

PROMOTING EXCELLENCE IN AFRICA

The Max Planck Society and the Alexander von Humboldt Foundation for Africa are planning three Max Planck-Humboldt Research Units, which entails the search for three Research Group Leaders at African institutions. The Max Planck Society will grant the leaders research resources of 150,000 euros per year for five years. The research groups

will cooperate with a Max Planck Institute of their choice and jointly train young scientists. “We are not funding a research topic, but rather supporting young talent who will bring their own approaches and topics,” said former Max Planck President Martin Stratmann at the opening of the program, explaining the main features of the model that the

Max Planck Society has already been using for some time on other continents. The goal is for very good researchers, who will become more visible by leading these research groups, to attract talented young researchers. This creates positive feedback loops – and thus nuclei for scientific excellence in Africa.

www.mpg.de/20343908 (in German)

8 PHOTO: ILJA C. HENDEL / SCIENCE IN DIALOGUE



A LOOK INTO OUTER SPACE

With the motto “Our Universe,” Science Year 2023 is an opportunity for a number of Max Planck Institutes to present themselves and their research to the public. Two exhibitions are traveling through Germany this year: the “MS Wissenschaft,” a floating science center, and the Universe on Tour exhibition, a mobile planetarium complete with exhibition tent. Both will be making stops in around 40 cities across the country until the fall. The exhibitions are diverse: in the mobile planetarium, visitors can immerse themselves in the universe via live shows projected in 360 degrees. Local astronomical research institutions, including Max Planck Institutes, will report on their current research following each show. On the “MS Wissenschaft,” 30 interactive exhibits invite visitors to discover outer space.

www.mpg.de/20280458 (in German)

This time, the “MS Wissenschaft” has the universe on board and will be traveling on rivers and canals in Germany and Austria until the end of September 2023.

HONORED★

PATRICK CRAMER

The Director at the Max Planck Institute for Multidisciplinary Sciences and new President of the Max Planck Society has been honored with the Shaw Prize. Patrick Cramer shares the top distinction with Eva Nogales from the University of California, Berkeley. Both have contributed significantly to the structural biological elucidation of gene transcription, one of the fundamental processes of life. The Shaw Prize is awarded annually in the life sciences, mathematics, and astronomy and each award is presented with one million US dollars in prize money.



PHOTO: DAVID AUSSERHOFER/MPG

ERIN SCHUMAN

With the Brain Prize 2023, the Lundbeck Foundation is honoring the pioneering work of Erin Schuman, Director at the Max Planck Institute for Brain Research in Frankfurt, as well as Christine Holt, University of Cambridge, and Michael Greenberg, Harvard Medical School. The researchers have revolutionized our understanding of how neurons regulate the production of the brain’s many thousands of proteins. The Brain Prize is the world’s most important neuroscience research prize, with prize money of around 1.3 million euros.



PHOTO: G. LAURENT



PHOTO: PICTURE ALLIANCE / SWEN PFORTNER

Patrick Cramer (left), the new President of the Max Planck Society, symbolically took over from Martin Stratmann (right) by donning the chain of office.

PATRICK CRAMER IS MAX PLANCK PRESIDENT

At the Annual General Meeting of the Max Planck Society in Göttingen on June 22, 2023, Patrick Cramer took over the presidency from Martin Stratmann. Cramer paid tribute to his predecessor's achievements in fostering female researchers and up-and-coming scientists, among other things. He said that Stratmann had given Germany and Europe fresh perspectives with projects such as Cyber Valley, the Max Planck Schools, the Dioscuri Excellence Programme for Eastern Europe, and the Agency for Leap Innovations (Sprind) proposal. Cramer also outlined three fields of action for the coming years in his inaugural address. One of his key ambitions is to attract employees to science and the science-support sector and nurture them once there. He emphasized that

paying attention to and appreciating people in all their diversity is crucial in this regard: "Everyone who shares our values is welcome," Cramer stated. Another area of focus is the ongoing development of Max Planck Society's international strategy under challenging circumstances. He said that it is important to look for new partners in Asia, Africa, and Latin America and to meet them on an even footing. And the third major field, according to the new President, is the responsibility of research to carry out its work in a way that is as ethical and environmentally friendly as possible, and to make the findings obtained freely accessible. Cramer also asserted that science needs to be more involved in societal debates.

