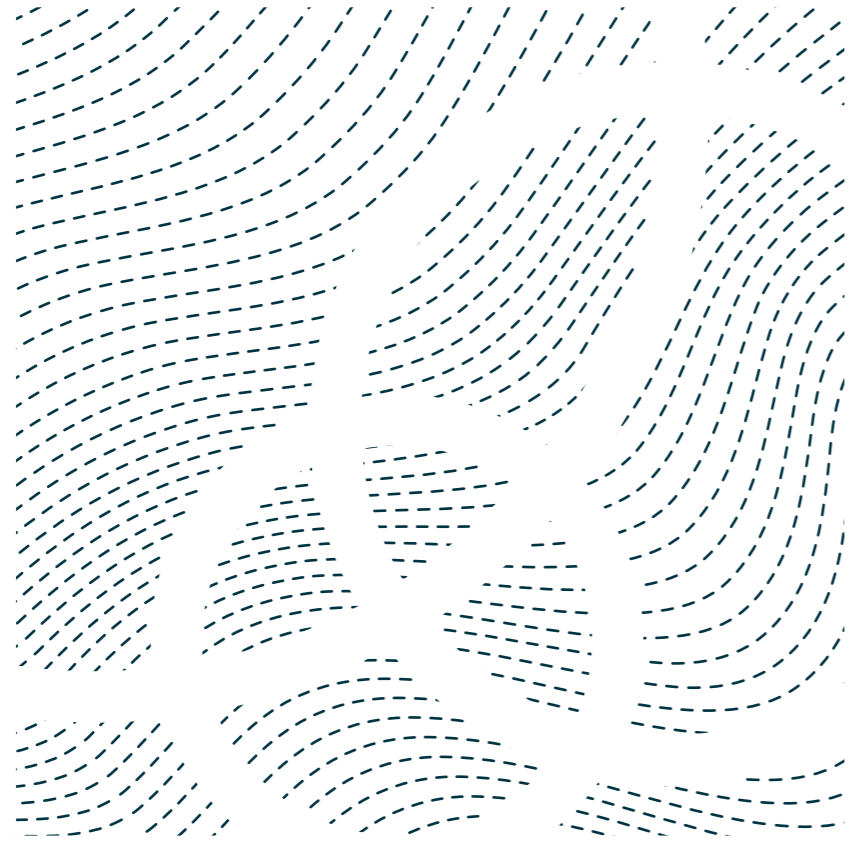
**Supporting  
scientific  
careers**

**New  
international  
collaborations**

**Open  
Science**

**Reducing  
bureaucracy**

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