With a Little Help from Apollo

The Max Planck Institute for Intelligent Systems opens its new building in Tübingen

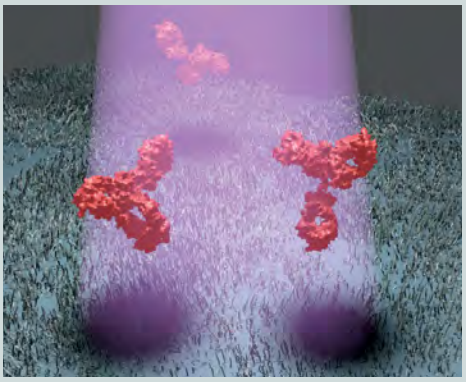
The opening ceremony saw genuine teamwork between man and machine: Apollo, the humanoid robot, held the red ribbon as it was cut by Minister President Winfried Kretschmann and Max Planck President Martin Stratmann. Science Minister Theresia Bauer and the Institute's Managing Director Stefan Schaal also helped cut the symbolic ribbon, thus officially opening the new building of the Max Planck Institute for Intelligent Systems following two years of construction work.

"With this Institute, the Max Planck Society has firmly anchored one of the most significant research fields for the digital revolution in Baden-Württemberg," said the Minister President at the opening ceremony held in late July. The Max Planck Institute, which also has a site in Stuttgart, was founded six years ago. Max Planck President Martin Stratmann spoke of his hope that the Institute's research would lead to major advances in cognitive robotics. The new building provides the perfect conditions for theoretical and experimental research. The generously dimensioned robotics lab, for instance, will provide a flexible training ground for robots. In the near future, the "Capture Hall" is set to become home to a globally unique 4D full-body scanner that can record the body and its movements through space and time in high definition.

Opening ceremony with distinguished guests (from left): Director Stefan Schaal, Science Minister Theresia Bauer, Apollo the robot, Max Planck President Martin Stratmann and Minister President Winfried Kretschmann after they jointly cut the ceremonial red ribbon.

Physics and Medicine for Patients

The Max Planck Society and the university and university hospital in Erlangen seal agreement on collaboration



Protein sensor: Max Planck researchers developed a method to identify unmarked biomolecules using their shadows. Such techniques could be used at the Center for Physics and Medicine.

The newly established Center for Physics and Medicine in Erlangen is putting an often-neglected factor in the development of diseases under the microscope: physics. The collaboration agreement was signed in late July. The Free State of Bavaria is supporting the project and the new premises with funding totaling 60 million euros. One of the Center's tasks will be to develop a better understanding of the mechanical, electrical and chemical processes in inflammations and tumor diseases so as to improve diagnosis and therapy. "We will use entirely new methods to measure and model living organisms' fundamental physical processes, such as the communication and forces between cells in diseased tissue," said Vahid Sandoghdar, Director at the Max Planck Institute for the Science of Light and one of the driving forces behind the Center. "We hope that the understanding we will gain of these processes will enable the development of novel treatments and drugs."

The precise focal points of the collaboration project will depend on the scientists appointed. The Center comprises a new department of the Max Planck Institute in Erlangen along with two new chairs for biophysics and mathematics in life sciences and the recently vacated chair for medical physics at the university, as well as five other research groups.

Photos: MPI for the Science of Light (bottom); Wolfram Scheible (top)

"Temperatures will continue to rise"

Thorsten Mauritsen of the Max Planck Institute for Meteorology is investigating how much time is left to achieve the Paris climate target

Thorsten Mauritsen

Earth's climate is in turmoil: Increasing levels of CO_2 collecting in the atmosphere have seen global temperatures rise by 0.8 degrees since the start of industrialization. According to a study conducted by Thorsten Mauritsen of the Max Planck Institute for Meteorology in Hamburg and Robert Pincus of the University of Colorado, even if all fossil fuel emissions were to cease immediately, the Earth would still become 0.3 degrees warmer. In an interview, Mauritsen explains why it will take millennia for the Earth to return to a state of equilibrium.

Mr. Mauritsen, what prompted you to conduct this study?
Thorsten Mauritsen: In 2015, I was a little confused as to why the 1.5-degree target was even being discussed in the Paris negotiations. I was certain that we had already passed that point, so I wanted to demonstrate in simple terms that this objective is no longer attainable. However, as I delved into the literature and carried out more calculations of my own, I came to realize that the scenario isn't entirely unrealistic – which is really something of a positive result.

