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AUSTRIAN
ACADEMY OF
SCIENCES



AUSTRIAN ACADEMY OF SCIENCES ANNUAL REPORT 2019

BRIEF SUMMARY

ABOUT THE ACADEMY

The mission of the Austrian Academy of Sciences (OeAW) is to “promote science in every way”.

Founded in 1847 as a learned society, today the OeAW has over 760 members and 1,800 employees dedicated to innovative basic research, interdisciplinary exchange of knowledge and the dissemination of new insights with the aim of contributing to progress in science and society as a whole.

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THE FREEDOM OF RESEARCH: BETWEEN THE KNOWN AND THE UNKNOWN

PREFACE BY THE PRESIDENT ANTON ZEILINGER



Photo: Elia Zilberberg/OeAW

The basic constitutional law in Austria dates from 1867. Article 17 says that “Knowledge and its teaching are free”. Academic freedom as a fundamental right was a central prerequisite and achievement for the development of science. This continues to be the case today – academic and research freedom is a crucial driver, especially for basic research. This freedom allows academies, universities, and research institutions to independently pursue a wide range of questions, to unreservedly follow scientific curiosity, and to realise unusual ideas. This is the only way that fundamental research can arrive at completely new discoveries that no one could previously have imagined.

SCIENCE AS A DRIVER OF INNOVATION AND A RISK PROVISION

Academic freedom was in 1867, and is even more so today, not an end in itself. Societies like ours are highly dynamic, they are constantly faced with new challenges, and their future is a horizon of open possibilities. That is why academic freedom is both an urgently needed driver of innovation and an indispensable risk provision.

To avoid any misunderstandings: basic research also knows the limits of feasibility. Some questions can be answered faster, while others take a lot of time and patience to come to reliable conclusions. And scientists do not always agree – if you are in uncharted territory, you cannot know whether there are one, several, or even no routes to your destination. Basic research, no matter in which area, means exploration and expedition, which – based on the human mind – go beyond the limits of existing knowledge into unknown expanses.

I am writing these lines in June 2020, amid a pandemic. Millions of people around the world are infected with SARS-CoV-2 or have COVID-19, and deaths are being mourned. The political, social, and economic consequences of the coronavirus crisis cannot be estimated; but they are certain to be huge. Corona changed our societies in a very short time and will keep us busy for a long time. It is also, and particularly, a challenge for science and research.

One thing is clear: without science there will be no solutions to this crisis. With its variety of research fields and the expertise of its members and employees, the OeAW is actively involved in advising politicians and imparting the latest knowledge about the pandemic.

First of all, of course, medicine and life sciences are in demand here. Institutes of the Academy are currently researching the genome of the virus and therapeutic options for people suffering from COVID-19. However, numerous other fields are now needed too. For example, the historical sciences – from archeology to contemporary history – give us instructive insights into past epidemics

and how they were dealt with. Mathematics is central to modeling the spread of the virus in the population and for the prognoses based on these models. The social sciences are the seismographs of society that draw attention to the currently increasing inequalities between social groups, generations, and countries. Not to be forgotten, psychology takes into account the consequences for the individual. Finally, the economic sciences are crucial, not least to be able to assess the economic effects of various measures used to combat the pandemic.

What we must not forget in all of this is that there is always a special responsibility associated with academic freedom. In this crisis, scientists have played a visible role in public affairs and politics beyond their subject. Even among the scientifically qualified, at times contradictory or incomplete assessments, predictions and requests were voiced. As scientists, we must be careful. We have to dare to speak out, but at the same time make it clear that there is much we do not know, that we have to continue joint research, and that it takes time if findings are to be scientifically sound. This applies not only in times of the coronavirus, but especially now.

THE BEST ENVIRONMENT FOR THE BEST MINDS

An annual report naturally looks less at current developments than at what has been achieved in the previous year. Before I address some of the milestones in 2019, I would like to return to the importance of scientific freedom one more time. The OeAW has the legal mandate to “promote science in every way”. We do this by living the freedom of science every day at our institutes and in our commissions. In short, the Academy offers space for new knowledge.

