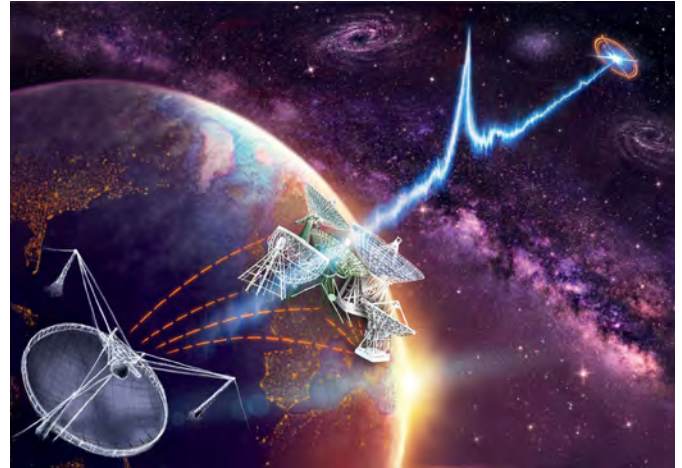


# Radio Burst from a Dwarf Galaxy

Astronomers discover the origin of one of these mysterious radio flashes

Astronomers successfully pinpointed the exact location of a “fast radio burst” for the first time. These short-duration radio flashes have been observed for several years now, but it wasn’t previously known where they come from. An international team working with Laura Spitler from the Max Planck Institute for Radio Astronomy has now solved this mystery. To do so, the researchers used a network of radio telescopes to observe not just one, but multiple bursts from a source called FRB 121102. The high angular resolution made it possible to precisely localize the position to within a fraction of an arc second. Using the 8-meter Gemini North telescope in Hawaii, they were then able to identify the radio bursts’ galaxy of origin and, based on its measured spectrum, determine its distance from us – more than three billion light-years. Despite this success, the cause of the radio bursts remains a mystery. However, the fact that FRB 121102 comes from a dwarf galaxy in which much more massive

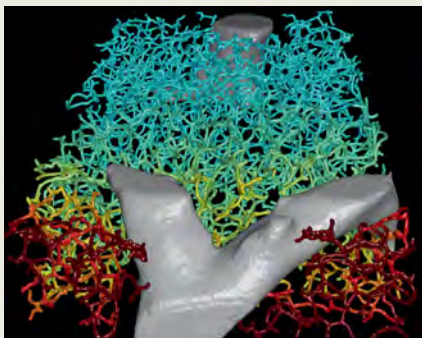
stars are able to form than is the case in our Milky Way may provide a clue. Perhaps this burst originated in the collapsed remnant of such a star. ([www.mpg.de/10886843](http://www.mpg.de/10886843))



Artistic representation of the radio telescopes in the European VLBI network (EVN) used to observe the FRB 121102 radio burst.

# Virtual Liver Could Reduce Need for Animal Research

Researchers simulate biliary fluid dynamics in the liver to predict drug-induced liver damage



Three-dimensional model of the bile duct network that transports bile from the liver to the intestine. The colors indicate the bile's flow rate (blue: slow; red: fast).

The liver is the central metabolic organ in the body and plays a crucial role in detoxification, making it particularly prone to drug-induced damage. This is why animal research is a legal requirement for testing the liver toxicity of new drugs. The liver produces bile in order to break down lipids and excrete waste products, and the bile is transported to the intestine through a finely branched network of channels. A research team at the Max Planck Institute for Molecular Cell Biology and Genetics in Dresden used high-resolution microscopes to examine this network in mice and analyze the layout and structure of the

channels. Then the researchers developed a 3D model of the bile ducts that can simulate the flow properties of bile. The model enables researchers to investigate liver diseases and the effects of drugs on the liver, such as cholestasis – the impairment of bile flow – which frequently occurs with new active substances. Next, the researchers aim to adapt the model to reflect the conditions in the human liver. Although animal research will continue to be necessary for the foreseeable future, the model could contribute to reducing the number of experiments involving animals. ([www.mpg.de/11186866](http://www.mpg.de/11186866))