You discovered that the Earth's temperature would rise by a total of 1.1 degrees Celsius even if fossil emissions suddenly stopped completely. How can that be?
The Earth system is out of balance: more energy flows into the system than is emitted. This excess energy is absorbed primarily by the oceans: water has considerable thermal capacity and therefore a long reaction time, so the oceans are currently cooling the air. Over time, however, the deep ocean layers will become warmer until eventually, after thousands of years, the climate system settles with the oceans and atmosphere at a higher average temperature. Without new emissions, at the end of this century, the temperature would be 1.1 degrees Celsius higher than before industrialization.

What factors do you think play a role in this?
In addition to CO_2, when we burn fossil fuels, we also emit aerosol particles into the atmosphere. These aerosol particles probably cool the Earth down a little – counteracting the CO_2, as it were. However, if we stopped burning coal and crude oil, these aerosols would disappear in a matter of weeks – but the CO_2 would remain in the atmosphere. As a result, temperatures would jump suddenly. Over a longer timeframe, though, the deep ocean layers absorb a portion of the CO_2. This reduces the predetermined warming at the end of the century by 0.2 to 0.3 degrees compared with the scenario where CO_2 remains constant. So that means nature is helping us out a bit.

What is the impact of other greenhouse gases such as methane and nitrous oxides?
These gases have a rather short lifespan of ten years at most. Of course, ten years is no short time at all until we consider these temperature increases over a period of a hundred years. These gas emissions contribute to the fact that the Earth is slightly warmer now. If these gases were to disappear from the atmosphere, the global temperature increase would be moderated somewhat.

How did you calculate the predetermined warming?
We actually only needed to know two things for this. First, we needed to find out how sensitive the Earth system is and how easily it reacts to the increase of CO_2 in the atmosphere over the course of a century – so-called transient climate sensitivity. We can estimate this using data from temperature increases to date as well as ocean temperatures. We also needed to know how strong the impact would be if aerosols, methane and nitrous oxides from fossil fuels were to disappear. This allowed us to estimate the temperature increase by the end of the century.

What is the difference between this and previous studies?
We used observation data to estimate sensitivity. Previous studies have been based on the results of climate models that involve many more assumptions, though our results do broadly support such model-based studies.

What can we learn from the results? Unfortunately, it's not possible to stop emissions with immediate effect.
We can see how far humanity is from climate goals like the Paris Agreement, which states that the Earth's temperature shouldn't rise by more than 1.5 to 2 degrees. According to our study, there is a 13 percent chance that we have already surpassed the 1.5-degree target. It also shows that, taking current emission levels as a basis, we still have 30 years until the probability of staying below the 1.5-degree level falls to 50 percent.

How do you explain the strong attention your study has gained?
We've clearly struck a chord. Surveys have shown that many people believe global warming would cease if greenhouse gas emissions stopped. Many people even think that temperatures will return to pre-industrial levels in a few decades. However, as climate researchers, we have known for a long time that this isn't the case. CO_2 has a much longer lifespan – it remains in the atmosphere for up to thousands of years. It is thus important to state it very clearly: temperatures will continue to rise even if emissions stop.

Interview: Ute Kehse

Photo: Private collection

Considering the Immune System as a Whole

Research Group created at Julius-Maximilians-Universität Würzburg

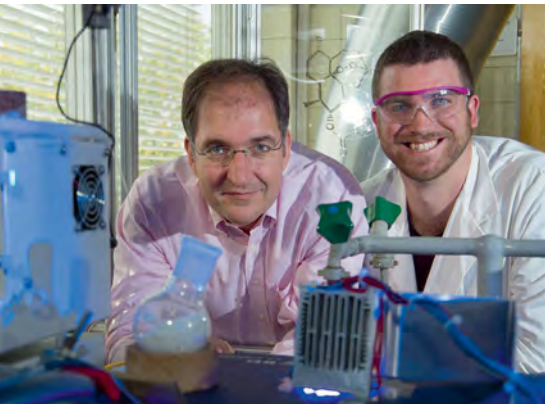
The new Max Planck Research Group for Systems Immunology at Julius-Maximilians-Universität Würzburg (JMU) has started work following the appointment of Georg Gasteiger. Its objective is to investigate the immune system and its interaction with the entire organism. This work isn't concentrated on protecting against pathogens or cancer cells alone: it is also focused on diseases caused by the immune system itself, such as multiple sclerosis or rheumatism. Financing was provided by the Free State of Bavaria, which contributed 25 million euros, and the Max Planck Society, with 2 million euros. An initial five-year term has been agreed.