www.mpg.de/20499257

MILLIONS RAISED FOR PROXIMA FUSION

Proxima Fusion is the first spin-off from the Max Planck Institute for Plasma Physics. The start-up was founded by former scientists and engineers from the Max Planck Institute as well as MIT and Google-X. The team's goal is to create a high-performance stellarator by the 2030s. A high-performance stellarator is a fusion device that harvests energy from the fusion of atomic nuclei by trapping a high-energy ionized gas, called plasma, in a ring-shaped magnetic field. Proxima Fusion's work builds on the Max Planck Institute for Plasma Physics' Wendelstein 7-X stellarator, by far the most advanced device of its kind. The start-up has now completed its pre-seed fundraising of 7 million euros. This will make it possible for the team to take the next steps towards the creation of a fusion power plant.

www.mpg.de/20380035 (in German)

BLOOD PRESSURE AND THE PSYCHE

Psychological factors can complicate the treatment of hypertension. As a large-scale study by the Max Planck Institute for Human Cognitive and Brain Sciences has shown, morbidly high blood pressure is often associated with symptoms of depression. This is consistent with observations from clinical practice, which note

that sufferers of the condition feel tired and fatigued and do not take their antihypertensive medication because it also affects their mood. On the other hand, the study also shows that people with only specific elevated sub-values feel better overall and are more emotionally stable. This is because higher blood pressure also

lowers the threshold for pain, both physically and mentally. Both phenomena complicate hypertension therapy. As a result, the researchers are calling for future treatments to take better account of the interactions between psychological and physical factors.

www.mpg.de/20162308 (in German)

On the safe side: when great apes have to choose between a transparent cup containing a grape and an opaque cup containing a possibly larger reward, most of them choose what they can see.

10



CURIOSITY PUT TO THE TEST

Humans are curious and like to try out unknown things. But is the same true of great apes? In an experiment, two researchers from the University of California, San Diego and the Max Planck Institute for Evolutionary Anthropology investigated this question. They gave adult chimpanzees, gorillas, bonobos, and orangutans two upside-down plastic cups to choose from. One cup was transparent and contained a small reward, while a larger reward awaited them in

the opaque one. The researchers set a similar task for children between the ages of three and five. On average, children chose the unknown option over the safe reward. In two versions of the study, 85 and 77 percent of children chose the opaque cup at least once compared with 24 percent of the apes. However, once the apes got to see the hidden rewards, they learned to explore the uncertain option in subsequent trials as well.

www.mpg.de/20388599

SCENT PREVENTS CANNIBALISM

When insect densities are high, migratory locusts can transition from solitary to swarming behavior. Cannibalism has long been thought to play a role in the swarming behavior of orthoptera. For example, the threat of cannibalism could cause swarms that frequently wipe out entire harvests in Africa to keep moving on because the animals are essentially fleeing from other members of their own species. Researchers at the Max Planck Institute for Chemical Ecology in Jena have now confirmed this assumption: they discovered that cannibalism among European migratory locusts (*Locusta migratoria*) increases with the number of swarming animals that are kept in a cage. Of all the scents that orthoptera emit in a swarm, one in particular stands out: phenylacetoneitrile. This substance protects its carriers from other orthoptera species because it is the only one with a deterrent effect on them. The team discovered the phenylacetoneitrile scent receptor on the surface of olfactory sensory cells after conducting tests on 49 olfactory receptors. The researchers now hope that the locusts will behave more cannibalistically if the scent receptor is inhibited. This might make it possible to dissolve the swarms.

www.mpg.de/20278575

CREATION AIDED BY METEORITES

Iron meteorites that fell to Earth in its early days may have played a central role in the origin of life: fine iron particles rained down when the celestial bodies entered the Earth's atmosphere. In the carbon dioxide-rich urate atmosphere, the metal particles may have catalyzed the creation of the first organic molecules, such as hydrocarbons, acet-aldehyde, or formaldehyde. The chemical industry also uses iron as a catalyst for such substances. The substances could then have formed amino acids and nucleobases, which are necessary building blocks of proteins and DNA, respectively, enabling the emergence of life. Researchers at the Max Planck Institute for Astronomy and Ludwig Maximilian University in Munich have now confirmed these assumptions in the laboratory. In a pressure chamber, they generated a mixture of CO₂ and hydrogen gas and used it to simulate the Earth's atmosphere

at that time. This consisted mainly of CO₂ and hydrogen and, because of the large quantity of gas, could have had an air pressure many times higher than that of today. As anticipated, the gas mixture reacted to

produce a number of complex organic compounds when it came into contact with iron dust, which is very similar to the abrasion of incoming meteorites.

www.mpg.de/20330250

A small fragment of the Campo del Cielo iron meteorite. Upon entering the Earth's atmosphere, the surface melted, and the smooth structures formed.



