

# EUR 1.3 MILLION FOR LUCID GENOMICS

The Berlin start-up Lucid Genomics, a spin-off of the Max Planck Institute for Molecular Genetics and the Institute of Medical Genetics and Human Genetics at Charité – Universitätsmedizin Berlin, has raised 1.3 million euros. The funds are being used to further develop AI-based technology that extracts all genomic information from genetic material and, in doing so, improves medical diagnostics and makes it easier to develop medication. At this time, se-

quencing of human genetic material takes into account only two percent of the genome and ignores the “dark genome” – the parts of the DNA that do not code any genes. To enable use of the entire genome, the team at Lucid Genomics is building upon years of experience in DNA sequencing and the development of machine learning methods that can be utilized to substantially improve recognition of genetic variants.

[www.mpg.de/23160085](http://www.mpg.de/23160085)

# OUTSTANDING! ★

PHOTO: KÖRBER-STIFTUNG



ERIN SCHUMAN

The Director at the Max Planck Institute for Brain Research in Frankfurt has been awarded the Körber European Science Prize, which is presented alongside

1 million euros in prize money. Schuman has demonstrated that proteins which play a decisive role in communication among nerve cells, memory formation, and the overall development of the brain are formed locally at the synapses, the switching points between nerve cells. This discovery disproves the hypothesis that proteins are created only in the cell bodies of nerve cells, which was assumed to be the case for quite some time.

## 8 A VISIT TO PRESIDENT LULA

*MaxPlanckResearch* made a visit to a prominent reader: Luiz Inácio Lula da Silva. During a literary journey through his native Brazil, Bruno Rodrigues de Lima, a researcher at the Max Planck Institute for Legal History and Legal Theory, also met the country's president and showed him an article in *MaxPlanckResearch 2/2024*: an article about Lima and his dissertation on the lawyer and human rights activist Luiz Gama

(1830–1882). Gama, the son of a Brazilian bon vivant and a former slave, was sold into slavery by his own father. He was able to free himself from bondage and became a successful lawyer, who championed the rights of enslaved people and helped hundreds gain their freedom. Lima's dissertation paved the way for a biography, which he was presenting in Brazil.

[www.mpg.de/22505145](http://www.mpg.de/22505145)

PHOTO: HENKEL



LORRAINE DASTON

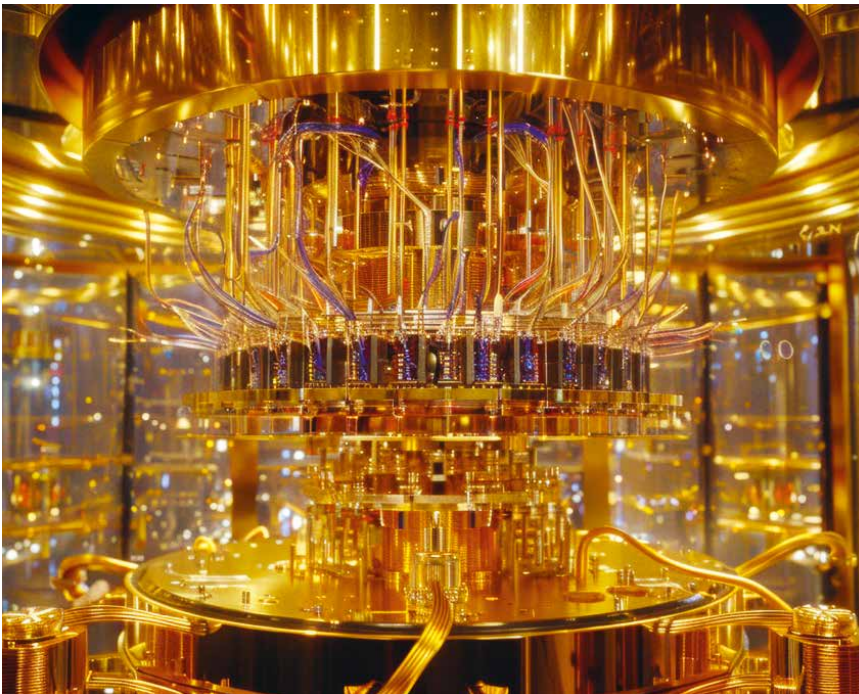
The retired Director of the Max Planck Institute for the History of Science has been awarded the Balzan Prize. The jury honored Daston for the scope, originality, and diversity of her work, which examines mental notions and associations that underlie research activity. The science historian laid the foundation for demonstrating the variability of key scientific concepts like objectivity, reason, and rationality throughout history – from the Early Modern Age to the present.