We want to enable the best minds – under excellent conditions and through fruitful interdisciplinary exchange – to make their innovative ideas a reality. We will focus on some of these researchers in the German version of this report. What unites them is that they use all the diverse opportunities that the OeAW offers for their research to work for the benefit of all. For the photos, our researchers took us to places where they get the inspiration that they then scientifically pursue at the Academy. The variety and diversity of these places clearly shows that research does not take place in the often-quoted ivory tower, but is anchored in the middle of society, in the middle of our lives.

Two numbers from 2019 that are particularly encouraging for the OeAW prove that we are not the only ones who find our scientists’ research projects promising: with eight ERC grants, the Academy is the most successful research institution in the country; in addition, more FWF grants than ever before have been obtained. In Austria, the OeAW is in second place behind the University of Vienna, which has more personnel.

“INCUBATOR” FOR GROUNDBREAKING RESEARCH RESULTS

Of the numerous research successes in the past year, I would like to highlight two that illustrate how – by combining creative minds and a productive environment – the “incubator” OeAW produces groundbreaking research results in diverse disciplines.

A team at IMBA – Institute of Molecular Biotechnology of the OeAW succeeded in developing human blood vessels from stem cells in 2019. With the help of these organoids from the laboratory, it is now possible to research vascular diseases directly on human tissue.

By chemically analyzing prehistoric baby bottles our Institute for Oriental and European Archaeology proved for the first time that animal milk was used to feed babies as early as 3,000 years ago. With this finding, the researchers made it into the journal *Nature*, which is certainly not to be taken for granted for the humanities and cultural studies.

FUTURE-ORIENTED PROMOTION OF YOUNG TALENTS

In 2019, we took new and creative paths not only in research, but also in the transfer of knowledge. In addition to the almost 200 public events at the Academy, we specifically targeted the young generation with two activities. Four science comics for 8- to 12-year-olds were published by the OeAW Press and presented to 300 children in the festive hall of the Academy. For the first time, the Vienna Children’s University was a guest in our main building, where more than 500 children slipped into the role of researchers.

Bringing young people into contact with science as early as possible and getting them interested in research is also the goal of another initiative that we launched in 2019: the Austrian Studienstiftung will accompany committed high-school graduates on their way through their studies and will promote them intellectually. This not only closes a gap in the funding landscape in Austria, but also builds a bridge to a career in science, which in the future may then begin with funding in one of our doctoral programs.

INDEPENDENT KNOWLEDGE FOR POLITICS AND SOCIETY

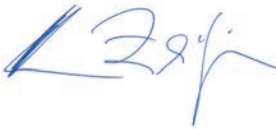
In the area of social and political advice, a two-day international conference at the OeAW focused on the United Nations Agenda 2030, exploring what has already been achieved and where action should be taken to achieve sustainable development. The “Science and Politics in Conversation” series addressed a no less important future field: scientists spoke to members of the National Council about the opportunities and risks of digitalization.

At the time, we had no idea how well chosen this topic was, in view of the rapid advance of everyday digitalization

due to the corona crisis. This also applies to another idea implemented in 2019: the first-time award of grants for outstanding science journalism projects. Here too, the pandemic is highlighting how important it is to have profound, informed, and independent science journalism – something that we want to promote with our scholarships.

ACKNOWLEDGMENT AND THANKS

Bringing the premise of academic freedom to life is only possible thanks to the tireless efforts and committed involvement of our researchers, employees, and members. We are also grateful to our partners in science, politics, and society for their material and immaterial support. For your interest and commitment, we would also like to thank all those who were guests at the Academy as speakers, listeners, participants in discussions, or visitors. For an extremely fruitful and constructive working relationship, I would like to express my special thanks to the two science ministers in office last year, Iris Rauskala and Heinz Faßmann, as well as to our patron, Federal President Alexander Van der Bellen.



