70 years of academic freedom

German research institutions launch a campaign to mark the anniversary of the Basic Law

Open to discussion: at the Zeit Forum in March, Max Planck President Martin Stratmann (middle) joined Zeit editor Andreas Sentker, Nadia Al-Bagdadi from the Central European University, Anuscheh Farahat from the Friedrich-Alexander-University (FAU) Erlangen-Nuremberg, and Ulrich Blumenthal from Deutschlandfunk to debate the question: academic freedom – a success story?

In May 2019, Germany celebrated the 70th anniversary of the Basic Law, which states in Article 5 that "sciences, research and teaching shall be free." German's scientific community is using the anniversary as an opportunity to discuss the resulting success stories and the opportunities and risks that this freedom presents, as well as asking what responsibilities it imposes. Originally prompted by the Max Planck Society, the campaign "Freedom is Our System. Together for Science" is an initiative of the Alliance of Science Organizations in Germany, which brings together ten important German research institutions. Over the course of 2019, a series of events, talks, debates, and opinion pieces will highlight the importance of independence in research and teaching – especially for basic research. At the same time, however, the scientists will take a critical look at their own developments and draw attention to potential risks to academic freedom. Among other topics, there will be discussions on the permissible scope of human genome research in the age of CRISPR/Cas9 and the need for regulatory measures in relation to autonomous, self-learning machine systems. The launch event in March was devoted to examining the responsibilities associated with new medical treatment methods.

Full steam ahead!

The MS Wissenschaft will dock in 27 cities across Germany and Austria

Since mid-May, the MS Wissenschaft – a cargo ship with an on-board science center – has been undertaking another grand voyage. After an inauguration in Berlin, it is sailing to 27 cities via navigable rivers and canals. Covering almost 600 square meters, this year's exhibition is all about artificial intelligence and examines the opportunities of machine learning, the intelligent analysis of large volumes of data, and the interaction between humans and machines, to name just a few aspects of this multifaceted subject area. Over 30 interactive exhibits invite visitors to embark on a journey of discovery, with opportunities for active participation and also for reflection. This year, three Max Planck Institutes are taking part with a broad range of research topics. For example, the exhibit *Der Körper denkt mit* ("The body thinks too") from the Max Planck Institute for Mathematics in the Sciences illustrates that even artificial intelligence isn't independent of the body or its surroundings. The HyperDiver diving robot from the Max Planck Institute for Marine Microbiology uses machine learning to determine the biodiversity and state of health of coral reefs. Lastly, the exhibit from the Kunsthistorisches Institut in Florenz explores the idea that the concept of a non-human form of intelligence is a long-standing source of inspiration for human creativity.

https://ms-wissenschaft.de (in German)

Exhibition on board: with a focus on the subject of artificial intelligence, the MS Wissenschaft will be on a tour around Germany until early October – and exhibits from three Max Planck Institutes are going along for the ride.

Photos: Phil Dera (top); Ilja Hendel/WiD (bottom)

"Viruses can quickly alter an entire population"

Guy Reeves on the release of genetically modified organisms into nature

Thanks to new techniques such as the CRISPR/Cas9 gene-editing scissors and the so-called gene drive, researchers can edit the genotype much faster than before and propagate these changes in a short time, even in large populations. In the laboratory, genetically modified organisms have been used successfully for some time now – for example, in basic research and drug production. Now, there are also plans to release them into nature. Guy Reeves from the Max Planck Institute for Evolutionary Biology in Ploen views the release of genetically modified viruses with particular concern.

There are various projects in which scientists or companies want to release genetically modified organisms. What you think about that?
Guy Reeves: What particularly worries me is the release of infectious viruses that have been genetically modified to bring about changes in mammals' immune systems. Many such viruses have already been developed in order to make mammals immune to diseases or even to sterilize them. A genetically modified virus that spreads throughout wild rabbit populations in order to provide them with immunity to two diseases was tested on the Balearic Islands in Spain in the year 2000. In Australia, another virus has been produced that can sterilize mice – but it is yet to be released.

Another example is a research project by the DARPA research agency of the U.S. Department of Defense. This uses insects to transmit genetically modified viruses to corn and tomato plants. At present, the experiments are still being conducted in secure greenhouses. However, if viruses of this kind are to be intentionally released into the environment, then the procedure will have to be tested very carefully indeed. Although these technologies have already reached an advanced stage, the process of testing them is only just getting started.

