

# Depressed Fish

Zebrafish could help in the search for new drugs

Fish are generally not very good at expressing their feelings, so they aren't an obvious research object for psychiatric disorders. This may be about to change, as research suggests

that the zebrafish could be a suitable model organism for the development of new psychiatric drugs. Scientists from the Max Planck Institute of Neurobiology in Martinsried, near Munich, and the University of California have observed that zebrafish suffering from chronic stress show signs of depression. Fish that lack the receptor for cortisol as a result of a genetic mutation can't regulate the stress hormone, they explain. They are then unable to adapt to new situations. Left alone in a new aquarium, the chronically stressed fish stayed quite still at the bottom of the tank. Their behavior returned to normal when an antidepressant was added to the water. The findings suggest that chronic stress isn't just a side effect, but may be a trigger for depression and anxiety. (MOLECULAR PSYCHIATRY, June 2013)



The zebrafish (*Danio rerio*) is a popular model organism for many questions in the field of genetics and developmental biology. In the future, this may also extend to psychiatric disorders.

# Nanocomponents Made to Spec

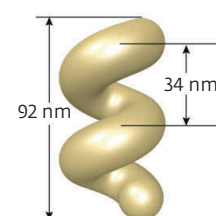
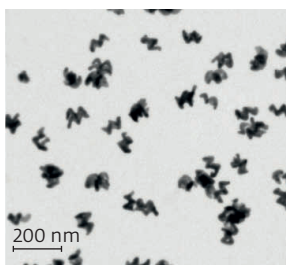
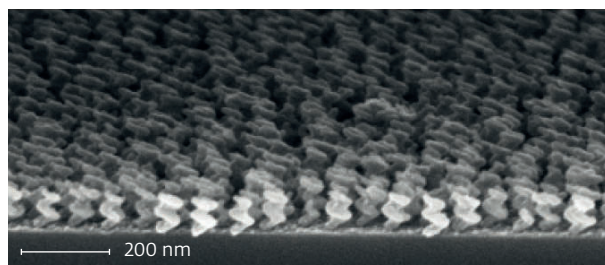
A precise and efficient method makes it possible to manufacture nanostructures with diverse shapes and complex material composition

Nanomachines are a step closer to reality and researchers at the Max Planck Institute for Intelligent Systems in Stuttgart are helping them along the way. They have developed a method for combining materials with very different chemical and physical proper-

ties into diverse nanostructures such as rods, hooks, screws and zigzag structures. By depositing the vaporized material onto a cooled, rotatable disk, the team working with Peer Fischer has even grown antennas for visible light. They had previously provided anchor

points on the surface of the disk in the form of countless tiny gold dots. This process allows nanocomponents to be manufactured with greater precision than previous methods, and at the same time, in batches of billions. (NATURE MATERIALS, online, June 23, 2013)

Nanohelices as light antennas: The tiny nanostructures can be produced very precisely and in large numbers using a new method. The color of light they absorb can be controlled by their dimensions and composition. They are also suited to filtering circularly polarized light.



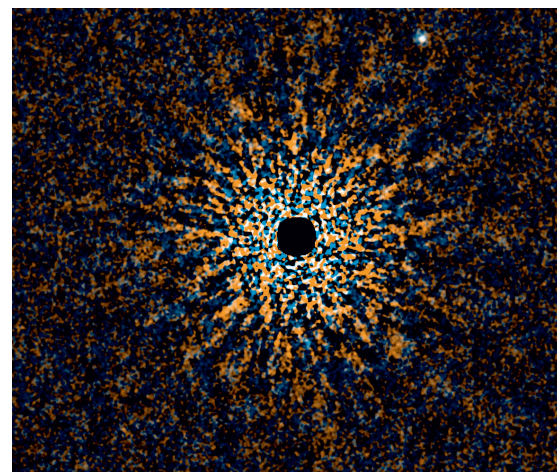
# Jupiter's Double

Subaru telescope snaps image of exoplanet GJ 504b, which orbits a sun-like star

Using the Subaru telescope in Hawaii, a team including scientists from the Max Planck Institute for Astronomy has taken the portrait of a Jupiter-like planet that orbits a sun-like star of spectral type G. At a distance of 60 light-years from Earth, GJ 504b is the coldest and probably also the lightest exoplanet yet imaged. It is extremely difficult to obtain direct images, but they yield important information about

physical and chemical state variables such as atmosphere and temperature. Estimates of the planet's mass are based on models of the rate of cooling since its formation; most researchers put it in the region of three Jupiter masses. The distance of this exoplanet from its star is 44 times the mean distance between the Earth and our Sun, that is, about six billion kilometers. (ASTROPHYSICAL JOURNAL 774, 11, 2013)

Portrait of a second Jupiter: The near-infrared false color image of GJ 504b, an exoplanet orbiting sun-like star GJ 504, was taken with the Subaru telescope. Light from the star (in the middle) was suppressed mechanically and through systematic image processing.