ANTON ZEILINGER

President of the Austrian Academy of Sciences

ROCKET LAUNCHES, ORGANOIDS FROM THE LAB AND SCIENCE COMICS FOR KIDS

THE ACADEMY YEAR 2019 IN REVIEW



Photo: European Space Agency

CHEOPS LAUNCHED INTO SPACE

It was a textbook start: on December 18, the ESA telescope CHEOPS lifted off into orbit from the European spaceport Kourou in French Guiana. CHEOPS stands for Characterizing Exoplanets Satellite. It is the first space mission to examine planets outside our solar system – so-called exoplanets – in detail. Technology from Austria is also on board. The Space

Research Institute of the OeAW in Graz is responsible for one of the two on-board computers, is involved in software development, and is represented in the CHEOPS science team. From its polar orbit at a height of 700 kilometers, the space telescope will now target around 500 exoplanetary systems over the next few years.



Photo: Elisa Zilberberg/OeAW

HISTORIC MUSIC ARCHIVE IN ST. STEPHEN'S CATHEDRAL SAVED

Thousands of valuable and in some cases unique historical sheets of music in St. Stephen's Cathedral in Vienna suffered water damage. But thanks to the rescue work of musicologists at the OeAW, the works, which also provide insights into the history of everyday life, were saved. Over the course of a year the historical sources were examined, cleaned, restored, documented, and cataloged. Now all the sheets of music have been taken to its new location in the cathedral archive, where it is stored professionally and is accessible again for research and performance.

AT THE ORIGIN OF THE UNIVERSE

Everything has a beginning. This also applies to the universe. How it came about is being investigated at the European Organization for Nuclear Research (CERN) in Switzerland – with Austria's participation for 60 years. To celebrate this milestone anniversary, the Institute of High Energy Physics of the OeAW presented new findings in "Big Bang" research to a broad audience at the "Science Week" in Vienna. This included a science exhibition, works of art, public workshops, and lectures, for example by Nobel laureate in physics Barry C. Barish.