PHOTO: O. TRAPP

11

PILLS MADE TO MEASURE

In the future, tablets could be produced in shapes reminiscent of design objects. And this would not just be an aesthetic gimmick; it would also be used to release medicinal agents into the body in a controlled way. A team from the University of California, Davis and the Max Planck Institute for Informatics in Saarbrücken starts by identifying the form that a pill must take

for the active ingredient to be released over a desired amount of time and for the ideal substance level to be reached in the body. The calculated structures sometimes resemble salt crystals, sometimes diatoms, and sometimes even extravagant design objects. It is easy for 3D printers to produce such fancy tablets. However, the calculation technique can also be altered to only

produce shapes that can be made with typical pharmaceutical mass production techniques. In contrast to an alternative approach, in which pills are made of various carrier materials with various active ingredient concentrations, it would be much more practical to control the release of an active ingredient solely through a tablet's shape.

www.mpg.de/20687249

In these pills from the 3D printer, the active ingredient is released over a desired period of time thanks to the fancy shapes.



PHOTO: MPL-INF





GETTING THROUGH WINTER WITHOUT THROMBOSIS

During their months-long hibernation, bears hardly move at all. If healthy people were to lie in bed for so long, they could easily suffer thrombosis. A research team has now discovered a mechanism that prevents the formation of these blood clots. Researchers at the Ludwig Maximilian University Hospital in Munich analyzed blood samples from brown bears in Sweden. Their findings demonstrate that during hibernation, platelets involved in blood clotting interact significantly less with immune system inflammatory cells than they do when bears are awake. The researchers demonstrated the same phenomenon in paraplegic patients. The deficiency of a protein called HSP47 is apparently responsible for this. Mass spectrometry of proteins, which the Max Planck Institute of Biochemistry played a key role in developing, was used to measure the significant decrease in HSP47 production in bears during hibernation. Additionally, the team found that individuals who are immobile for extended periods of time due to illness have significantly lower levels of the protein. The researchers at the University Hospital now want to search for suitable molecules that switch off HSP47 and thus reduce the risk of thrombosis.

www.mpg.de/20166288

12 Even during the long period of rest in winter, a brown bear is protected from thrombosis.

PREJUDICE FOSTERS CORRUPTION

People very often base their behavior on what they expect from others. However, this social competence, which is positive in itself, also has downsides – for example, in the case of corruption. In a representative study of more than 5,500 people from 18 countries, a research team from the Max Planck Institute for Human Development and the Universities of Cologne and Amsterdam examined the role of prejudice in bribery. In an online game, participants were asked to decide whether or not to offer a bribe to their counterpart. The other party could accept or reject the money. The players interacted with both compatriots

and participants from the other nations. The result: players from countries perceived to be corrupt were offered bribes more often than average. However, they were less likely to accept them than their peers expected. At the same time, the players underestimated how often participants from countries with a reputation for integrity accepted the money. In contrast, the nation from which those offering bribes came was of secondary importance. To reduce international corruption, the research team suggests dispelling stereotypes regarding a country's propensity for corruption.

www.mpg.de/20246730

40%

is the increased efficiency achieved when titanium is added to an alloy made from Niobium, Iron and Antimony, which converts heat into electricity.

