Violence Is a Guy Thing

Chimpanzee males are more likely to engage in conflict

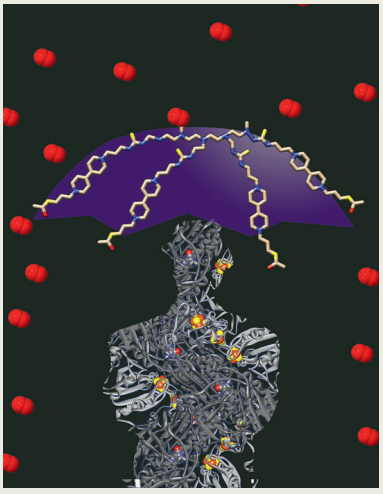
Killing conspecifics doesn't fit the placid image many people have of chimpanzees. But are these acts of violence perhaps merely the consequence of humans increasingly changing the animals' habitat and disturbing their social life? An international team of researchers that also includes scientists from the Max Planck Institute for Evolutionary Anthropology in Leipzig has now evaluated data from the past 50 years on this issue. According to their findings, humans don't influence the frequency of deadly violence. The killing of conspecifics is much more a result of adaptation to their natural habitat conditions. For instance, killing occurs more frequently among chimpanzees when the population density is high and large numbers of males live together. The animals eliminate rivals in this way. Males usually kill other non-kin males in smaller groups – this keeps the risk to themselves low. Bonobos, in contrast, which are closely related to chimpanzees, are extremely peaceful: researchers have observed just one killing among them in 50 years. (Nature, September 18, 2014)

Scene from the Budongo Forest in Uganda: Two screaming male chimpanzees take flight from an assailant.

A Protective Umbrella for Fuel Cells

A redox hydrogel protects biocatalysts that generate electricity from hydrogen against oxygen

Fuel cells could soon be able to generate electricity more cost-efficiently than previously. Scientists at Ruhr-Universität Bochum and the Max Planck Institute for Chemical Energy Conversion in Mülheim an der Ruhr have found a way to convert hydrogen contained in them into water, with enzymes acting as valuable biocatalysts. Currently, scientists and engineers use metal-based catalysts for this process. While these are efficient and stable, they are only available in small quantities and are therefore expensive. The likewise highly efficient enzymes, or hydrogenases, to be precise, are more readily available and economical, but are quickly destroyed in the conditions that exist in a fuel cell. The research team from Bochum and Mülheim has now developed a redox hydrogel consisting of a polymer that catches the destructive oxygen before it destroys the hydrogenases. (Nature Chemistry, August 3, 2014)



The redox hydrogel developed by researchers in Bochum and Mülheim an der Ruhr acts as a protective shield for a hydrogenase.

Photo and graphic: Liran Samuni (top), Ruhr-Universität Bochum (bottom)

The Way to the Top

Thanks to their asymmetrical form, some slipper-shaped microorganisms can swim to the surface of water on their own

Self-organizing control system: Their asymmetric pear form may explain why slipper-shaped microorganisms can swim upward.

Up toward the sun and food supplies – how slipper-shaped microorganisms find their way safely to the water's surface has been explained by an international team headed by Clemens Bechinger from the Max Planck Institute for Intelligent Systems and the University of Stuttgart using an extremely simple trick of physics. The shape of the unicellular organisms looks like an asymmetric pear. The researchers emulated this with tiny, L-shaped swimming bodies. They gave the microswimmers thrust by heating up their underside so that the surrounding fluid warms up, generating a thermic propulsive force. Two forces then impact on an L-shaped particle while swimming: gravity tips the "L" toward the long limb. The frictional force pushes it in the direction of the short limb. At a suitable speed, the effects of the two forces cancel one another out and propel the swimming body upward. This method could also soon be used to enable the self-organized steering of swimming microrobots. (Nature Communications, September 19, 2014)