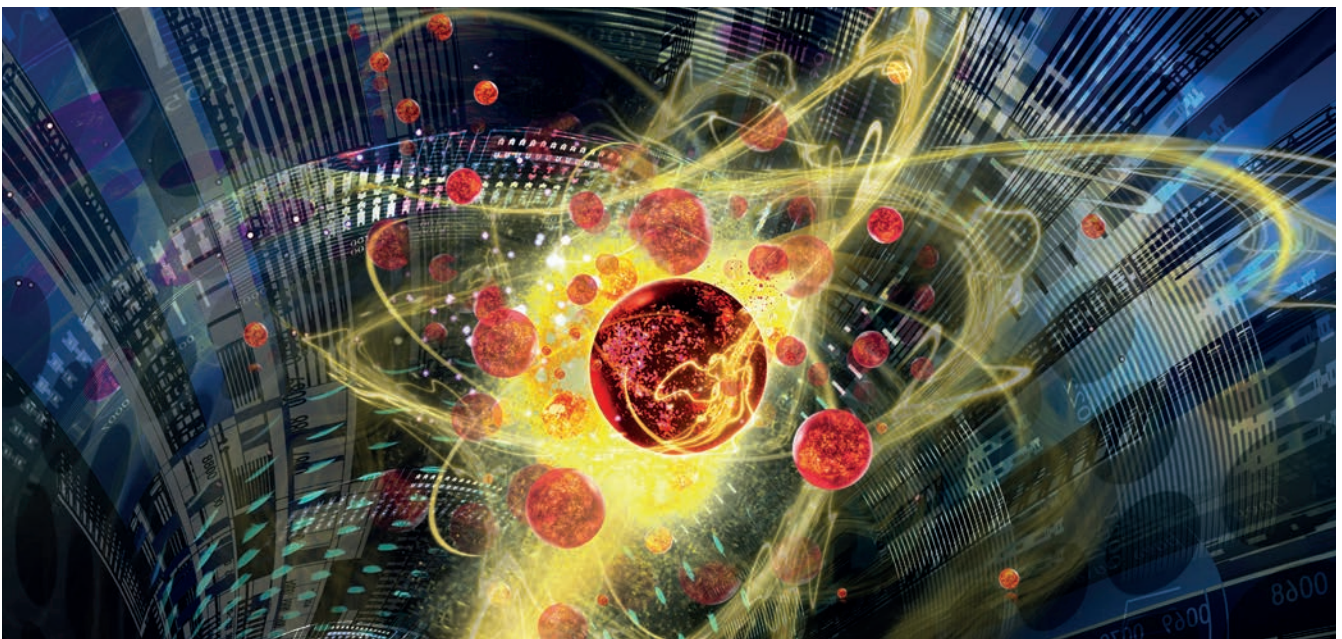


Illustration: Harald Ritsch/OeAW

MOST HIGHLY CITED

Every year, the US company Clarivate Analytics compiles a list of the world's most cited researchers. In 2019, these included 29 scientists who are researching at the OeAW or are closely associated with the Academy as members either at home or abroad. A total of 44 researchers in Austria are mentioned in the list. Of these, 16 are members of the OeAW,

and 6 conduct research at OeAW institutes. This number is particularly gratifying for the Academy, because, although only 2 % of all scientists working in Austria are employed by the OeAW, their proportion of the "highly cited researchers" is above average at 13 %.



Photo: Klaus Pichler/OeAW

BLOOD VESSELS FROM THE LAB

Every single organ in our body is traversed by a dense network of blood vessels. This network is not only vital, it is also susceptible to various diseases, such as diabetes. A team at IMBA – Institute of Molecular Biotechnology of the OeAW succeeded in developing human blood vessels from stem cells for the first time in 2019. With the help of these organoids from the laboratory, it is now possible to research vascular diseases directly on human tissue.

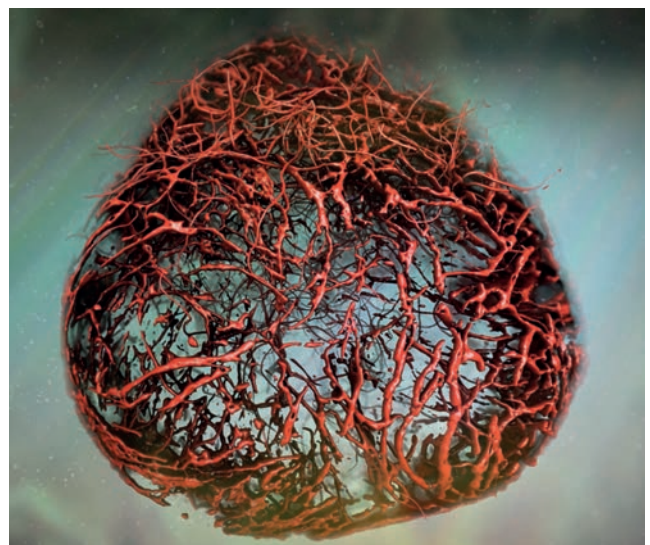


Illustration: IMBA/OeAW



Photo: Elia Zilberberg/OeAW

SCIENCE COMICS INSPIRED CHILDREN AT THE ACADEMY

Superbugs, aliens, Mars flights, and time travel: little science fans from eight to twelve years old can now explore the world of research in the form of comics. In 2019, the OeAW launched a competition for illustrators and selected four winners out of 90 entries. The comics, delivered to schools throughout Austria, were presented at a science

day in the main building of the OeAW in Vienna at which over 300 children attended. At interactive stations for astronomy, history, genetics, and biology, the kids could also become researchers themselves. For those interested: all comics can be downloaded and browsed on the website oeaw.ac.at/akademics.

QUANTUM TELEPORTATION TO THE POWER OF THREE

For the first time an international team with scientists from the OeAW has succeeded in teleporting three-dimensional quantum states. The researchers from Austria and China reported on this world premiere in the journal *Physical Review Letters*. The successful experiment is an important step towards practical applications such as a quantum internet, because higher-dimensional quantum systems can transport significantly larger amounts of information.