The Brazilian lawyer Bruno Rodrigues de Lima meets President Luiz Inácio Lula da Silva.



PHOTO: RICARDO STUCKERT

IMAGE: ADOBESTOCK



## NEW ENCRYPTION STANDARDS

Once quantum computers have reached their full computing power, they could crack present-day encryptions used to protect emails, online transactions, or bank transactions. That is why experts from around the world have been developing cryptography methods that will still be secure in the post-quantum era. The National Institute for Standards and Technology in the United States has now published standards for three ciphering methods. Peter Schwabe, Di-

rector at the Max Planck Institute for Security and Privacy in Bochum played an essential role in their development. The U.S. authority selected the three methods Sphincs+, CRYSTALS-Dilithium, and CRYSTALS-Kyber from among 82 proposals. It will probably establish standards for a fourth method named Falcon later. These standards make it easier for online service providers to use the new ciphering methods

[www.mpi-sp.org/68024](http://www.mpi-sp.org/68024)

## MOURNING SOCIETIES

Every year, hundreds of thousands of people fall victim to armed conflicts, either by losing their own lives or through the loss of relatives. Researchers have now examined how many people in Ukraine, Afghanistan, and other regions have lost a close relative. They evaluated data concerning deaths in regions impacted by war for this purpose. Their calculations show that several loved ones suffer trauma as a result of each casualty. In Syria, for instance, every casualty leaves behind an average of four mourning relatives, and in Ukraine the average is above two. By the end of 2023, an estimated 1 in 20 people in Syria had lost a loved one owing to the conflict over the course of their lives, and in Ukraine it was 1 in 200. Studies show that mourning lasts for decades, prevents reconciliation, and can sow the seeds of future violence. That is why fast solutions to the conflicts and support for the bereaved are necessary.

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Artistic depiction of a cold gas giant revolving around a red dwarf.

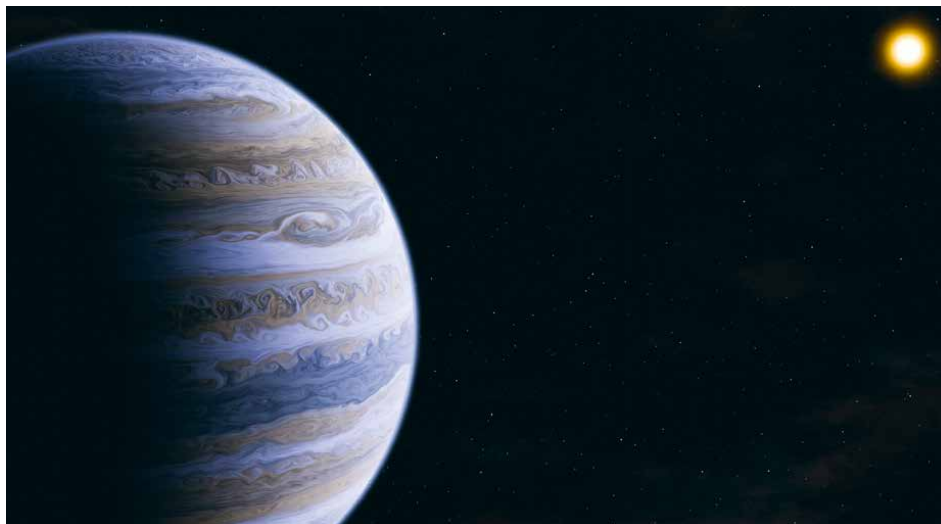


IMAGE: T. MULLER (MPIA/HDA)

## ALZHEIMER'S DISEASE AND DEPOSITS

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Harmful clumps of protein form in the nerve cells of the brain in people with Parkinson's and Alzheimer's disease. Until now, it was believed that immune cells, known as microglia cells, could not absorb these proteins until they had been released from dead nerve cells. However, researchers from the Max Planck Institute for Biology of Ageing have now discovered that microglia can remove harmful proteins directly from the nerve cells. To do so, they use tubular extensions to connect to the nerve cells. Using these tubules, the microglia can not only transport toxic substances, but also supply damaged neurons with new mitochondria and thus support their energy metabolism. Genetic mutations that impair the tubules' ability to function also