## Experienced Minds Are More Reliable

Cognitive performance in older people is more consistent than in younger adults

In the working environment, older adults encounter the persistent preconception that they may have more experience, but they are less productive than their younger peers. This is only half true: more experienced, yes, but they may not be any less productive. Scientists from the Max Planck Institute have found that the cognitive performance of older adults varies less from day to day than that of younger adults. Working with a group of more than 100 adults aged 20 to 31 and a similarly sized group aged 65 to 80, researchers set them 9 tasks each on 100 days. The older group didn't fare as well as the younger ones in terms of average performance, but their results were less dependent on their daily condition. It appears that, through experience, older adults learn strategies for completing tasks properly, and they are consistently motivated and more balanced and stable. The indication that older people's cognitive performance is more consistent fits with the findings of researchers at the Max Planck Institute for Social Law and Social Policy. They have found that older adults are more reliable and, on balance, more productive, and they are also less likely to make serious and costly mistakes. (PSYCHOLOGICAL SCIENCE, July 10, 2013)

Photos: NAOI (top), fotolia (bottom)

## More Brain through Gameplay

The influence of computer games on children and young people is contested in terms of both positive and negative impact. A study by researchers from the Max Planck Institute for Human Development and Charité Berlin now suggests that games increase spatial awareness. Using magnetic resonance imaging, the scientists found that the longer the subjects had spent playing video games during their life, the larger the entorhinal cortex was. The entorhinal cortex plays an important role in spatial awareness. Logic and puzzle-type games such as Tetris and Minesweeper had the biggest impact on this part of the brain, along with jump-and-run games like Super Mario, while the effect on players of action-based role-play games was less pronounced. These results suggest that enthusiastic gamers may be better able to get their bearings in their physical environment. (MOLECULAR PSYCHIATRY, online, August 20, 2013)





# Climate Change Picks Up Speed

Global warming may be reinforced by extreme meteorological events



One extreme engenders another: Long periods of drought, such as that shown here in Greece, result in the ecosystem absorbing considerably less carbon than under moderate climate conditions.

with Markus Reichstein, Director at the Max Planck Institute for Biogeochemistry, using satellite images and surface measurements from some 500 stations around the world. The carbon dioxide remaining in the atmosphere as a result of extreme weather events is equivalent to approximately one third of global CO<sub>2</sub> emissions per year. Terrestrial ecosystems absorb about the same amount each year, storing it as biomass in the longer term. Without extreme weather events, they could remove twice the volume of greenhouse gases from the atmosphere, but if extreme events increase, forests and other ecosystems will be less able to help with climate protection. (NATURE, August 15, 2013)

Extreme weather events could become more frequent as a result of climate change, and may further reinforce it. Lengthy droughts, heat waves, heavy rains and violent storms apparently result in terrestrial ecosystems such as

forests, grasslands and agricultural land absorbing about eleven billion tons less carbon dioxide through photosynthesis each year than areas not exposed to these extreme events. This is the finding of an international team working

## A Magnetar at the Heart of the Milky Way

Radio astronomers use pulsar with strong magnetic field to investigate supermassive black hole

Astronomers have detected a magnetar at the center of our Milky Way. Emitting extremely precise radio pulses, much like a cosmic lighthouse, this extremely compact neutron star (pulsar) mea-



suring just 20 kilometers in diameter possesses an extraordinarily strong magnetic field. Its presence enables researchers to investigate the direct vicinity of the black hole at the heart of the galaxy. Using the magnetar as a magnetic probe, a team headed by the Max Planck Institute for Radio Astronomy in Bonn has made preliminary findings that indicate the existence of a strong magnetic field at the center of the Milky Way. The magnetic field is generated by ionized matter that is swallowed up by the black hole. This explains the emission of radiation ranging from radio waves to X-rays that has long been associated with the immediate vicinity of the black hole. Superstrong magnetic fields directly at the black hole may also explain why it absorbs comparatively little matter, giving the impression that it is on a diet, unlike the black holes observed in other galaxies. (NATURE, August 14, 2013)