Why are viruses so problematic?
Almost no other biological system can affect an entire population with such speed – that is, within a single generation. In comparison, the gene drive – which is the subject of much discussion nowadays – operates at a snail's pace. What's more, the host range of a virus can be very broad, so it's sometimes difficult to predict which species a virus is able to infect.

Are you against the release of genetically modified organisms under all circumstances unless they are agricultural crops?
No, not at all. It's not about standing in the way of new technologies. But we have to be careful and weigh up the potential risks and benefits. Accordingly, infectious genetically modified organisms in particular should only be released following careful testing. In general, I also don't think it's sensible to use viruses whose risks are hard to control if there are alternative techniques that can achieve the same objectives. For example, the number of malaria infections can also be reduced by using mosquito nets and by improving people's living conditions.

There's a sterility gene that's intended to wipe out mosquitoes and therefore to prevent the spread of malaria. How does that work?
A gene of this kind causes female mosquitoes to produce sterile daughters. Their sons, on the other hand, are capable of procreation and continue to spread the gene throughout the population. However, this only works if the mother has two mutated copies of the sterility gene. In that case, she will actually only have half as many offspring, and the mosquito population will shrink – although mosquito populations are often huge, and it would take a long time for them to die out in this way. After all, two copies of the sterility gene have to meet in a mosquito for the insect to actually become sterile.

A phenomenon known as the gene drive could accelerate this process.
Exactly. The gene drive mechanism ensures that all offspring of a female mosquito receive two mutated versions of the sterility gene, even if she only contains one copy. The population would therefore shrink much faster than normal. However, the gene drive is nowhere near as fast as many people think. Even in an animal with generations as short as those of the mosquito, it could take the gene drive eight years or more, under ideal conditions, to make a population incapable of reproduction. Moreover, from our experiences with insecticides, we've learned how quickly insects can adapt if the selective pressure is strong enough – and if they developed resistance to a sterility gene, it would be like having six winning numbers in the lottery. I'm certain that large insect populations will adapt to a gene drive of this kind and deactivate it. Mosquito are very unlikely to be exterminated in this way.

Guy Reeves

Are the current laws governing these kinds of experiments adequate?
The regulatory authorities face an enormous challenge. They have to consider extremely complex mathematical models – a difficult task even for well-equipped authorities in industrial nations. But many of the prospective projects will affect emerging economies that are not equipped for this sort of thing at all – and, of course, viruses and insects don't obey national borders.

Interview: Harald Rösch

Photo: private

Getting started: the Co-Directors of the Max Planck Center in New York, Melanie Wald-Fuhrmann and Catherine Hartley, Hugh Brady, President of the University of Bristol, Max Planck President Martin Stratmann, and Klaus Blaum, Co-Director of the new Center in Tokyo (from left).

New York, Bristol, Tokyo

Three new Max Planck Centers founded on three different continents

The Max Planck Society has further expanded its collaboration with top international partners, opening three new Max Planck Centers in spring 2019. The first of them is the Max Planck NYU Center for Language, Music and Emotion in New York. This Center combines the traditionally independent research areas of language and music on the one hand with emotion, memory, and decision-making on the other – and researchers plan to study interfaces between these areas through experimental work. At the Max Planck Bristol Center for Minimal Biology, researchers want to construct artificial cellular skeletons and develop nanoscale molecular machines. By doing so, they hope to gain more accurate insights into the building blocks needed for life. The dimensions in question are even smaller at the Max Planck-RIKEN-PTB Center for Time, Constants and Fundamental Symmetries, which is a collaboration by a total of four partners: the Max Planck Institutes for Nuclear Physics and Quantum Optics, the Japanese research institute RIKEN, and the Physikalisch-Technische Bundesanstalt (PTB). One of their objectives is to develop clocks that are even more accurate than today's atomic clocks, with a view to determining natural constants more accurately and investigating the symmetry between matter and antimatter.

Exemplary further development

Federal prize for a highly parallel drug analysis method developed in Goettingen

Successful technology transfer: Moritz Rossner from the Max Planck Institute for Experimental Medicine.