Computer Diagnostics

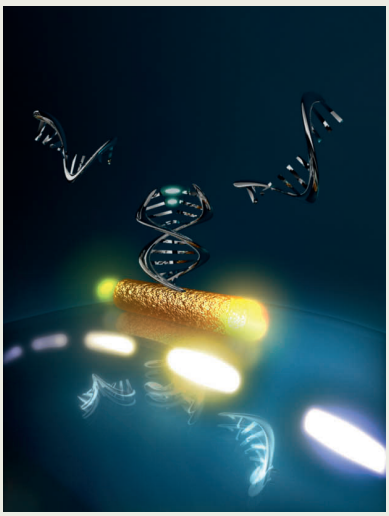
PhenIX identifies genetic diseases

People with genetic diseases often have to embark upon an odyssey from one doctor to the next: fewer than half of all patients suspected of having a genetic disease actually receive a satisfactory diagnosis. Scientists from the Charité in Berlin and the Max Planck Institute for Molecular Genetics have now developed the PhenIX software, which reliably identifies genetic diseases. In contrast to previous tests, the program combines the analysis of genetic irregularities with the patient's clinical presentation. In the first step, a specific search is conducted by the patient's physician for around 3,000 genes known to cause diseases. In the second step, a database is searched for the patient's symptoms. From the relevant symptoms, PhenIX determines an overlap with the most likely diseases responsible. In a pilot study on patients for whom no diagnosis could be made despite years of investigation, the procedure identified the exact cause of illness in over 25 percent of the cases. PhenIX is already available to hospitals that have the necessary technical equipment. (Science Translational Medicine, September 3, 2014)

Highly Sensitive Biosensors

Molecule detectors enable improvement in medical diagnostics

It may soon be possible to diagnose some illnesses more easily and at an earlier stage, thus enabling more effective treatment. Two research groups at the Max Planck Institute for the Science of Light in Erlangen recently unveiled two biosensors that can be deployed to detect individual, unlabeled biomolecules. A team headed by Vahid Sandoghdar has developed an optical detector that makes the scattered light, that is, the shadow, of individual proteins and other biomolecules visible. Using an optical microsphere and gold nanoparticles, researchers led by Frank Vollmer have amplified the interaction of light with DNA to the extent that they can now track interactions between individual DNA molecule segments. Detectors for single biomolecules are of interest in clinical diagnostics, research into disease mechanisms, and environmental analyses. (Nature Communications, July 29, 2014 & Nature Nanotechnology, August 31, 2014)



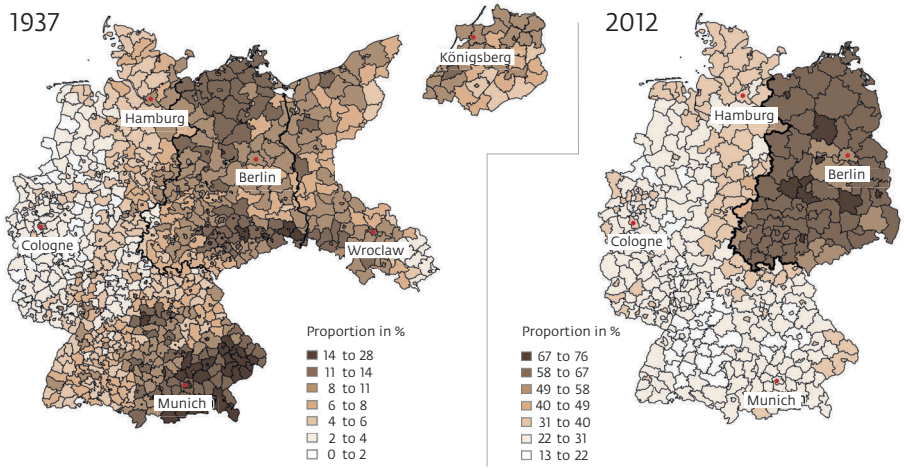
A glass microsphere and gold nanowire mounted on it amplify light so strongly that it is possible to detect individual DNA fragments.

Photos: iStockphoto/Nancy Nehring (top), Joseph Alexander/Rockefeller University (bottom)

Births Out of Wedlock in the East

Non-marital births are more common in eastern Germany than in the West

Even 25 years after the fall of the Berlin Wall, starting a family is still a fundamentally different process in eastern and western Germany. While 59 percent of births in the new federal states are non-marital, the proportion in the old western states is half as high. This disparity was, in fact, increased by the division of Germany, but it was not caused by it. As far back as the late 19th century, the proportion of non-marital births in large parts of western Germany stood at between 2 and 8 percent, while it is 12 percent in modern-day eastern Germany. Whereas agriculture in the East was characterized by dispersed farms and large numbers of seasonal workers during this period, western Germany was dominated by smaller, family-run farms. Curbing non-marital births was therefore seen as a matter of great concern in the West to prevent inheritance disputes, for example. As long ago as the 19th century, large proportions of the population in eastern Germany rejected religious rituals. Given the long history of these differences, it is unlikely that they will disappear over the coming decades. Rather than the East, it is the West in Germany that emerges as the exception here, as a low percentage of non-marital births – as found in the old federal states – is increasingly becoming the exception in the European context. (Population, Space and Place 2014)



As early as 1937, the proportion of non-marital births, at an average of 10.2 percent, was considerably higher east of the subsequent German-German border than west of it (6.3 percent). In 2012, it was more than twice as high in the East (58.8 percent) as in the West (28.4 percent).