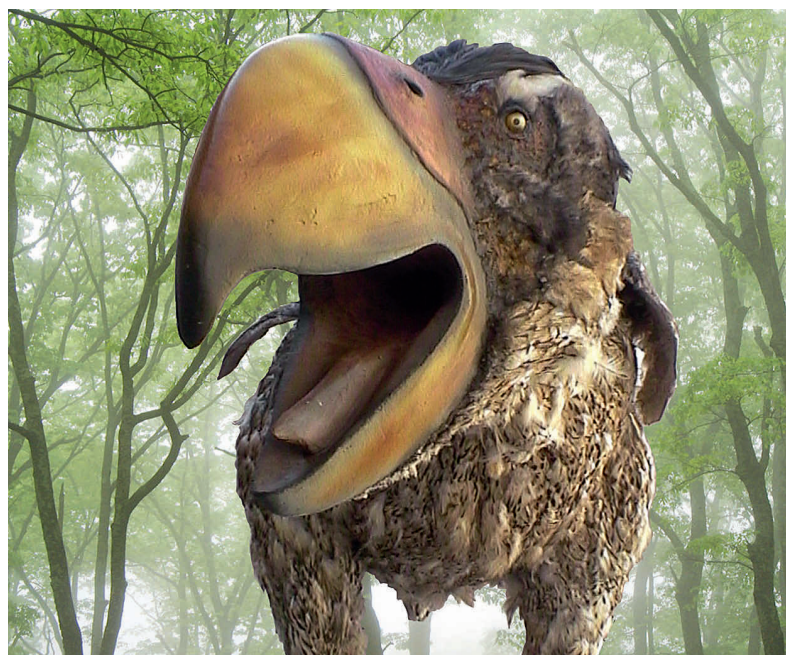
At the center of the galaxy: This artist's impression shows the magnetar PSR J1745-2900, a pulsar with an extremely strong magnetic field. It is located in the direct vicinity of a supermassive black hole with approximately 4 million times the mass of our Sun.

# Harmless Terror Bird

The prehistoric bird *Gastornis* was probably not a bird of prey but an herbivore

It seems that the prehistoric bird *Gastornis* has been wrongly accused of being a terrifying predator. For decades, paleontologists speculated that it used its huge beak to snap its prey's neck, and gave it the moniker "terror bird". Now it seems it was actually a vegetarian. This is the conclusion reached by a German research team including Stephen Galer of the Max Planck Institute for Chemistry in Mainz, based on analysis of the calcium isotope composition of fossilized *Gastornis* bones. Isotopes are forms of an element that have different weights. The relative amount of "light" and "heavy" isotopes changes as calcium passes along the food chain, and this can be used to differentiate between herbivores and carnivores. And the *Gastornis*, which lived more than 40 million years ago, apparently belonged to the former. (GOLDSCHMIDT-KONFERENZ, August 25–30, 2013)

Despite its fearsome beak and enormous size, it seems *Gastornis* wasn't a prehistoric bird of prey but an herbivore. Using modern computer technology, a life-size model of the bird from the Jura Museum Eichstätt has here been transferred to a more plausible natural environment.



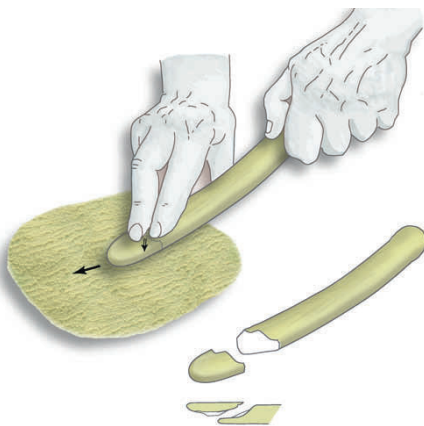
# Prehistoric Softeners

Neanderthals made tools similar to those still used by leather workers today

Without clothes, Central Europe is an inhospitable place, and this was certainly the case throughout the last Ice Age. It's not surprising, then, that even early humans developed techniques for producing clothes from animal hides. They did this using tools that

were very similar to the lissoirs still used by modern-day leather workers to make the material softer, smoother and more water-resistant. Scientists from the Max Planck Institute for Evolutionary Anthropology in Leipzig and the University of Leiden in the Neth-

erlands discovered this type of Neanderthal bone tool at their respective excavations in southwest France. The prehistoric lissoirs, fashioned from the ribs of deer, are approximately 50,000 years old, predating the first evidence of modern humans in Western Europe. This is the first indication that modern humans acquired cultural achievements from Neanderthals, and not only the other way around. However, it isn't yet possible to exclude the possibility that modern humans entered Europe and influenced Neanderthal behavior earlier than we can currently demonstrate. (PNAS, August 12, 2013)



