

Chancellor Pushes the Red Button

High-level visit to the control room of the Wendelstein 7-X nuclear fusion reactor: Chancellor Angela Merkel, a physicist herself, visited Greifswald in early February to switch on the first hydrogen plasma at the fusion reactor. “Every step we have taken toward the fusion power plant over the course of a century represents a success,” underscored Merkel before a large audience from the realms of science and politics before getting down to action. For the all-important push of the button, employees from the Max Planck Institute of Plasma Physics had a glass cube structure with the silhouette of the fusion reactor specially constructed and positioned on a steel column. Shortly after Angela Merkel spiritedly pressed the button, a bright light flickered on the monitors. These screens provided a glimpse inside the plasma vessel, where the brief fusion reaction the Chancellor had set in motion via the 2-megawatt pulse of microwave heat could be seen. Reaching a temperature of 80 million degrees and lasting a quarter of a second, the first hydrogen plasma in the system fully met the expectations of scientists and engineers at the Institute.



Before the start: Project manager Thomas Klinger, Managing Director Sibylle Günter, Helmholtz President Otmar Wiestler, Chancellor Angela Merkel, Max Planck President Martin Stratmann and Erwin SELLINGER, Minister President of Mecklenburg-Vorpommern (from left).

New Network for Alumni

Former Max Planck scientists join together

Every year scientists from many different countries visit the Max Planck Institutes and, conversely, many head off to all parts of the world as alumni. For some time now, the Max Planck Society has endeavored to cooperate with them in establishing a global, cross-disciplinary network. The alumni work has thus far focused on former working locations. “Max Planck alumni feel an affinity primarily with their institute,” said Filippo Guarnieri, who previously worked at the Max Planck Institute for Gravitational Physics. But he also empha-

sizes that: “Their skills are nevertheless important to the Max Planck Society as a whole, across institute boundaries.”

This was reason enough for him and five other alumni from different institutes to establish the Max Planck Alumni Association e.V. This new union will enable all alumni to work on independent projects autonomously and for the benefit of the entire organization and its scientists – for instance to foster knowledge sharing, career development and recruiting.

“The end product is what matters”

Detlef Weigel, Director at the Max Planck Institute for Developmental Biology, explains why genome editing offers a targeted way of breeding better crops

Greater resistance to pests, less sensitivity to drought, higher yields – this is just a small selection of the requirements that crops will have to fulfill in the future. Humanity needs new crops that can withstand the changes arising from global warming and meet the growing demand for food. With the help of a new method called genome editing, scientists are seeking to develop new crop varieties more efficiently than before. If no foreign genes are inserted into these plants, they can't be distinguished from plants that have been bred using traditional methods. For this reason, Detlef Weigel from the Tübingen-based Max Planck Institute for Developmental Biology, together with colleagues from the US and China, is asking for genome-edited plant varieties of this kind not to be classified as genetically modified plants.

Mr. Weigel, how are new varieties bred from crops today?

Detlef Weigel: It's important to realize that traditional breeding also aims to alter the DNA of the plants. For example, if you would like to obtain a new plant that can withstand drought and produce high yields, you can cross existing varieties that are resistant to drought or produce particularly high yields. The genes for these traits are newly mixed in the descendants' DNA, and some plants receive the genes for both traits. Chemical substances or radiation can also be used to generate mutations somewhere in the genetic code. Plants with new traits can also arise in this way. However, it is very time-consuming and complicated to seek out plants with the desired traits from thousands of mutants.

What is the difference between genome-edited and genetically modified plants?

With traditional genetic engineering, genes are often introduced into a plant's DNA that do not arise naturally in the species, for example genes for resistance to a herbicide. Different processes exist for this: for example, the genes can be “shot” into the plant cells using a kind of “gene gun.” With genome editing, we cut the

DNA with a protein at a predefined location. The genome editing method known as CRISPR/Cas9 has become the most common method. We can then modify the DNA at the interface or insert new sections. So genome editing should be viewed as a variant of mutation breeding, with the difference that the generation of particular mutations is targeted.