# Speed Dating among Birds

During mating season, male pectoral sandpipers fly across a huge breeding range

Highly elaborate courtship rituals, exhausting fights with rivals, hardly any sleep and also, if they're lucky, a copulation – a visit to their breeding grounds in the Arctic appears to be hardly less strenuous for pectoral sandpipers than the journey there. This is the conclusion scientists from the Max Planck Institute for Ornithology in Seewiesen reached after they equipped 120 male pectoral sandpipers with small mobile satellite transmitters that come off again by themselves after a time. According to the data they obtained in this way, after flying up to 14,000 kilometers from their wintering grounds, these birds often fly thousands of kilometers more through their breeding grounds in the Arctic. Within four weeks, they visit up to 24 potential breeding sites so as not to miss any mating opportunities, and possibly even to mate multiple times. They can do this because they don't defend any territory and don't support the females in caring for the offspring. During mating season, the males hardly sleep at all so that they can court the females and fend off their rivals nearly around the clock during the long summer days in the Arctic. In the end, though, only a few males actually succeed in siring offspring. ([www.mpg.de/10888750](http://www.mpg.de/10888750))



The mating flight of male pectoral sandpipers – which weigh in at about 100 grams – is characterized by throat inflation and deep hooting calls.

# Early Forestry in the Amazon



Photos: MPI for Ornithology (top), Carolina Lewis (bottom)

Indigenous inhabitants left their mark on the rainforest by domesticating tree species in the pre-Columbian era

Humans have been shaping the Amazon rainforest much longer than previously assumed. As an international team including Florian Wittmann from the Max Planck Institute for Chemistry in Mainz discovered, the indigenous peoples of Amazonia began growing and propagating such plants as the Brazil nut, the cacao tree and the acai palm as far back as 8,000 years ago. These domesticated

trees are therefore still found in the Amazon rainforest more frequently today than would be expected if humans had not intervened. In addition, they exhibit fewer genetic variations than occur when species propagate naturally. The notion that the vast rainforests were untouched by human influence before the Spanish arrived in South America is therefore incorrect. ([www.mpg.de/11147178](http://www.mpg.de/11147178))

Cultivated primeval forest: Humans shaped the flora in the Amazon Basin to a greater extent than was previously thought – for instance with acai palms, as in the Humaitá National Forest in the state of Amazonas, Brazil.

# A 50,000-Year Connection to Country

DNA analyses show unique attachment of Australian aborigines to their homeland



Aborigines preserve their traditions through such events as the DanceSite Festival in Alice Springs, Australia. Research can help them answer the question of just where they come from.

Australian Aborigines have exceptionally deep roots in their respective regions: the approximately 400 linguistic and regional groups have continuously inhabited the same territory for as many as 50,000 years. A team of researchers, including Wolfgang Haak from the Max Planck Institute for the Science of Human History, used 111 historical hair samples to analyze mitochondrial DNA, which allows tracing of maternal ancestry. The results show that modern Aborigines are the descendants of a single founding population that settled in Australia 50,000 years ago. At that time, the land was still part of the ancient continent of Sahul, which was connected to New Guinea by a land bridge. The rise in sea level later separated Australia and New Guinea, after which the populations spread along the continent's east and west coasts within 1,500 to 2,000 years. Thereafter, the settlers remained loyal to their regions – even when there were no natural barriers to further migration. The study was conducted as part of the Aboriginal Heritage Project, which is aimed at helping people with Aboriginal heritage to trace their regional ancestry. ([www.mpg.de/11153645](http://www.mpg.de/11153645) – available only in German)

## Green Chemistry from the Mussel Foot

The byssal threads are produced by a combination of self-organized and biologically regulated processes