Work began four years ago after the initial contract was signed. As Director, Gasteiger has led his team since June; at the same time, he holds the newly created Chair for Systems Immunology at the University. Wolfgang Kastenmüller has undertaken leadership of the second team as well as a further chair in the field. The appointment procedure for the third Director is currently ongoing. "We want to ensure that the Max Planck Society's research is closely linked with German universities," said Max Planck President Martin Stratmann in explaining the strategy for Max Planck Research Groups at universities. This applies particularly to fields that offer the prospect of significant new insights.

Campus location: The new Max Planck Research Group is housed in the building of the Institute of Pharmacology and Toxicology at JMU Würzburg.

Drugs for Developing Nations

Process for cost-effective production of pharmaceutical ingredients licensed



Promising development: Peter Seeberger (left) and Kerry Gilmore have created a new method to produce medications efficiently through their flow chemistry process.

The company Fluxpharm has obtained a license for a chemical process developed at the Max Planck Institute of Colloids and Interfaces in Potsdam. Using flow chemistry technology, a variety of standard ingredients can now be produced significantly more efficiently and cost-effectively than with conventional methods. Until now, pharmaceutical substances have often been produced using a so-called batch process, in which all requisite reagents are placed in a single vessel where they react with one another. However, this production method is time consuming and requires significant quantities of additional chemicals. The reaction in the flow chemistry process developed by Max Planck researchers, in contrast, takes place as the reagents flow through the pipes of a specially constructed reactor. This method enables much smaller quantities of substances to react more safely and efficiently.

Fluxpharm wants to develop the technology further and make it commercially available. Plans include advancing production of the pharmaceutical HIV drug Efavirenz in order to provide the drug to more people in poorer countries. The process is also suitable for other substances.

Photos: Ulrich Kleiner (bottom); Josef Wilhelm/Uni Würzburg (top)

Graduate Education with an International Profile

Pilot phase begins for three Max Planck Schools

The Max Planck Schools' stated aim is to bring together exceptional scientists from across Germany to attract the most talented junior scientists for doctoral study. Three selected schools will commence a five-year pilot phase in 2018: the Max Planck School of Cognition, the Max Planck School of Photonics and the Max Planck School on Physics, Chemistry and Construction of Life. The development was announced in Berlin in early September by German Federal Minister of Education and Research Johanna Wanka, Max Planck President Martin Stratmann, and President of the German Rectors' Conference Horst Hippler. The schools are composed of members of 21 universities and 31 institutes from non-university research organizations, including 22 Max Planck Institutes. The diverse nature of their composition underlines the initiative's inter-institutional character.

Future-oriented concept: Max Planck President Martin Stratmann and German Federal Minister Johanna Wanka publicly announce the new Max Planck Schools at a press conference in early September.

"As supra-regional research and education networks, the Max Planck Schools bring together the best minds from across Germany. This new method of concentrating scientific excellence in particularly innovative fields of research will allow us to compete in the international arena for the most creative talent," said Max Planck President Martin Stratmann. The three schools, whose concepts for implementation are to be further refined, will receive annual funding of 9 million euros from the German Federal Ministry for Research and Education during the pilot phase.

On the Net

Pioneer of Glycobiology
Peter Seeberger, who was awarded the 2017 Stifterverband Science Prize, discovered a method to develop novel vaccines, therapies and diagnostic agents using automated sugar synthesis. A video on our YouTube channel profiles the scientist and explains how his research is developing innovative treatment methods in the fight against multi-resistant hospital germs and malaria.
www.youtube.com/user/MaxPlanckSociety

A Scalpel for the Genome
The CRISPR/Cas9 method makes it possible to alter the genetic make-up of an array of organisms much faster and more easily than ever before. But how does this promising technique actually work? And what are its applications? Our subject portal on genome alteration sheds light on the system's background and discusses its ethical limitations. The portal features interviews, photos and videos as well as an overview of other genetic engineering techniques.
www.mpg.de/10729275/genome-editing

Picture This
Since August 2017, the Communications Department of the Max Planck Society has been running an Instagram account. Employees can share photos and videos from their institutes, of events and of the results of their research using the hashtag #MaxPlanckSociety. This social media presence, aimed at a younger audience, aims to convey an entertaining image of life and work in all 84 facilities.
www.instagram.com/maxplanckgesellschaft

Photo: BMBF/Hans-Joachim Rickel