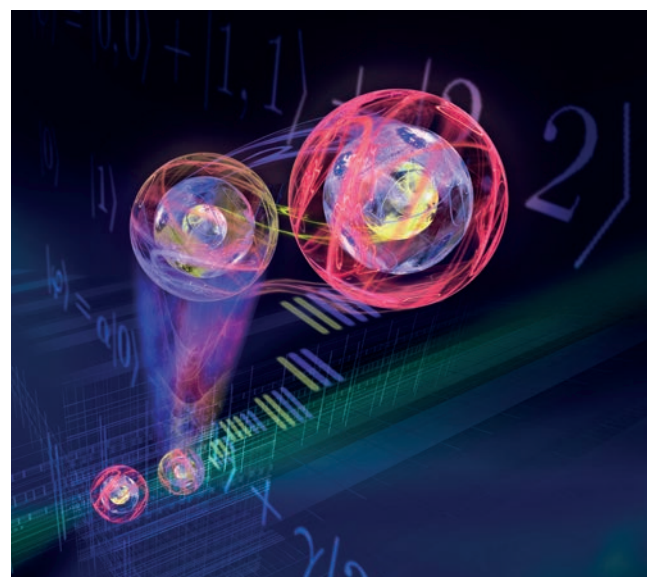


Illustration: Harald Ritsch//OeAW



Valentine Auer

Benjamin Breitegger

Uli Jürgens

Katharina Kropshofer

Photos: Daniel Hinterramskogler/OeAW

GRANTS FOR SCIENCE JOURNALISM AWARDED FOR THE FIRST TIME

Strengthening domestic science journalism and better anchoring the relevance of research in public awareness – that is the goal of a new scholarship program from the OeAW that is aimed at journalists throughout Austria. In 2019, for the first time, four journalistic projects were able to convince the independent jury made up of representatives from the Austria Press Agency (APA), the

public radio station Ö1, Press Club Concordia, and the Austrian Newspaper Association: Valentine Auer works on the history of Romani people in Vienna, Benjamin Breitegger undertakes a future check of Austria, Uli Jürgens examines the biography of a theater director, and Katharina Kropshofer devotes herself to the subject of animal experimentation.



Photo: Daniel Hinterramskogler/OeAW

AGENDA 2030 SCRUTINIZED

To find answers to global challenges such as climate change, the United Nations adopted a total of 17 goals for sustainable development in 2015. The two-day public symposium “Global Sustainable Development Goals in a Mediatized World” at the OeAW – accompanied by a thematic art exhibition, which also included a whale constructed by pupils from plastic bottles in the festive hall of the Academy – put the Agenda 2030 to the test. The symposium debated the hurdles still to be overcome to

achieve the goals, along with the role for science and the media. Six months later, Wolfgang Lutz (full member of the Academy) delivered a follow-up to the conference with a discussion event at the Academy. The OeAW demographer is the only Austrian in a 15-member team of independent scientists who have, on behalf of the UN, written a report on the implementation progress of the sustainability goals. In “The Future is now”, the experts warn that action must be taken now if the goals are to be achieved.



Photo: Wikimedia Commons

SUCCESS STORY ERC GRANTS

The OeAW has long been one of the research institutions with the most grants from the European Research Council (ERC) in Austria. In 2019, a special accomplishment could be added to this success story: the Academy was awarded more grants, with a higher total value, than has been the case since the ERC began awarding grants in 2007. With eight grants in 2019, the OeAW is in this respect by far the most successful research institution in the country – resulting in more than 12 million euros additionally available to implement pioneering ideas at OeAW institutes.

LOWER MURA VALLEY RECOGNIZED AS A BIOSPHERE PARK

The Lower Mura Valley with a total of 13,000 hectares of riverscape was named a biosphere reserve by UNESCO in 2019. The UNESCO Man and the Biosphere Committee, which is located at the OeAW, was responsible for the submission. The Lower Mura Valley is therefore part of a series of model regions that are committed to harmonizing nature conservation, conservation of biological diversity, and regional development. For Austria, it is the fourth biosphere park along with the Great Walser Valley (2000), the Vienna Woods (2005), Salzburg’s Lungau (2012), and the Carinthian Nock Mountains (2012).

