SCIENTIFIC FREEDOM IN ISRAEL

For the Max Planck Society, the long-standing and intensive scientific collaboration with Israel is hugely important. The research organization is convinced that freedom in research and the autonomy of academic institutions is absolutely crucial to a country’s prosperity. Together with the Alexander von Humboldt Foundation, the Fraunhofer-Gesellschaft, the German National Academy of Sciences Leopoldina, the Helmholtz Association, and the German Council of Science and Humanities (Wissenschaftsrat), the Max Planck Society signed a declaration in mid-July on Israel’s judicial reform. In it, these institutions convey the concern of their partner organizations in Israel that the reform could have a negative impact on international scientific cooperation and jeopardize academic freedom and shared scientific potential. The Free University of Berlin, German U15, the University of Potsdam, and the Einstein Foundation Berlin, as well as a network of renowned European universities, likewise aligned themselves with this statement following its publication.

www.mpg.de/20643396

THE DARK SIDE OF THE UNIVERSE

At the beginning of July, the Euclid space telescope was launched into space on a Falcon 9 rocket. From there, it will spend the next six years studying the influence of dark matter and dark energy on the evolution of the universe. It is a challenging task, because although these make up 95 percent of the universe, they are both extremely difficult to detect. The telescope contains the biggest optical lenses ever created for a scientific space mission, and some of the key components for Euclid’s optics were developed by researchers at the Max Planck Institutes for Astronomy and for Extraterrestrial Physics. The telescope will observe several billion galaxies within a radius of ten billion light years and produce a three-dimensional map. The measurements are a test of Einstein’s theory of gravity at great distances.

www.mpg.de/20562770

AWARDS

JEAN-JACQUES HUBLIN
The Director Emeritus of the Max Planck Institute for Evolutionary Anthropology in Leipzig has been presented with the 2023 Balzan Prize for “Evolution of Humankind: Paleoanthropology.” His discoveries, most significantly the remains of the oldest Homo sapiens found to date in Africa, have made a major contribution to the study of human evolution. Furthermore, Hublin’s ability to bring together findings through different cutting-edge techniques was also emphasized. The prize likewise recognizes his talent for organizing scientific teams as well as his qualities as a teacher and scientific communicator.

HEINO FALCKE
Astrophysicist Heino Falcke, guest scientist at the Max Planck Institute for Radio Astronomy in Bonn and professor of astrophysics and radio astronomy at Radboud University in the Netherlands, will receive the 2023 Balzan Prize for “High-resolution images, from planetary to cosmic objects.” He is being honored for his fundamental research that makes it possible to image the environment of a black hole with high precision. He also played a major role in the development of the Event Horizon telescope, which captured the first ever image of a black hole.
IN BRIEF

MRI WITHOUT ANESTHESIA

The Institute of Pediatric Radiology at the University of Leipzig Medical Center is using a magnetic resonance imaging (MRI) technique called Flash 2 that allows gentler radiological examinations of children. The technique was developed at the Max Planck Institute for Biophysical Chemistry (now the Max Planck Institute for Multidisciplinary Sciences) in Göttingen. The procedure, which also enables users to see movements in the body in real time, makes it possible for the first time to examine small children without sedation or anesthesia. Flash 2 is already in use at other institutions, such as the University Medical Center Göttingen, the Radcliffe Hospital at Oxford University, and Johns Hopkins University in Baltimore.

www.mpg.de/mpr-2023-031

30 YEARS OF MAX PLANCK IN SAXONY

In the summer of 1993, the Max Planck Institute for the Physics of Complex Systems began its work in Dresden as the first Institute to be located in the Federal State of Saxony. Five further Institutes have been founded there since. It was very positive that the independence and the criteria of the Max Planck Society were adhered to, praised Minister President Michael Kretschmer at a ceremony in Dresden’s Kulturpalast: this, he said, put the new federal states as a whole on the international science map with the exciting areas of study being pursued there. The number of highly regarded scientific awards, among other things, are a testament to this 30-year success story: in addition to the 13 Gottfried Wilhelm Leibniz Prizes for Max Planck researchers alone, there have been two Körber and Breakthrough Prizes, the Paul Ehrlich and Ludwig Darmstaedter Prize, the Hegel and Balzan Prizes (see “Awards”), and, last but not least, the 2022 Nobel Prize in Medicine for Svante Pääbo, Director at the Max Planck Institute for Evolutionary Anthropology. “The Nobel Prize would never have gone to Leipzig without all the efforts the Max Planck Society made back then,” Kretschmer emphasized. Despite pressure from the federal and state governments, the research organization had insisted at the time on building something new in the eastern federal states and not simply taking over former GDR institutes. Now, the six Max Planck Institutes boast almost 30 research departments with more than 2,000 employees and a research budget of more than 90 million euros a year.