Colorful Cuttlefish

Max Planck researchers study the dynamic "passing clouds" in *Metasepia tullbergi*

Cuttlefish are masters of color display – their pigment cells allow them to adapt their skin color to their immediate environment and produce propagating color waves along their bodies. What these "passing clouds" signify during mating and hunting hasn't yet been determined. Using high-speed video, researchers at the Max Planck Institute for Brain Research in Frankfurt observed the dark bands that pass over the body surface of the cuttlefish *Metasepia tullbergi*. The researchers identified eight regions in which color waves pass over the body in different directions without crossing the boundaries into neighboring ones. *Metasepia* are able to combine these areas in different ways and thus create different displays of color. Active regions are also perfectly synchronized, which means the bands reach the boundary of their region at exactly the same time. The researchers want to combine these results with findings from neurobiological investigations, which are now being planned. Their objective is to decipher the connectivity of the nerve cells responsible for the color waves in cuttlefish. (Current Biology, August 4, 2014)

http://tinyurl.com/otber98

The *Metasepia tullbergi* fully deserves its name: Paintpot cuttlefish.

Graphic: MPIDR Population History Collection/BKG 2012; photo: Stephan Junek

Radio Burst from the Charioteer

Astronomers observe mysterious flash from far beyond our galaxy

Fast radio bursts from outer space last just a few milliseconds. Researchers at the Parkes Observatory in Australia recorded such events for the first time several years ago, but no other telescope has confirmed the phenomenon. Had the Australians been picking up signals originating from Earth? Using the Arecibo radio antenna in Puerto Rico, however, astronomers have discovered another radio burst that lasted just a few seconds and came from the direction of the Charioteer constellation. This observation by a group led by Laura Spitler from the Max Planck Institute for Radio Astronomy in Bonn provides new evidence of the mysterious pulses that appear to come from deep in outer space. Astronomers are still speculating about their source: possibilities include evaporating black holes, merging neutron stars or flares from magnetars – neuron stars with extremely powerful magnetic fields. (Astrophysical Journal, July 10, 2014)

Encircled radio source: This optical sky image shows the area in the direction of the Charioteer constellation where the fast radio burst FRB 121102 was detected. The position of the burst, between the old supernova remnant S147 and the star formation region IC410, is marked with a green circle.

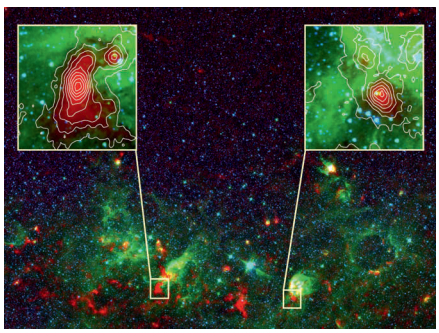
Algae Provide Gas

Algae could soon become a rich source of regenerative fuel. The microorganisms naturally produce hydrogen with sunlight as a source of energy. But they would have to become 10 to 100 times more efficient to feasibly generate energy for widespread application. Scientists from the Max Planck Institutes for Chemical Energy Conversion and Kohlenforschung (coal research) in Mülheim and from the Ruhr-Universität Bochum have contributed toward this goal with a recent project. Through genetic engineering, they increased the efficiency of the enzymes that aid the algae in producing hydrogen by a factor of five. In their experiments, the researchers isolated the biocatalysts in test tubes to obtain fuel. However, it is also possible to breed algae with the modified enzymes in water tanks and to extract the gas. (Energy & Environmental Science, July 29, 2014)

Birth of a Star in Quick Time

Scientists observe the nurseries of massive stars in our galaxy

Massive stars are born in the coldest parts of the Milky Way – deep inside clouds of dust that are so dense that they almost completely swallow up the radiation in the visible and infrared ranges. To follow the earliest stages of the birth, astronomers had to observe longer wavelengths. They thus remapped the plane of our galaxy at a wavelength of 0.87 millimeters. Using the 12-meter APEX telescope, they detected various clumps of gas and dust. Based on their distribution, a team headed by Timea Csengeri from the Max Planck Institute for Radio Astronomy in Bonn estimated the time scale for the formation of stars. The researchers discovered that the process seems to proceed very rapidly, taking only 75,000 years on average. Not only is the lifetime of massive stars around 1,000 times shorter than less massive ones, but their birth phase also proceeds much more quickly. (Astronomy & Astrophysics, May 12, 2014)