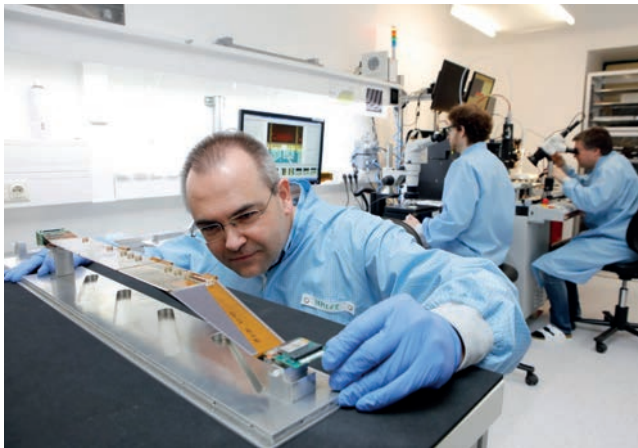


Photo: Klaus Pichler/OeAW

NEW PARTICLE ACCELERATOR EXPERIMENT LAUNCHED IN JAPAN

After years of preparation and a successful test run, the new Belle II experiment on the SuperKEKB collider in Japan has begun. The particle accelerator near Tokyo consists of an underground ring about three kilometers long, in which electrons and their antiparticles, the positrons, are accelerated and made to collide. Austria is also involved in the experiment, which is being used to search for dark matter. The Institute of High Energy Physics of the OeAW developed and built part of the detector and is involved in evaluating the data.

HUNDREDS OF CHILDREN GET A TASTE OF RESEARCH

Building globes, travelling virtually through the cells of our body, or writing like an emperor in the Middle Ages. In 2019, for the first time, classes of the Vienna Children's University took place at the OeAW main building and 550 children between the ages of seven and twelve were able to slip into the role of researchers at workshops and

lectures. In the words of a participating child: "Really cool!" Furthermore, sixty pupils got a taste of research at Girls' Day: together with science minister Heinz Faßmann, the girls got an insight into the dynamic field of life sciences at the IMBA – Institute of Molecular Biotechnology of the OeAW.



Photo: OTS-Fotoservice/Martin Hörmandinger/OeAW

WITTGENSTEIN PRIZE FOR OEAW MEMBER, START PRIZE FOR OEAW RESEARCHERS

The Wittgenstein Prize, which is awarded once a year by the Austrian Science Fund FWF, is considered the “Austrian Nobel Prize” and in 2019 went to, among others, OeAW member Michael Wagner. The microbiologist was awarded the country’s highest science award for his work on the role of microbes in the nitrogen cycle.

START Prizes for young scientists went to three OeAW researchers: the Iranist Bruno de Nicola, the materials scientist Christoph Gammer, and the mathematician José Luis Romero.



Photo: Michèle Pauty/FWF

100 SUBMISSIONS ON THE PRIZE QUESTION FROM THE OEAW

“Can the societal relevance of research be assessed? And if so, how?” That was the publicly advertised prize question of the OeAW. Around 100 submitted essays from all over the world attempted to answer this question. The first prize, endowed with 12,000 euros, was awarded to Julian Hamann, David Kaldewey, and Julia Schubert, three sociologists from the Universities of Hanover and Bonn,

who argued for a diversity of assessment methods. Further prizes went to Alexander Bogner, technology assessment researcher at the OeAW, and the economist Pirmin Fessler from the central bank of Austria. All three articles have been published in German in the free OeAW series “Research & Society”.



Julian Hamann

David Kaldewey

Julia Schubert

Alexander Bogner

Pirmin Fessler

Photos: Private, Universität Bonn

ANIMAL MILK DETECTED IN PREHISTORIC BABY BOTTLES

The humanities and cultural studies do not often make it into the journal *Nature*. However, an international team with the participation of the Institute for Oriental and European Archaeology of the OeAW succeeded in 2019. The researchers were able to prove that milk from sheep, goats, and cows was used to feed babies as early as 3,000 years ago. This was shown by the analysis of Bronze Age baby bottles, in which traces of milk from ruminants could be detected. These new findings contribute significantly to the understanding of motherhood and childhood in prehistory.