www.mpg.de/20777132

Founder of paleogenetics: Nobel Prize winner Svante Pääbo talks about his research into the history of humankind at the ceremony in Dresden.

www.mpg.de/20777132
IN BRIEF

IMAGE: DANIELLE FUTSELAAR (ARTSOURCE.NL)

Every night the fruit bats fly out to feed in the areas around the Kasanka National Park.

A SKY FULL OF FRUIT BATS

Once a year, a small forest in Zambia becomes the stage for one of the world’s greatest natural spectacles: in November, straw-colored fruit bats from all over the African continent fly to a group of trees in Kasanka National Park in Zambia. For as yet unexplained reasons, these large bats congregate there for three months, forming Africa’s largest colony of fruit bats. The precise number of bats in the colony also remains unknown, but researchers from the Max Planck Institute of Animal Behavior in Constance have now applied a new standardized method to reveal that the colony in Kasanka comprises 750,000 to 1,000,000 animals. By weight, it therefore constitutes the biggest bat colony in the world. Fruit bats are a keystone species on the African continent, as the animals disperse plant seeds during their long-distance flights. In doing so, they help forests to grow back in deforested regions. Yet the Kasanka colony is threatened by agriculture and the loss of habitat. Only if their numbers remain high can the animals continue to play their vital role in the ecosystem. Losing the Kasanka colony would therefore be devastating for the entire African continent.

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SATIELITES DISRUPT ASTRONOMY

Whenever people communicate with receiving stations via cell phones or satellites, they use radio waves. Official agreements ensure that this communication radiation does not hinder astronomical observatories from measuring radio waves from space, which are much weaker. One exception not previously explored has been registered by researchers at the Max Planck Institute for Radio Astronomy, among others. This involves interference radiation emanating from the on-board electronics of certain satellites, with the focus initially on the Starlink satellites produced by the company SpaceX. Although radio telescopes in remote regions can be shielded against radiation from cell phones, for example, they are still exposed to human-generated radio waves from orbit. This radiation emitted by satellites has not previously been taken into account in international regulations. SpaceX has already improved future satellite generations accordingly.

www.mpg.de/20610867

Artist’s impression of a satellite constellation in a low-Earth orbit.
AN EXTENDED FAMILY FROM THE STONE AGE

Genetic material dating back 6,700 years has given the research team insights into the world of early farming communities from the Stone Age. The material comes from remains found at a Neolithic burial ground in the Paris Basin. With the help of DNA analyses, researchers from the Max Planck Institute for Evolutionary Anthropology in Leipzig have used it to reconstruct two extended families over several generations. The family trees show that the sons remained in the community, while the daughters apparently had to leave their birthplace. Female members of the family came from elsewhere. The fact that some of the women who had married into the family were distantly related to one another indicates the community exchanged its female family members with a few neighboring sites. The families were tall by Stone Age standards, so nutritional and health conditions must have been good. No half-siblings were buried in the cemetery, so people may have lived in permanent monogamous relationships. The researchers were even able to identify the founding father of the families. After three or four generations, the resources on site seem to have been exhausted, so the people abandoned the settlement site and moved on.