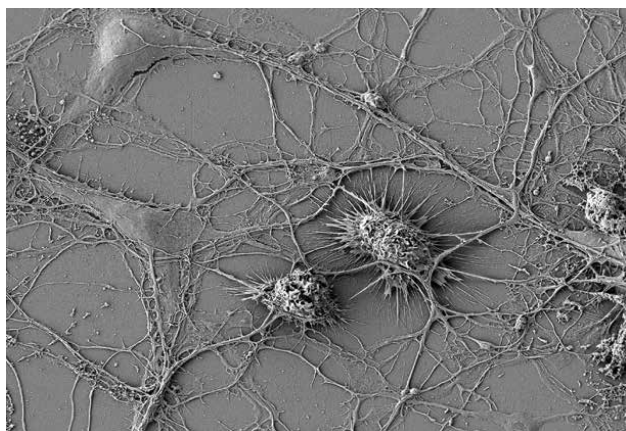
increase a person's risk of becoming ill with Parkinson's or Alzheimer's disease. Problems in tubule formation can, as a result, contribute to the development of neurodegenerative diseases. Researchers at the Max Planck Institute for Multidisciplinary Sciences have also discovered that, in addition to the nerve cells, oligodendrocytes produce beta amyloid proteins, whose deposits play a key role in Alzheimer's disease. Oligodendrocytes wrap around the nerve fibers and, in doing so, increase the nerve cells' transmission speed. The researchers found 30 percent fewer deposits in the brains of mice whose oligodendrocytes were not able to form beta amyloid.

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[www.mpg.de/22338550](http://www.mpg.de/22338550)

## SUPER-JUPITER PHOTOGRAPH

In a rare cosmic snapshot, the James Webb Space Telescope has directly imaged the exoplanet Epsilon Indi B in the triple star system Epsilon Indi. With six times the mass of Jupiter, the exoplanet belongs to the super-Jupiter class. It is the oldest known gas giant and also the coldest, with a surface temperature of approximately 0 °C. It revolves around its home star at a distance similar to the one between Neptune and the Sun. Primarily indirect methods of proof have been able to detect around 6000 exoplanets, but to date it has only been possible to photograph an exoplanet beside its star in about two dozen cases because the star usually outshines the much darker planet. Due to the type of observation concerned, the planets that have been photographed to date are almost exclusively young, hot gas giants that emit infrared light because of their temperature. However, the mature exoplanet Epsilon Indi B, which a team from the Max Planck Institute for Astronomy has now photographed, and its main star, a red dwarf, are about as old as the solar system. The researchers were even able to gain information about the planet's atmosphere from the image. This allows them to learn more about how gas giants form. Additionally, a comparison with our solar system helps clarify whether other systems form similarly to ours or whether our solar system is exceptional in this regard.

[www.mpg.de/22154949](http://www.mpg.de/22154949)



Two immune cells (microglia, in the middle) in the brain are connected to nerve cells (left) via nanotubes.

IMAGE: SCHEIBLICH / HENEKA

## ROBOTIC LEG JUMPS TO NEW HEIGHTS

Researchers at the Max Planck Institute for Intelligent Systems and ETH Zurich have developed a robotic leg driven by electrohydraulic artificial muscles. This system is more energy efficient than traditional electric motors and enables high jumps and fast movements across various surfaces – without complex sensors. The artificial muscles resemble plastic bags that are used to create ice cubes, and they stretch and compress when sub-

jected to electricity. This allows the robotic leg to lift its weight with lightning speed and demonstrate enough elasticity to adjust itself flexibly to different terrains. This technology constitutes considerable progress in soft robotics and opens up new possibilities for adaptive robots in various applications, for example, humanoid robots with an especially efficient and adaptable gait are now conceivable.

[www.mpg.de/23443589](http://www.mpg.de/23443589)



The common noctule primarily lives in the forest and inhabits wide stretches of Europe.