Illustration: Christian Bisig/ Archäologie der Schweiz

"EXILE & EXCELLENCE" NOW ONLINE AND ON DVD

The film "The Class of '38. Exile & Excellence" portrays 16 outstanding scientists who, as children, were persecuted by the National Socialists and forced to leave Austria. Eric Kandel, Martin Karplus, and Ruth Klüger, among others, have their say in the moving contemporary historical source by the Austrian-British filmmaker Frederick Baker. Based on an idea by OeAW President Anton Zeilinger

and scientifically supported by the OeAW historians Heidemarie Uhl and Johannes Feichtinger, the film was shown on ORF in commemoration of the November Pogroms and was presented in the presence of Nobel Prize winner Eric Kandel in the festive hall of the Academy. A shortened version of the film can be viewed online, and a long version is available on DVD from the OeAW Press.



Photo: Daniel Hinterramskogler/OeAW

AUSTRIAN SCHOLARSHIP FUND CREATED

They have been around in Switzerland and Germany for a long time: scholarship funds that support talented young people through their studies. Now, Austria also offers the same opportunity. The “Austrian Studienstiftung” was established in 2019 on the initiative of the OeAW. It aims to support exceptionally motivated and committed young people from all walks of life during their studies; for example, through extracurricular activities or professional mentoring. The Studienstiftung started with an announcement for the participation of high school graduates from all over Austria in winter schools in Vienna, Lower Austria, Upper Austria, and Tyrol.



Photo: Daniel Hinterramskogler/OeAW



Photo: Thomas Topf/Parlamentsdirektion

TAKING A CLOSER LOOK AT DIGITALIZATION

Science and politics should create better awareness of the opportunities and risks of rapid digital development. After all, digitalization is not a threat for the digitally literate. That was the conclusion of members of parliament and researchers who met to discuss the topic at the invitation of the Austrian National Council and the OeAW. “Science and Politics in Conversation”, the name of the dialogue format,

took place for the second time in 2019. At the invitation of the President of the National Council, Wolfgang Sobotka, and OeAW President Anton Zeilinger, scientists and members of parliament meet to exchange views on current social challenges and to incorporate scientific knowledge into political decision-making.



Photo: Bernhard Graf/OeAW

120 YEARS OF THE PHONOGRAMMARCHIV

From the emperor's voice to endangered languages: the Phonogrammarchiv of the OeAW collects recordings, past and present, from all over the world. In 2019, the world's oldest sound archive celebrated its 120th anniversary. The archive currently holds around 14,000 hours of recordings. "And we are still collecting", emphasizes Kerstin Klenke, the new Director and guardian of five collections that belong to the world cultural heritage of UNESCO. The anniversary was marked with a ceremony, which included a "speech concert", and a scientific symposium on responsibility, perspectives, and knowledge transfer from archives.

EUROPE'S TOOL FOR ECONOMIC CRISES

The eurozone needs reforms; that is clear ten years after the serious global economic, banking, and euro crisis. But what kind of reforms? In 2019, a top-class panel discussion took place at the Academy. Chaired by OeAW member Robert Holzmann, then designated Governor of Austria's central bank, the panel consisted of Agnès Bénassy Quéré from the Sorbonne in Paris, Elke König, Chair of the Single

Resolution Board (SRB), Klaus Regling, Director of the European Stability Mechanism (ESM), and OeAW member Josef Zechner from the Vienna University of Economics and Business. The conclusion: "more Europe" is also needed in the financial and banking sectors to be able to face future crises with resolve.



Photo: Elia Zilberberg/OeAW

RESEARCH ON FACEBOOK

Social media channels are sources of fake news. Science institutions are all the more in demand to counteract with verified facts. The OeAW has therefore been active on Twitter for a long time, operates the podcast MAKRO MIKRO on SoundCloud and Spotify, and has its own video channel on YouTube. Facebook has been a new addition to the Academy's social media family since 2019. There, you can regularly experience the latest scientific news in a fun way.



Photo: Unsplash/OeAW

FACTS AND FIGURES

THE ACADEMY AT A GLANCE

87
EU PROJECTS

2.383
SCIENTIFIC
PUBLICATIONS

1.816
EMPLOYEES

36
ERC GRANTS

1.170
YOUNG RESEARCHERS

28
RESEARCH INSTITUTES

137
FELLOWSHIPS AWARDS

206
FWF PROJECTS

765
MEMBERS IN AUSTRIA
AND ABROAD

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