The major advantage here is that these modifications can be obtained in the same way as they are made in traditional breeding and crossing experiments. For example, individual letters of the genetic code can be exchanged. This corresponds to a modification that can also arise through natural mutation. Short sections of DNA can also be inserted and, in this way, genes from a species can be replaced with genes from its other varieties or from closely related species – something that is also done in traditional cross-breeding.

The criticism regarding genetically modified plants is aroused by the aforementioned “foreign genes” in particular. Do genome-edited plants also contain such foreign DNA?

The genetic information for the cutting protein is usually inserted into the plant's DNA so that it can be formed in the plant cells. This gene doesn't arise naturally in plants and is, therefore, foreign DNA. Following the successful modification of the genome, however, it can be completely removed. Using the analysis methods available today, it is possible to ensure that a genome-edited plant no longer contains any foreign DNA. Genome editing can also be used to insert completely foreign genes into the genome – as is the case in traditional genetic engineering. However, this kind of genome editing should be subject to different regulations than the kind that is used to make minor modifications.

Is it possible to distinguish at all between genome-edited and traditionally bred plants?

If no foreign genes are inserted, then, no, it isn't possible. A plant that has been modified using genome editing doesn't differ in any way from a plant whose ge-



Detlef Weigel is in favor of classifying genome-edited plants as traditionally bred plants.

nome was altered through breeding. At the end of the process, there is nothing to indicate how the new variety arose.

So genome-edited plants shouldn't be treated like genetically modified plants if they don't contain any foreign DNA?

Exactly! This is why we are asking for them to be classified as traditionally bred plants. In our view, how a plant variety came into being doesn't make any difference; the end product alone is what matters. In my view, it doesn't make any sense to classify plants as different if it isn't possible to say how they came into being.

Is this possible from a legal point of view, or would it require a change in the law?

The German Genetic Engineering Act states that the descendants of a genetically modified plant must also be classified as genetically modified. So the fact that genome-edited plants temporarily contained the gene for the cutting protein would make them and their descendants genetically modified plants forever – despite the fact that the foreign gene was removed without trace. This was certainly not the intention of the legislator, as genome engineering didn't yet exist when the Genetic Engineering Act was passed. So we suggest that the Genetic Engineering Act should not be applied to genome-edited plants. Interview: Harald Rösch

Leibniz Prizes Awarded to Three Max Planck Researchers

Prestigious award presented to Marina Rodnina, Emmanuelle Charpentier and Benjamin List

The Gottfried Wilhelm Leibniz Prize, awarded annually by the German Research Foundation, is one of the most prestigious scientific prizes in Germany. The prize is endowed with up to 2.5 million euros, and once again, three Max Planck Directors received the award in March 2016.

Marina Rodnina from the Max Planck Institute for Biophysical Chemistry was honored for her pioneering efforts on understanding the function of ribosomes. She succeeded in shedding light on the fundamental principles of how ribosomes – the protein factories of living cells – function. Emmanuelle Charpentier, Director at the Max Planck Institute for Infection Biology, was presented the award for developing the CRISPR/Cas9 technique. This mechanism, which stems from



Great honor: The winners of this year's Leibniz Prizes include Max Planck Directors Marina Rodnina, Emmanuelle Charpentier and Benjamin List.

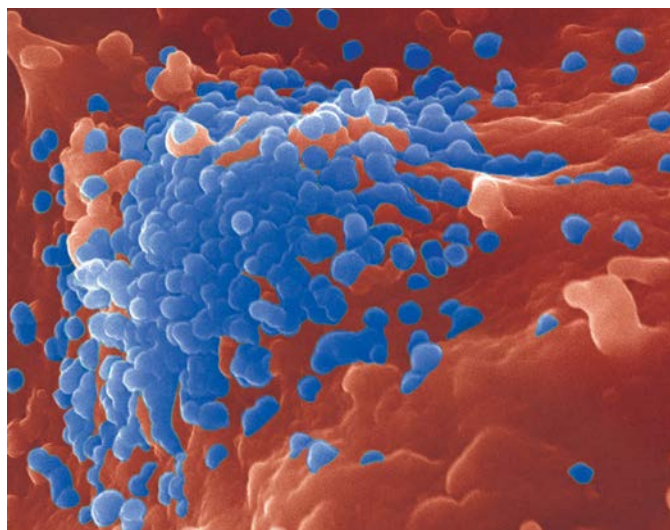
bacteria, can be deployed as a high-precision tool to investigate the function of genes and to manipulate genetic material. Benjamin List, Director at the Max-Planck-Institut für Kohlenforschung (Coal Research), received

the prize for establishing an entirely new field of catalysis research. List discovered one of the foundations of organocatalysis, which allows natural substances rather than metals to be used as catalysts for the first time.