## RAPID HEARTBEAT

Flying is strenuous. That is why bats in particular need to mind their energy consumption. Scholars at the Max Planck Institute of Animal Behavior in Konstanz have now measured the energy requirements of the common noctule in the spring and summer. They attached small heart rate transmitters weighing only 0.8 grams to the bats. Heartbeats can be used to draw conclusions about energy consumption. Since the receivers can register the transmitters' signals within a range of only a few hundred meters, the researchers needed to follow the animals in planes while they flew. The measurements revealed that male noctule bats consume over 40 percent more energy in the summer than they do in the spring. This is primarily due to the

fact that the bats enter into a form of brief hibernation during the day in the spring, which enables them to reduce their heart rate from 900 to 6 beats per minute. In the summer, on the other hand, the males are awake day and night and invest a great deal of energy in sperm production in order to be well-prepared for mating season in the fall. They acquire the energy needed for this purpose by hunting for twice as long in the summer as they do in the spring. They can consume over 30 maybugs and 2500 mosquitoes in a single night during the summer. However, since insect populations are declining, it is becoming increasingly difficult for bats to fulfill their high energy requirements in the summer.

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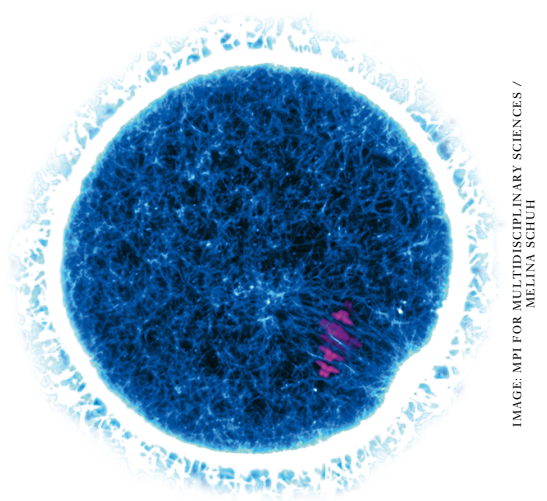


IMAGE: MPI FOR MULTIDISCIPLINARY SCIENCES / MELINA SCHUH

Egg cell from a mouse with chromosomes (magenta) and the cell skeleton protein actin (blue-white).

## PROTEINS FOR A LIFETIME

Of the approximately 1 to 2 million egg cells that a woman is born with, only about 400 mature before menopause. Some of these cells thus become several decades old. Extremely long-lived proteins could play an important role in preserving fertility as long as possible. Researchers at the Max Planck Institute for Multidisciplinary Sciences in Göttingen made this discovery during experiments with mice. While most cell types renew the majority of their proteins within a few days, the researchers say that many proteins in egg cells and other types of cells in the ovaries of female mice remain intact until the end of their lives. Above all, these include proteins that repair DNA or protect cells from clumping molecules. Since mitochondria, the power plant of the cell, originate from the egg cell, they should remain functional at least until an embryo is capable of producing its own. Accordingly, mitochondria also contain especially long-lived proteins. Over time, the quantity of these proteins in the egg cells and ovaries declines. Their gradual disappearance could explain why fertility diminishes over time.

[www.mpg.de/22190551](http://www.mpg.de/22190551)

# ONE TEST FOR MANY DISEASES



PHOTO: THORSTEN NAESER

One sample, many diagnoses: The vial hardly contains more than a drop of blood plasma. An infrared measurement can be used to diagnose various metabolic disorders, among other conditions.

and approximately 5 million people have high blood pressure without knowing it. Since now only one measurement is needed to diagnose various common illnesses – a measurement which only requires a drop of blood and a few minutes – this method makes it possible to perform comprehensive health screening for an entire population. That could help detect the diseases early on and thus reduce the risks associated with them.

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In the future, it might be possible to diagnose some common illnesses more easily and quickly than in the past. In a representative study, a team at the Max Planck Institute of Quantum Optics, LMU Munich, and Helmholtz Munich has demonstrated that machine learning and infrared light measurements of blood plasma can be used to detect various metabolic disorders, such as type 2 diabetes, and high blood pressure. The method can also be used to diagnose prediabetes, which other procedures often overlook. In the past, individual tests have been required to detect each of numerous different diseases. That is one reason why the diseases remain undetected for a long time in many cases. According to the Robert Koch Institute, as a result around 1.3 million people suffer from undetected type 2 diabetes,

# STARS REVEAL A BLACK HOLE

When stars revolve around an invisible center, like planets around a star, this indicates the presence of a black hole with considerable mass. Under the leadership of the Max Planck Institute for Astronomy, astronomers have discovered such a black hole with 8200 solar masses in the star cluster Omega Centauri. This star cluster is located in the Milky Way and is 17,000 light years away from Earth. At one time, the star cluster was its own galaxy, but it was incorporated by the Milky Way billions of years ago. However, its galactic nucleus remained largely unchanged. The black hole in Omega Centauri is more massive than the black holes that remain after the explosion of a heavy star and lighter than the other known extreme: supermassive gravity traps of millions to billions of solar masses in the centers of full-fledged galaxies. Since such especially massive specimens can form when smaller black holes converge, scientists had long suspected that there must also be black holes with medium-sized masses. However, they had been unable to reliably prove the existence of such black holes until now.