The development of new drugs is a very laborious and expensive process. When a new substance is discovered, researchers must determine how a large number of molecules – so-called targets – react to it within the cells. This is the only way to prove that the substance has the desired medical effect and to identify its side effects. At the Max Planck Institute for Experimental Medicine in Goettingen, a suitable integrated measurement process has been developed for the first time. The method is able to analyze substances for a multitude of targets in parallel in a single measurement, allowing drugs to be developed much faster and more cost-effectively than with existing methods. The team of researchers working under Project Leader Moritz Rossner in Goettingen refined the method for use in the pharmaceutical industry and subsequently founded the company Systasy Bioscience. For this work, the scientists have now earned third place in the VIP+ innovation awards of the Federal Ministry of Education and Research (BMBF). These honors are awarded to especially successful projects, which are supported by the Ministry as part of the so-called VIP program to encourage validation.

Photos: Kahn/Courtesy of NYU Photo Bureau (top); Kate Kirkby; GSI; private (bottom)

A river under human influence

Using the Mississippi as an example, an interdisciplinary project shows how human activity can cause permanent changes in nature

Can the transition into a new geological era dominated by humans also be illustrated at the regional level? That is precisely the aim of the project "Mississippi. An Anthropocene River", which was designed by Haus der Kulturen der Welt (HKW) and the Max Planck Institute for the History of Science. Its participants also include numerous U.S. partners and the Max Planck Institutes for Chemistry, Biogeochemistry and the Science of Human History. The project is partly sponsored by the German Foreign Office as part of the ongoing Year of German-American Friendship in the U.S. The areas around the Mississippi – which was once more of an immense floodplain than a river – evolved into a huge agricultural and industrial corridor as the river was dammed and canalized in the 20th century. Passing through complex, rapidly changing man-made ecosystems, the river acts as the catchment area for a range of cultures and is the scene of historical inequalities. As part of the Mississippi project, scientists, artists, and activists are working together to develop new methods of research and teaching that transcend the boundaries between disciplines. In collaboration with local initiatives, they are delivering insights into the local dynamics of changes taking place on a global scale.

Changeable: the motif of the Mississippi project is based on a 1940s map documenting historical changes in the riverbed.

Graphic: Meandering Mississippi. Map by Harold N. Fisk, U.S. Army Corps of Engineers, 1944 | Geological Investigation of the Alluvial Valley of the Lower Mississippi River

On the net

The power of emotions
Hate and love, disgust and security – emotions not only move and control us but also wield immense power over politics and society, as demonstrated by the exhibition The Power of Emotions. Germany 19 | 19. The concept was developed by Ute Frevert, Director at the Max Planck Institute for Human Development, together with her daughter Bettina Frevert, who works in historical-political education. The 22 A1-sized posters are intended for display in schools, city halls, libraries, and other public places. Through individual emotions, they explore key events in German history from the founding of the Weimar Republic in 1919 to the Peaceful Revolution of 1989. Among other things, the website allows users to order the set of posters and offers an overview of where the exhibition is currently being shown.
https://machtdergefuehle.de/?lang=en

Ethnological research in three minutes
What does field research look like? What methods do you work with? In these videos, scientists from the Max Planck Institute for Social Anthropology in Halle provide an insight into their work. For example, Imad Alsoos speaks about mobilization strategies of Islamic groups in Palestine and Tunisia, Charlotte Bruckermann presents her field research on CO_2 emissions trading in China, and Brian Campbell gives an outline of everyday life in the multireligious city of Ceuta, a Spanish enclave in Morocco. The charming thing about these three-minute videos is that they are not only in English but also in the mother tongues of the various researchers – in Arabic, German, and Maltese.
https://www.eth.mpg.de/4811217/conference_videos

Identifying plants via smartphone
While out walking, you spot a plant that you'd like to know more about. What's the plant called, is it poisonous, or might it be a protected species? If you don't have a plant identification book to hand, your mobile phone will be able to help in the future – thanks to the app *Flora incognita*. This identification software was developed with the help of scientists at the Max Planck Institute for Biogeochemistry in Jena. Flowers and leaves can be photographed using the smartphone's camera – and, in a matter of seconds, you receive a suggestion for the name of the plant as well as further information. The free app, which is now available in seven languages, allows plants to be identified by anyone, anywhere.
https://floraincognita.com/?noredirect=en_US