THE DREAM OF FLIGHT

While we are sleeping, our brains go through various phases of sleep: REM sleep (rapid eye movement) and non-REM sleep. It is during REM sleep that our brains are particularly active and produce sometimes vivid and emotional dreams. In the non-REM sleep phase, the brain is less active and disposes of waste products. Similar sleep patterns have been found in birds. To find out exactly what goes on when birds sleep, researchers from the Max Planck Institute for Biological Intelligence in Martinsried observed the sleep and wakefulness states of pigeons using infrared video cameras and functional magnetic resonance imaging. During the REM phase, areas of the bird’s brain that analyze visual stimuli as they occur during flight are active. Other areas that process nerve signals from the body and wings are then also fired up. This implies that birds, like humans, dream during the REM phases and perhaps even experience flight sequences. Furthermore, the researchers demonstrated that during the REM phases the amygdala, a structure of the brain that plays an important role in emotional processes, is activated. This suggests that birds also experience emotions while dreaming.

WATER FOR DISTANT PLANETS

According to the currently most popular theory, water first pelted the Earth in the form of icy chunks at a later stage in the development of the young solar system. Yet new findings by a team at the Max Planck Institute for Astronomy support another idea, according to which water could have been one of the early building blocks of rocky planets. The researchers observed the star system PDS 70, which lies 370 light-years away. There, planets are currently clustering in a disk of dust and gas that surrounds the young star. Data from the James Webb Space Telescope included evidence of water vapor in the innermost disk, which is precisely where Earth-like planets normally form. These results are surprising because water quickly degrades into its components when irradiated by light from the young central star. Whether young Earths are already orbiting around PDS 70 and whether or not they have already drawn from the water reserves remains unclear, but the discovery points to a way that water could accumulate on potentially life-friendly planets during their formation.
IN BRIEF

**Spread of Indo-European languages.**

**LANGUAGES FROM ANATOLIA**

Indo-European languages are spoken by almost half of the world's population today. Previously it was unclear where and when this language family emerged, mainly due to inconsistencies in the analyzed data. Now, a team from the Max Planck Institute for Evolutionary Anthropology, together with 80 linguists, has reconstructed the origin and distribution of Indo-European languages.

The researchers examined the core vocabulary of more than 160 languages, some of them historical, and thus created a family tree of Indo-European languages with unprecedented accuracy. According to this, the origin of the languages lies to the south of the Caucasus in Anatolia, a fertile region where agriculture also originated. It was there, 8,100 years ago, that Proto-Indo-European began to divide into different languages. Around 7,000 years ago, humans migrated from Anatolia to the steppe regions to the north of the Black Sea, taking their languages with them. From there, further migrations took them westward around 5,000 years ago. This is how branches of the Indo-European language tree also came to Europe.

**THERAPY THROUGH TECHNOLOGY**

People with anorexia fear gaining weight. A new application for virtual reality glasses should help to alleviate this fear. Researchers at the Max Planck Institute for Intelligent Systems have created a simulated environment in which the affected person can look at their own body at different bodyweights – both from their own perspective and in a virtual mirror. In a pilot study with 24 patients, most participants found the confrontation with their virtual counterpart to be helpful in their recovery. For this type of body therapy to work, the representation of the person has to be as realistic as possible. To ensure this is the case, the researchers developed a general body model based on thousands of real body scans.

**A QUESTION OF PERSONALITY**

The decline in birthrates in many industrialized countries since the mid-1950s is due in part to changing values. People decide on a more individual basis whether or not they want to have children, with self-realization and self-fulfillment both important factors here. Researchers at the Max Planck Institute for Demographic Research have analyzed data from around 14,000 households in Germany. The core question here: do personality traits such as empathy or extroversion play a role? For women, this seems not to be the case, unlike for men. Empathetic men seem to be more ready to become fathers, albeit only with a slightly increased tendency. If a man is considered particularly extroverted, the tendency to have the first child is similarly high for him, but negative for the second child. There could be various reasons for this. Extroverted men are more likely to meet a partner, while any restrictions imposed by the first child could lower the desire to have children. Alongside personality traits, however, social, economic, and cultural aspects also undoubtedly play a role.
IN BRIEF