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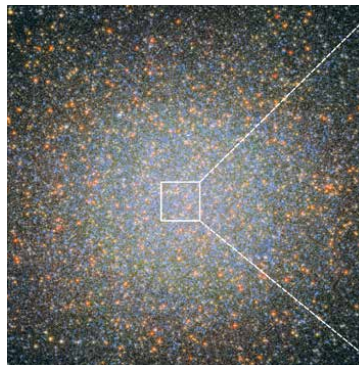
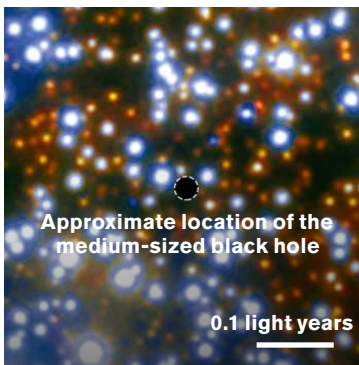
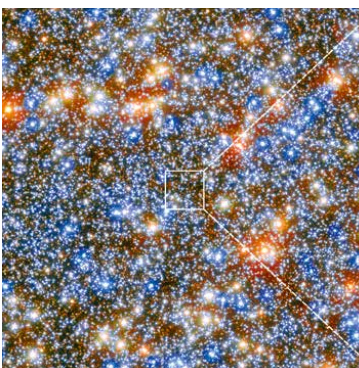


IMAGE: ESA/HUBBLE & NASA, M. HABERLE (MPIA)



Zooming in on individual stars at the center of the globular cluster Omega Centauri at three levels. The stars are revolving around a black hole in the center (bottom) at up to 400,000 km/h.

PHOTO: GABRIEL BARATHIEU



The fragrance ambroxide, which is contained in many perfumes, was obtained from sperm whales for a long time. A team from Mülheim has now found a simpler alternative to the common present-day synthetic method.

## SWELL SMELLS!

People have been using ambroxide as a fragrance since antiquity. Back then, they derived it from ambergris, a waxy substance obtained from the digestive tracts of sperm whales. Today more than 30 metric tons of it are created every year from a substance in muscatel sage, which grows from the Mediterranean to Central Asia. However, this process of manufacturing ambroxide requires several reaction steps. What is more, the availability of muscatel sage fluctuates. Now a team at the Max-Planck-Institut für Kohlenforschung in Mülheim has cooperated with the chemical company BASF and managed to synthesize the substance from nerolidol in one step. Nerolidol is present in many plants, such as ginger and jasmine. The combination of catalyst and solvent is decisive for the simple synthesis. Both of these substances can be recovered after the reaction, which is an important advantage in industrial applications. [www.kofo.mpg.de/988988](http://www.kofo.mpg.de/988988)

Modern technology makes it possible to determine information about place of residence and nutrition across centuries.



PHOTO: PATXI PÉREZ RAMALLO

## ARCHAEOLOGICAL RIDDLE SOLVED

Rumor has it that Bishop Teodomiro from Iria Flavia in northeastern Spain discovered the grave of the apostle Jacob on a hill in Galicia in the ninth century. He reported his discovery to King Alfonso of Asturias, who had a chapel built on top of the site and founded one of the most important places of pilgrimage for Christians: Santiago de Compostela. Whether the bishop lies buried in the cathedral was a matter of dispute for some

time, even though an inscription on a gravestone in the church indicates this is the case. In the 1950s, researchers found remains that were attributed first to a man, then to a woman. Now an international team headed by Patxi Pérez Ramallo, who previously worked at the Max Planck Institute of Geoanthropology, has investigated the human remains again using bone, isotope, radiocarbon, and DNA analyses. The analyses of the

bones revealed that they were the remains of a man who was probably over 45 years old. Owing to the age and diet of the deceased revealed by the isotope analysis and their genetic profile, the researchers assume that the remains most likely belong to Bishop Teodomiro. If that is the case, he would be the oldest identified historic figure in Spain and one of the oldest in Europe.

[www.mpg.de/22500491](http://www.mpg.de/22500491)