MORE ELECTRICITY FROM WASTE HEAT

If we still cannot live without fossil fuels, we should at least use them as effectively as possible. Thermoelectric materials could help in this endeavor: they can generate electricity from the waste heat that is inevitably released when coal, oil, and gas are burned. There are different numbers of high-energy electrons present at the two ends of, for example, a wire made of niobium, iron, and antimony. This can be exploited to generate an electrical voltage. So far, however, thermoelectric materials have not been efficient enough for use in technical applications. By adding titanium to the material, researchers at

the Max-Planck-Institut für Eisenforschung have now increased the efficiency of a promising thermoelectric made of niobium, iron, and antimony by up to 40 percent. Like all metallic materials, the metal accumulates at the boundaries between the tiny crystal grains that make up the material. This change in the microstructure means that a higher stress can be generated with the material at the same temperature difference. However, the increase in efficiency is only a first step; for practical use, thermoelectrics still have to become even more efficient.

www.mpg.de/19984293

FOREIGN SMOKE IN THE AMAZON

Up to two-thirds of the soot over the central Amazon rainforest comes from Africa. This is the conclusion reached by a team led by the Max Planck Institute for Chemistry in Mainz and the University of São Paulo. It was already known that smoke was flowing from Africa to South America. How much, however, was unclear until now. Researchers have now found a way to distinguish the sources of the soot particles based on the particles' properties. Using this method, they discovered that soot particles from Africa are significantly larger than those from the Amazon and contain less organic material. This revealed to the international team that bushfires and burning savannahs in northern and southern Africa contribute significantly more to air pollution in central Amazonia than previously thought. The proportion of African smoke is particularly high in the rainy season, when the air in the Amazon is usually very clean. The African soot then sometimes causes the air there to become as dirty as that in a large European city. In the dry season, when a lot of smoke hangs in the air anyway because of numerous natural and man-made fires in the rainforest, the soot from Africa increases the pollution even more. This air pollution not only affects the health of the people living in the Amazon, but also influences the climate: the smoke can cause reduced precipitation and cooling at the earth's surface.

www.mpg.de/20314950

PHOTO: MENRAD O. ANDRAE, MPI FOR CHEMISTRY



A plume from Africa with a high concentration of soot particles reaches the coast of Brazil.

Fruit and vegetables cut into bite-sized pieces are convenient to eat and motivate children to reach for them if a meal lasts long enough.

USEFUL SUBSTANCES FROM CO₂

Converting carbon dioxide from fossil fuel combustion into useful substances could reduce the carbon footprint of, for example, the chemical industry. A study by the Max Planck Institute for Terrestrial Microbiology shows how the greenhouse gas can become an industrial recyclable via the intermediate formic acid. The researchers have developed an artificial metabolic pathway that converts the rather inert formic acid into more reactive formaldehyde, which is needed to synthesize many useful substances, such as drugs. To this end, they identified new enzyme variants that catalyze the conversion of formic acid to formaldehyde very efficiently. Genetically modified microorganisms that have been endowed with this metabolic pathway could use the formaldehyde to manufacture products such as insulin or biodiesel in the future.

www.mpg.de/20293586



PHOTO: ADOBESTOCK

MORE PALATABLE

Children voluntarily reach for more fruits and vegetables when families take more time to eat. This is the result of a study on evening meal habits with the participation of the Max Planck Institute for Human Development in Berlin. The participating elementary school-aged children ate significantly more fruit and vegetables when they were bite-sized on the

table and when they sat there for just ten minutes longer than usual – about half an hour in total. The study also found that longer family meals did not result in children eating more bread or cold cuts. The researchers suspect that bite-sized fruits and vegetables are convenient to eat and therefore particularly tempting.

www.mpg.de/20189732

RECYCLING DURING FASTING

Cells are also familiar with the principle of recycling: their waste disposal system breaks down defective or damaged molecules and extracts energy from them. Until now, it was assumed that the cells primarily control the recycling themselves. However, scientists at the Max Planck Institute for Metabolism Research in Cologne

have now found in mice that this process depends heavily on the brain. In their study, the researchers did not feed the animals for four hours. They then studied how a specific group of neurons in the hypothalamus – the brain's hunger center – responded to the short fast. Surprisingly, they found that, during fasting, the brain

not only sends signals that stimulate the organism to eat; when energy levels are low, neurons also trigger the release of the hormone corticosterone, which causes cells in the liver to recycle cellular waste. It could be that this newly discovered mechanism in the brain contributes to the positive effects of fasting. www.mpg.de/20182361

A pierced deer tooth from Denisova Cave in southern Siberia. Researchers have extracted ancient human DNA from its surface.