The chemical industry can learn a lot from the common mussel. Not only is the mollusk's mother of pearl remarkably tough, but the byssal threads with which it clings to the seafloor are also particularly tear-resistant, and their ends adhere under water better than any other material. Furthermore, the way in which the mussel spins the complex threads in its foot could serve as a blueprint for an environmentally friendly production process for synthetic composite materials. Scientists working with Matt Harrington at the Max Planck Institute of Colloids and Interfaces in Potsdam discovered that

key bioproduction steps proceed autonomously, that is, without any active intervention by the mussel. The only reason the core, the cuticle and the adhesive plaque at the end of a byssal thread are produced at the correct sites is because the mussels secrete the respective starting substances in a precisely coordinated fashion into the right locations in a fine groove in their foot. This finding could point to a way to use simple technologies to get polymers to arrange themselves into larger structures, largely without using heavy-metal catalysts. ([www.mpg.de/11091566](http://www.mpg.de/11091566))

The byssal threads of mussels adhere under water better than any glue from a tube. They are strong, elastic, hard and self-healing.

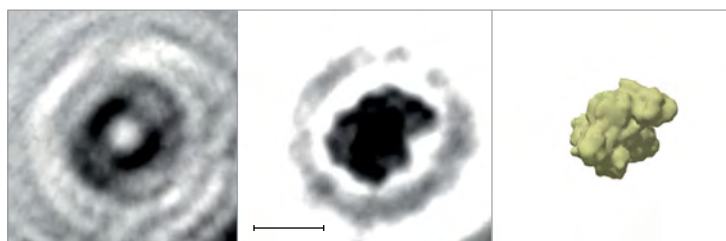


# Holograms for Biomedicine

Low-energy electron beams can be used to study the three-dimensional structure of individual proteins

Biologists will soon have a brand new instrument for surveying the toolbox of life: electron holography. Scientists at the University of Zurich and the Max Planck Institute for Solid State Research in Stuttgart used very low-energy electrons to record holograms of single proteins for the first time, making their three-dimensional structure visible. This particularly gentle meth-

od enables – unlike standard structural biology methods – these biomolecules to be studied in the form in which they perform their various tasks in living organisms. Electron holograms of proteins could thus not only improve our understanding of biochemical processes, but also facilitate the search for new active substances. ([www.mpg.de/10996153](http://www.mpg.de/10996153))



The image of the protein albumin (center) is calculated (the bar corresponds to 5 nanometers) from the hologram (left). The holographic image corresponds very well with a simulation (right).

## New Biomarkers for Bowel Cancer Treatment

Scientists can predict in the lab how an anti-tumor drug will affect cancer cells

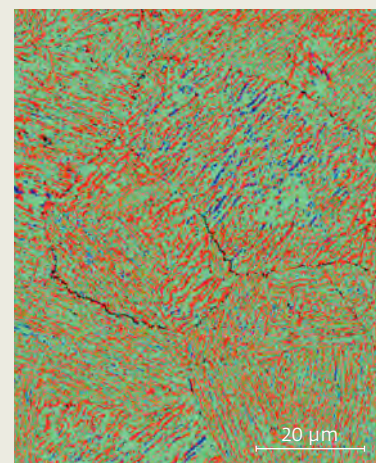
Bowel cancer is the third most common form of cancer in the world, with most cases affecting the colon and rectum. There are many different subgroups of these so-called colorectal carcinomas, and the effectiveness of the available drugs varies – there is no one drug that works for every patient. A public-private consortium that also includes researchers from the Max Planck Institute for Molecular Genetics in Berlin identified biomarkers that may soon make it possible to treat colorectal cancer patients

individually based on tumor type. First, the researchers essentially compiled a molecular fingerprint of all the tumor groups. Then they tested how the tumors respond to various treatments, and in this way, linked a tumor's fingerprint to its response to various active substances. Among other things, the research team discovered molecules that can predict the effectiveness of the chemotherapy drug 5FU and Cetuximab – two drugs commonly used to treat this disease. ([www.mpg.de/11044397](http://www.mpg.de/11044397))