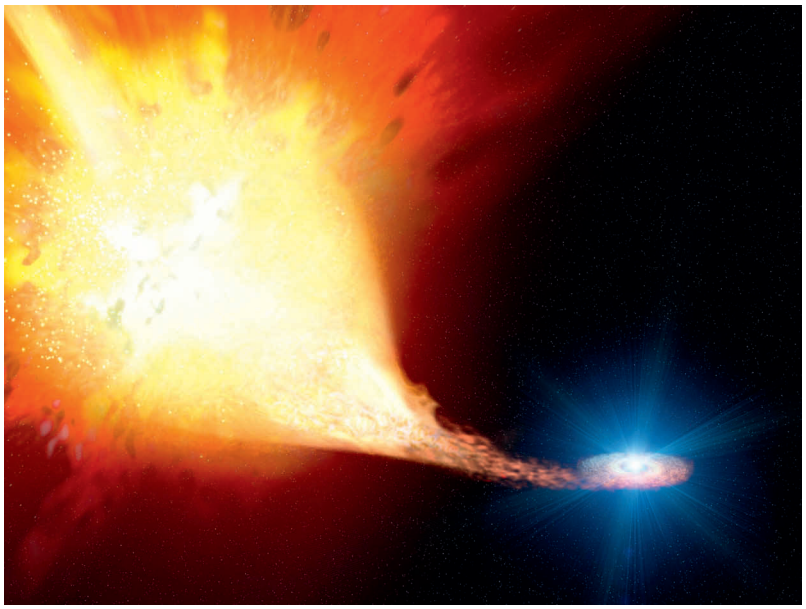
Map of the galactic landscape: The ATLASGAL survey (extract) covers approximately two-thirds of the whole region of the Milky Way within 50,000 light-years of the galactic center. The enlarged sections show a cold clump of gas and dust (left) and a young massive star (right).

Photos: Rogelio Bernal Andreo (DeepSkyColors.com) (top), ATLASGAL team (bottom)

Looking into the Heart of a Catastrophe

Researchers observe gamma-ray lines from a type Ia supernova

In type Ia supernovas, a white dwarf star collects material from its companion until it explodes, releasing large amounts of radiation. However, astronomers hadn't been able to provide evidence of gamma rays directly from such a catastrophe. This has now been achieved for the first time by researchers from the Max Planck Institutes for Astrophysics (Eugene Churazov) and for Extraterrestrial Physics (Roland Diehl) in Garching using SN 2014J, which flared up in the M 82 spiral galaxy this year. One of the studies also tested the conventional theories that the white dwarf must exceed a critical mass limit before the explosion. However, the observations of the group led by Diehl suggest that the flow of matter from a companion star ignited the white dwarf "from the outside" without reaching the critical mass limit. (Science Express, July 31, 2014 and Nature, August 28, 2014)



Before the big explosion: The artist's impression shows a binary star system where mass is transferred from a companion to a white dwarf. As soon as sufficient matter has collected on the surface of the dwarf star, this can trigger a nuclear explosion, which in turn ignites the catastrophic nuclear burning and destroys the white dwarf – a type Ia supernova flares up.

New Species without Sex

Grafted plants can transfer their entire genetic material to a partner

In horticulture and viticulture, growers have long made use of the fact that even plants that can't be crossed can be grafted together at their contact zones. By grafting elite grape cultivars onto pest-resistant rootstocks, for example, they thwart pests living in the soil. Varieties can transfer their entire genetic material to a partner at the contact zones. Researchers from the Max Planck Institute of Molecular Plant Physiology in Golm grafted the tobacco plant *Nicotiana glauca* onto *Nicotiana tabacum*, which can't be crossed with it, and then bred new plants from the contact tissue. The daughter plants not only received each of the two antibiotic-resistant genes that the researchers had previously introduced into the genetic material of the two parents, but they also possessed exactly the same number of chromosomes as the two parents. The new plants and their offspring can reproduce without any problem – the researchers succeeded in creating a new tobacco plant species. Breeders can use this method to create new plant varieties with higher yields or more robust growth.

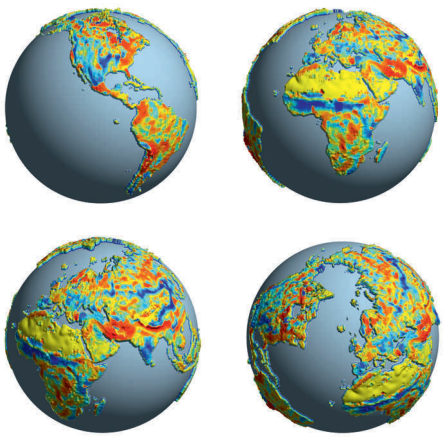
Natural grafting between an oak (left) and a beech (right). The complete genetic material can be exchanged between the graft partners at contact zones like these. This can result in the emergence of new plant species.