Four views of a Neanderthal lissoir fragment (left). The natural flexibility of the ribs helps keep a constant pressure against the hide without tearing it (right). When the tool breaks, it produces small fragments like those recently found.



# A Quick Test for the Black Death

A sugar-based detection method enables easy and accurate identification of the *Yersinia pestis* bacterium



Diagnosing the presence of *Yersinia pestis*, the cause of the plague, may soon be easier than ever before. Scientists working with Peter Seeberger, Director at the Max Planck Institute of Colloids and Interfaces in Potsdam-Golm, developed a simple, inexpensive and reliable test for detecting the bacterium. The researchers first identified and synthesized an oligosaccharide (complex sugar) found on the bacterial surface, before combining it with a protein to heighten its immunological effect. The resulting glycoprotein can locate the pathogen in two ways, the first being to act as an antigen and detect *Yersinia pestis* in the blood of infected patients. However, the Potsdam-based scientists also used it to generate antibodies that can detect the plague pathogen directly in infected tissue. (ANGEWANDTE CHEMIE INTERNATIONAL EDITION, online, July 10, 2013)

Tracking the "Black Death": Chakkumkal Anish, head of a group at the Max Planck Institute of Colloids and Interfaces, inspects a carrier that can detect the plague pathogen *Yersinia pestis*.

## No Silver Bullet for Voter Satisfaction

Referendums are regarded as an effective way to counteract disenchantment with politics, but it isn't necessarily true that they increase the level of satisfaction with political decisions, according to the findings of an international team working with researchers at the Max Planck Institute for Research on Collective Goods. Shortly before regional elections in the German state of Rhineland-Palatinate, the scientists interviewed 615 citizens between 18 and 70 years of

age. Taking the themes of nuclear phase-out, centralized school-leaving examinations and Islamic religious instruction in public schools, they presented different scenarios in relation to how positive or negative decisions had been reached. These included a form of direct democracy such as a referendum, an expert committee, a parliament dominated by a particular political party, and a cross-party parliamentary majority. According to the study, respon-



dents were more ready to accept referendum results over other scenarios only in the case of issues that were important to them. Perhaps there is no silver bullet for voter satisfaction after all. (PREPRINTS OF THE MPI FOR RESEARCH ON COLLECTIVE GOODS, Bonn 2013/10)

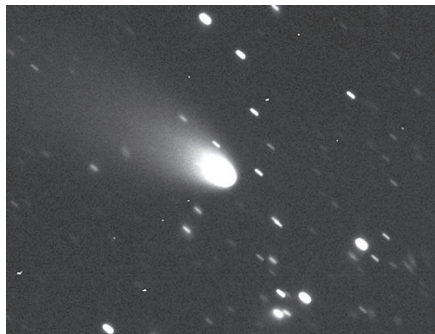
## Memory in the Cerebral Cortex

The hippocampus region of the brain has long been considered a center for the long-term storage of memory. Now, however, according to scientists at the Max Planck Institute for Medical Research in Heidelberg and the University of Seville, neurobiology textbooks will have to be rewritten, since their findings show that memory is actually stored in the cerebral cortex. The scientists studied the learning behavior of genetically modified mice in which NMDA recep-

tors are turned off only in the motor cortex. Without the NMDA receptors in the primary motor cortex, the genetically modified mice can't remember the connection between a sound and an electrical stimulus. This is consistent with the findings of another team at the Max Planck Institute in Heidelberg, that mice without NMDA receptors in the hippocampus can still learn and store spatial associations. (NATURE COMMUNICATIONS, August 27, 2013)