IMAGE: MPI FOR EVOLUTIONARY ANTHROPOLOGY

JEWELRY FROM THE ICE AGE

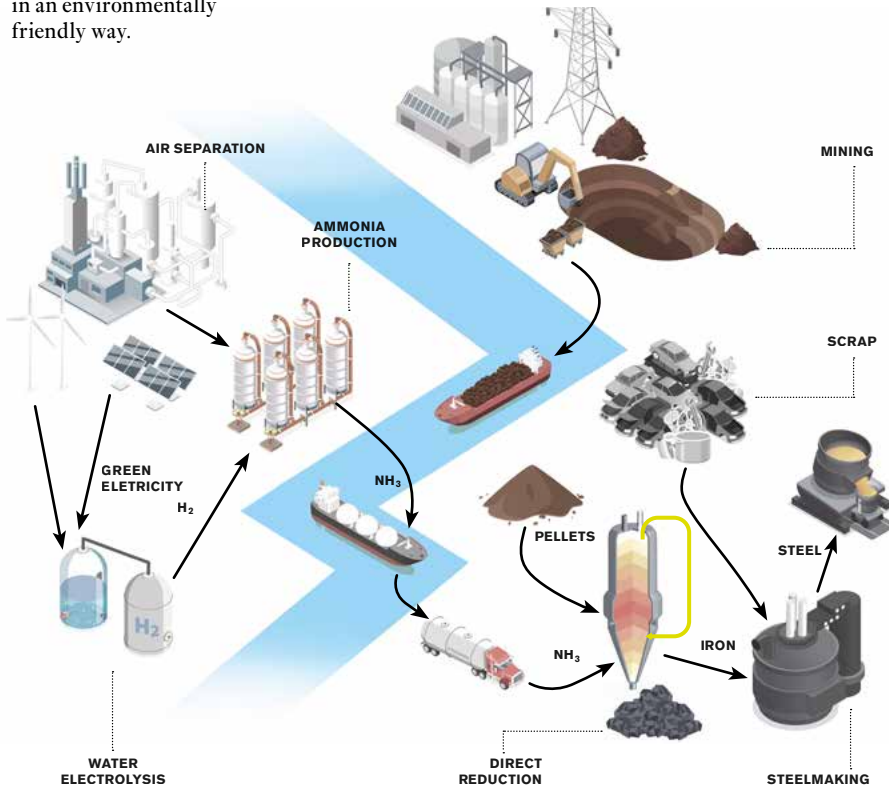
Objects made of stone, bones, or teeth provide important insights into the way people of the Stone Age lived. Until recently, however, it was mostly impossible to identify the maker or user of such an object. A research team led by the Max Planck Institute for Evolutionary Anthropology in Leipzig has now succeeded in doing so for the first time. The researchers have developed a method that allows them to wash DNA out of old bones and teeth, and even do so without damaging them. Using this method, they reconstructed DNA from a deer tooth pendant found in southern Siberia that is about 20,000 years old. Genetic analysis revealed that the pendant came from a wapiti deer and was made, used, or worn by a woman. This woman shared a genetic ancestry with individuals who lived at the same time in Siberia's easternmost regions. The findings show that even when jewelry and tools are thousands of years old, it is still possible to infer information about their users.

www.mpg.de/20241058

15

Direct reduction with ammonia made from green hydrogen can turn iron ore into iron in an environmentally friendly way.

GRAPHIC: ISTOCK; GCO BASED ON A TEMPLATE BY MA. Y., ET. AL., REDUCING IRON OXIDE WITH AMMONIA: A SUSTAINABLE PATH TO GREEN STEEL. ADV. SCI. 2023, 10, 2300111



ON THE PATH TO GREEN STEEL WITH AMMONIA

Hydrogen is a beacon of hope for the climate-neutral economy – and this is also true for the steel industry, which accounts for seven percent of CO₂ emissions worldwide. But perhaps the industry should also rely on ammonia to produce green steel, at least in Germany. A team from the Max-Planck-Institut für Eisenfor-

schung in Düsseldorf has shown that ammonia converts iron ore into iron just as well as hydrogen. Ammonia can be synthesized with green hydrogen, which is produced, for instance, in sunny countries. Despite the additional conversion step, this would be worthwhile because ammonia is much easier to transport. It is also

necessary to produce hydrogen or ammonia for a climate-neutral economy in other parts of the world because there is unlikely to be enough renewable electricity for this in Germany and other Central European countries – even if the energy supply from wind and sun is expanded as far as possible.