Photos: ESA/Justyn R. Maund (University of Cambridge) (top), MPI of Molecular Plant Physiology (bottom)

Carbon, Stay Awhile!

Precipitation is an important climate factor in the carbon cycle

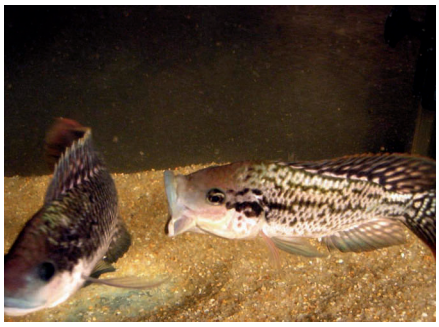
Plants play a crucial role in the global climate system, removing the greenhouse gas carbon dioxide from the air and converting it into carbohydrates. Carbon can be stored for several years or even decades before it is converted back into CO_2 and returned to the atmosphere. The average global carbon turnover time in land ecosystems is 23 years, as an international research team headed by Nuno Carvalhais and Markus Reichstein from the Max Planck Institute for Biogeochemistry in Jena has discovered. In the humid and warm tropics, it takes just 15 years before a carbon atom is released back into the atmosphere. However, at cold, higher latitudes, such as the Siberian tundra, it takes 255 years. The researchers also established that land ecosystems store approximately 2,800 billion tons of carbon, which is 400 billion tons more than previously assumed. A surprising discovery: precipitation plays just as important a role as temperature in determining the turnover time. (Nature, September 25, 2014)



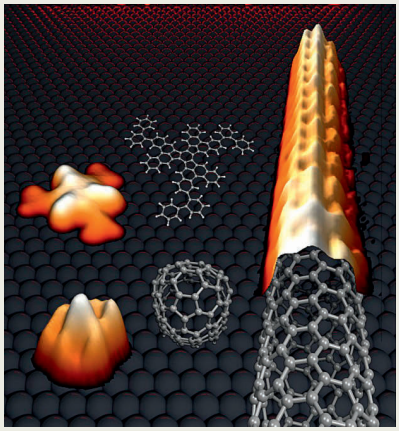
The world map arches upward relief-like where carbon is retained for relatively long periods in land ecosystems. The areas where the turnover time depends heavily on temperature appear in red. The greater the influence of precipitation, the deeper an area's shade of blue.

Ready for Mating at the Right Time

Fish aren't generally considered particularly communicative – unjustly so, as they possess several communications channels. One of them is chemical signals emitted into the water. Scientists from the Max Planck Institute for Chemical Ecology in Jena have discovered a steroid in the urine of male tilapia fish. The males send the signal to attract mating partners. The steroid also boosts the hormone production of the females and accelerates oocyte maturation. The males can then fertilize the released eggs. The discovery may help make the aquaculture of the tilapias, a popular food fish, more efficient: breeders can use pheromones to increase female fertility. (Current Biology, published online ahead of print on August 21, 2014)



Rival male Mozambique tilapias (*Oreochromis mossambicus*) in an aquarium: The dominant male (right) defends his nest, a hollow in the sand made with his mouth, which he provides for the attracted female to spawn. At the same time, the dominant male attempts to prevent mating with other males.



Even nanotubes start out small: An end cap (bottom left) is produced from planar carbon, and forms the seed for the growth of a carbon nanotube (right). The structural models and the images taken with a scanning tunneling microscope are shown.

Custom-Made Nanotubes

It will soon be possible to specifically equip carbon nanotubes with the properties they require for electronic applications. Researchers at Empa in Dübendorf, Switzerland, and from the Max Planck Institute for Solid State Research in Stuttgart have succeeded for the first time in growing single-walled carbon nanotubes (CNTs) with a single, pre-specified structure. All of the nanotubes therefore have identical electronic properties. Other production methods result in a mixture of single-walled and double-walled tubes of different lengths and structures. To prevent this from occurring, the team produced the nanotubes from custom-made organic precursor molecules based on an idea that originated from the Stuttgart-based Max Planck researchers. The tubes grow on a platinum surface in a self-organized process. In the future, such CNTs could, for instance, be used in ultrasensitive light detectors and miniscule transistors. (Nature, August 7, 2014)

Photos: Nature 2014/N. Carvalhais (left), Empa/Juan-Ramon Sanchez (right), Olinda G. Almeida/Peter C. Hubbard, Centre of Marine Sciences (CCMAR), University of the Algarve, Faro, Portugal (bottom)