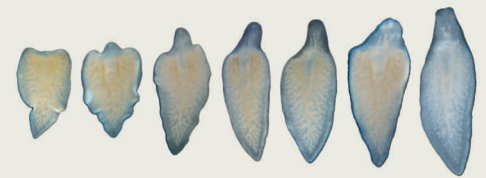
# An Early Start for the Rosetta Comet

Celestial bodies don't always respect astronomers' schedules. On its way toward the Sun, comet Churyumov-Gerasimenko will begin to give off gas and dust earlier than previously expected. *Rosetta*, a space probe of the European Space Agency (ESA), is due to rendezvous with the comet next year and deposit a lander on its surface in the autumn of 2014, but the comet's activity should be measurable from Earth by



March 2014. This is one of the findings of a team of researchers under the lead of the Max Planck Institute for Solar System Research in Katlenburg-Lindau. The scientists analyzed observational data that ground-based telescopes recorded during the comet's last three orbits around the Sun. The analyses haven't yet given a very clear picture of the comet, since it was far from the Sun and barely visible against the bright background of the center of the Milky Way. The breakthrough came with a process developed for detecting exoplanets. Using this method, consecutive images were subtracted from each other, making the starry background disappear and Churyumov-Gerasimenko stand out more clearly. (ASTRONOMY & ASTROPHYSICS, August 20, 2013)

Comet in focus: This 2008 image shows Churyumov-Gerasimenko at a distance of 284.2 million kilometers from the Sun.



After blocking just one signaling pathway, researchers found that the flatworm *Dendrocoelum lacteum* could grow a completely new head.

## Heading for Regeneration

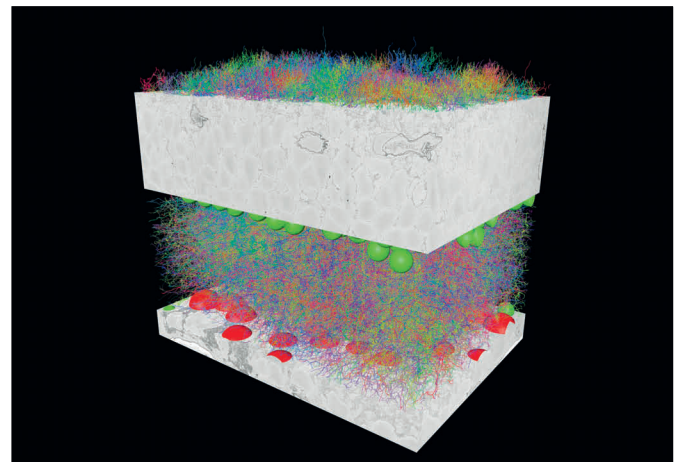
Flatworms like *Schmidtea mediterranea* just won't die. Cut one into 200 pieces, and each and every piece will regenerate into a new worm. The closely related *Dendrocoelum lacteum*, on the other hand, hasn't quite mastered the trick and is incapable of regenerating heads from its posterior half. Researchers at the Max Planck Institute of Molecular Cell Biology and Genetics in Dresden discovered a signaling pathway in the cells of *Dendrocoelum lacteum* that prevents new heads from growing from the back half of its body. By blocking the end product of this "Wnt signaling pathway" and thus switching it off, they found that the flatworm could now grow a new, fully functional head even from the tip of its tail. This indicates that just a few switches are sometimes enough to influence an organism's regenerative capacity. (NATURE, July 25, 2013)

## An Eye for Complex Connections

Scientists succeed in fully reconstructing a piece of retina

The complex connections of the retina hold some of the secrets to understanding the human brain, which has a hundred billion nerve cells, each of them in contact with thousands of other cells. Researchers from the Max Planck Institute for Medical Research in Heidelberg and the MPI of Neurobiology in Martinsried, near Munich, have now taken a first step on the road to decoding the puzzle. After taking a month to gather the data, and four years to analyze it, they created a precise diagram of all neurons and their connections in a piece of mouse retina. Even though the cube of retina was only a tenth of a millimeter on each side, it contained nearly a thousand neurons and about half a million connections. Computer algorithms aren't yet reliable enough to follow the neuronal processes over long distances, so 200 students spent 20,000 hours manually analyzing the countless microscope images. Part of the solution may

be an online game called Brainflight, which will allow Internet users all over the world to fly along nerve paths, thus helping develop better algorithms for computer-aided data analysis. (NATURE, August 8, 2013)



Reconstruction of 950 neurons and their connections in a piece of mouse retina. The spheres indicate the cell bodies (red: ganglion cells; green: amacrine cells; blue: bipolar cells; gray: electron microscope image of the retinal tissue).