HIV Scissors to Combat AIDS

Enzyme removes the genome of the AIDS pathogen from infected cells

To date, no cure has been found for infection with HIV. The drugs that infected patients must take for the rest of their life suppress the spread of the virus and thus the outbreak



of the disease. In 2007, a team of researchers headed by Joachim Hauber from the Heinrich-Pette Institute in Hamburg and Frank Buchholz from the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden succeeded for the first time in cutting out HIV genetic material from human cell cultures using an enzyme. Scientists have now taken an important step forward: they have developed the gene scissors to the point where over 90 percent of the HIV genotype can be removed from the human genome.

The scientists have proven the effectiveness of their technique in cell cultures and animal research. The number of viruses fell below the detection limit in animals receiving this treatment. Frank Buchholz, now a professor at the Technische Universität Dresden, believes this represents a medical milestone: "The creation of molecular scalpels will change medicine. It's not just HIV patients who will benefit from this development, but also many others with genetic diseases."

Burgeoning HIV: Up to ten billion virions are newly formed from activated T-cells every day. After a short time, these virus particles are ready to infect the next cells.

Exchange of Talent with Dutch University

Max Planck Society and Radboud University agree on joint program

Soon, up to 100 master's degree students from Radboud University in the Netherlands will be able to undertake internships each year at the Max Planck Institutes. Gerard Meijer, the University's President, and Martin Stratmann, Max Planck President, concluded an agreement at the beginning of March. "This presents us with a great opportunity to establish ties with young talent who will become the cutting-edge scientists of the future," emphasized Stratmann when signing the agreement. Meijer highlighted the opportunities for students to gain research experience at one of the prestigious Max Planck Institutes.

The internships will last 6 to 12 weeks, with the participating institutes providing supervision, workplaces and equipment. The remaining costs will be covered by Radboud University and the Erasmus program. A further framework agreement between the two scientific institutions also enables Max Planck scientists to obtain lecturing experience at Radboud University. This will be particularly beneficial to young researchers seeking a university career. Research cooperation is also to be stepped up. The collaborative program will initially run for five years.



Invaluable cooperation: Max Planck President Martin Stratmann (left) and University President Gerard Meijer seal the launch of new joint activities between the two institutions with their signatures.

On the Net



CV of Failures

We all experience failures in our careers, but we tend to keep quiet about them. Not so Johannes Haushofer, a 36-year-old assistant professor from Princeton who recently shared his "CV of failures" for all the world to see on his Twitter account. The CV includes sections entitled "Degree programs I did not get into," "Research funding I did not get," and "Paper rejections from academic journals." Haushofer's intention was to provide some perspective on failure by making it visible – and with great success, as his post very quickly went viral. www.princeton.edu/~joha/Johannes_Haushofer_CV_of_Failures.pdf

A Quantum Future

Researchers are seeking to make quantum communication tap-proof, enabling message recipients to determine whether a transmission has been tapped. This is made possible by the uncertainty principle that Werner Heisenberg described back in 1927. Our new educational video ("Quantum physics – tap-proof through randomness") for upper secondary school students clearly explains what lies behind this principle and how it can be applied to copy protection.

www.youtube.com/watch?v=3sheEyIrNGI

Fascinating Insights

The Wellcome Image Awards for the best scientific photographs of the year in the field of biology and medicine were presented on March 15. Twenty spectacular images were honored, including a submission by Alfred Anwander from the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig. Wellcome Image is an extensive image database that provides unrestricted access to photographs and illustrations from the history of medicine to current biomedical research. A team of scientists, artists and journalists select the best scientific photographs each year. www.wellcomeimageawards.org/2016