AI OPTIMIZES ITSELF

Artificial intelligence is staggering not only in its performance, but also in its hunger for energy. According to the German statistics firm Statista, training GPT-3, which makes ChatGPT an eloquent and apparently well informed chatbot, devoured around 1,000 megawatt hours – that’s about the same consumption as 200 German households of three or more people over an entire year. Víctor López-Pastor and Florian Marquardt, two scientists from the Max Planck Institute for the Science of Light in Erlangen, are now presenting a concept for training artificial intelligence with much greater efficiency. The core idea is to carry out the training in the form of a physical process, for example the superposition of light waves in special optical components. Here, the parameters of the machine, which correspond to the synapses of an artificial neural network, are optimized by the process itself. In the training of conventional artificial neural networks, on the other hand, external feedback is needed to adjust the strength of the many billions of synaptic connections. The Erlangen-based researchers – together with a cooperation partner – now want to put their concept to the test in experiments.

www.mpg.de/20826914

A TURN OF THE HEAD AT THE CLICK OF A MOUSE

Photos generated by artificial intelligence are a matter of luck and frequently do not produce exactly the desired outcome. However, thanks to a method developed by a team of researchers at the Max Planck Institute for Informatics in Saarbrücken, the creativity of the algorithms can now be steered in a chosen direction, quite literally. The technique, named DragGan, makes it possible, for example, to change the direction of a pet’s gaze on an AI image with just a few mouse clicks. It is also possible to edit the photo with DragGan, although that requires additional steps. What’s more, this can result in an image that is more different from the original photo than just in the detail that has been deliberately changed. To be sure, the researchers are aware that the method is also suitable for falsifying photos, but it is precisely because of this potential for misuse that they believe it is important to develop methods of image processing. After all, only this way can they best understand the techniques that are being created in any case and most readily detect their misuse.

www.mpg.de/mpr-2023-033

Learning with light: This is what a light wave for training artificial intelligence in a self-learning physical machine might look like. Crucial aspects include not only the irregular form, but also the fact that its development is reversed from the time of its greatest expansion (red).

Controlled AI: DragGan turns editing images created using artificial intelligence into child’s play. With a click of the mouse, users can bring elements of the image they wish to change into the chosen position, for example moving the head of a lion and opening its jaws.

www.mpg.de/mpr-2023-033
IN BRIEF

LEARNING WHEN OVERWEIGHT

After the first painful encounter with a red-hot hob, you usually learn that this is one way you can burn yourself. Our brain’s capacity to connect sensory stimuli with their outcomes is primarily regulated by nerve cells located in the midbrain. These cells are very sensitive to the hormone insulin. Researchers at the Max Planck Institute for Metabolism Research in Cologne set a learning task to test subjects who were overweight and normal weight to measure how well associative learning functions. The researchers found that the ability to link sensory stimuli was less pronounced in the obese subjects than in those of normal weight and that brain activity was reduced in the areas of the brain that influence this behavior. However, with the use of the weight loss drug liraglutide, activity can be normalized again. Even after a single dose of liraglutide, the researchers observed no difference in brain activity between people of normal weight and those with obesity. The active ingredient stimulates insulin production and creates a feeling of being full after eating. It is often used to treat obesity and type 2 diabetes. The results show that the ability to learn depends not only on external conditions, but also on the metabolic state of the body. Because it can cause alterations in brain function even in young individuals who are significantly overweight, preventing obesity is of vital importance.

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SWEET COPY PROTECTION

In the future, it may be possible to detect counterfeit products more reliably than before. Using inexpensive, non-copyable fluorescent markings, a team from the Max Planck Institute of Colloids and Interfaces has developed a method to prevent products such as medicines and electronic components from being copied. The researchers use a laser to generate fluorescent molecules in random patterns in sugar films. To prevent the spread of counterfeit products, a medicine package could be labeled with one of the individual patterns. A pharmacy could then compare the sample with a photo that was taken during production and stored in a database. According to estimates by the EU, the European pharmaceutical industry loses around EUR 9.6 billion in sales every year due to counterfeit medicines. Although counterfeit medicines rarely find their way into circulation through legal distribution channels such as pharmacies, this does happen from time to time. To enable a check as to whether a medicine is a counterfeit, QR codes have been added to medicine packaging throughout the EU since 2019, but these only guarantee limited copy protection.

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Control and chance: Artificial intelligence can help to control the overall color impression of luminous patterns created with a laser in sugar layers (top row). The micro-patterns of the fluorescent molecules, on the other hand, are completely random (bottom row).

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