www.mpg.de/20091468

THE YO-YO EFFECT

Many people who have dieted are familiar with the yo-yo effect: after the diet, the lost kilos are quickly put back on. Researchers from the Max Planck Institute for Metabolism Research have now shown in mice that communication between nerve cells in the animals' brains increases during a diet. The nerve cells in the hypothalamus that trigger the feeling of hunger receive stronger signals, so that the mice eat significantly more after the diet and gain weight more quickly. The increased signaling in the hypothalamus leads to a prolonged and excessive sense of hunger. In the long term, these findings could help in the development of drugs aimed at preventing this amplification, thereby assisting in maintaining reduced body weight after dieting.

www.mpg.de/20048019

16

A solid catalyst powder in a liquid reaction medium.



PHOTO: FRANK VINKEN

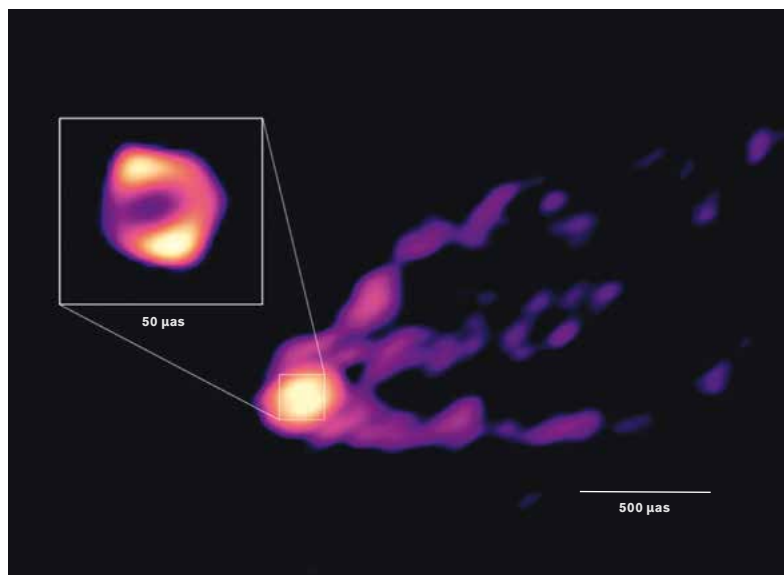


IMAGE: R. LU ET AL., NATURE 2023

Reconstructed image of the jet anchored in the vicinity of the supermassive black hole at the center of the distant galaxy M87. The image shows the ring of light encircling the black hole and the matter being propelled away from the region surrounding the black hole.

THE DIGESTIVE SYSTEM OF THE MASS MONSTER M87

A few years ago, the image of an orange-glowing donut caused a sensation. Scientists had captured the first ever image of the immediate vicinity of the supermassive black hole at the center of the galaxy Messier 87 (M87). This galaxy is known for a jet that channels matter far out of the galaxy, powered by the rotation of the black hole. The precise mechanism by which the jet is anchored in the vicinity of the black hole, and how matter

streams into the jet, is not yet fully understood. Astronomers, with the participation of the Max Planck Institute for Radio Astronomy, have now made strides in providing new insights. Utilizing a network of radio telescopes spanning nearly the size of Earth itself, they are using the example of M87 to render visible, for the first time, the matter flows in the extreme center of a galaxy.

www.mpg.de/20220818

CATALYSTS OF THE ENERGY TRANSITION

When it comes to the energy transition, there has to be the right chemistry. This enables the storage of electricity generated from wind and solar sources into fuels and fundamental materials for chemical production, and the utilization of CO₂ for this purpose. However, the corresponding chemical compounds can only be produced effi-

ciently with the right catalysts; these are currently still in short supply. In the recently inaugurated Max-Planck-Cardiff Centre on the Fundamentals of Heterogeneous Catalysis (Funcat), three Max Planck Institutes and the Cardiff University have joined forces to pursue new paths in catalyst research. Employing artificial intelli-

gence and Big Data, among other methods, they aim to predict promising catalyst candidates that can enhance chemical reactions and direct them towards the desired products. As a test case for the new approach, the researchers are developing reaction accelerators that convert CO₂ into useful substances.

www.mpg.de/20002391