## Steel with a Bone Structure

Microlamellae prevent rapid material fatigue

Material fatigue can have similarly fatal consequences in traffic as when a driver becomes tired. In 1998, for instance, more than 100 people died when an ICE train derailed in Eschede, Germany, because the steel in one of the wheel tires had worn out and cracked. A type of steel that Dirk Ponge and Dierk Raabe developed at the Max-Planck-Institut für Eisenforschung in Düsseldorf could help prevent accidents like this. As the researchers have now discovered through an international cooperation, this material, like bones, is made up of microlamellae, so tiny cracks that occur when this steel is exposed to stress don't propagate very rapidly. As a result, the material doesn't fail as quickly.



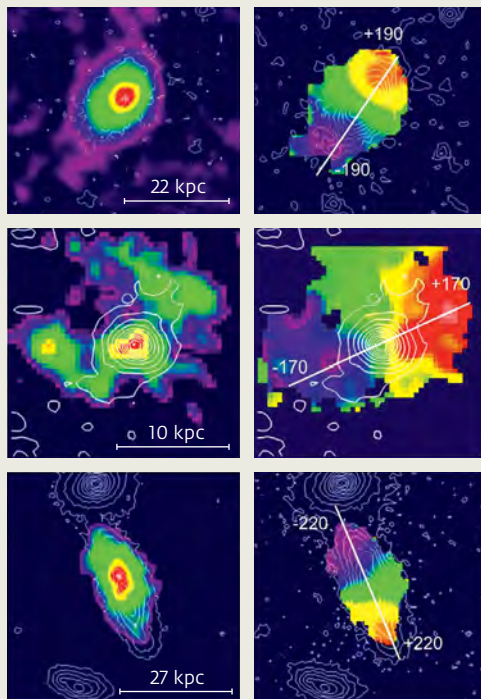
Tiny lamellae reduce the rate at which a new type of steel fails. Red and green indicate different crystal structures.

# Most People Don't Want to Know Their Future

Learning what the future holds, good or bad, is not appealing to most

Want to know what the future holds? Most people would rather not. They prefer to remain uncertain about what life has in store for them, even if the news is positive. That's what scientists at the Max Planck Institute for Human Development and the University of Granada determined after surveying more than 2,000 adults in Germany and Spain. Only 1 percent of participants consistently wanted to know what the future held. In contrast, 86 to 90 percent would not want to be informed about upcoming negative events, such as the failure of their marriage or the death of their partner. In addition, 40 to 77 percent preferred to remain ignorant of upcoming positive events, such as their soccer team's victory or Christmas presents. Researchers call this phenomenon deliberate ignorance. It stands in contradiction to the established knowledge that humans basically strive for certainty and accrual of information. Gerd Gigerenzer, the study's lead author, explains deliberate ignorance with the widespread fear of bad news and with the desire to maintain the enjoyment of suspense that pleasurable events provide. ([www.mpg.de/11070648](http://www.mpg.de/11070648))

In Greek mythology, seeress Cassandra's knowledge of the future becomes a curse. Today, that is precisely why most people prefer not to know what the future holds in store for them.



## Dark Matter Not Found

Milky Way systems in the early universe consist mainly of gas and stars

A new set of observations of galaxies in the early universe shows that these galaxies are completely dominated by "normal" matter. A team of researchers working with Reinhard Genzel from the Max Planck Institute for Extraterrestrial Physics found that dark matter evidently plays a much smaller role there than in star systems in today's galaxies. The astronomers used spec-

Galaxies in focus: For each of the three galaxies, the right column shows a velocity map. All galaxies show a clear rotation pattern, with blue areas moving toward the observer and red areas moving away from the observer.

tral imaging to observe several hundred massive, star-forming galaxies in the early universe. This technique enabled the researchers to determine the rotation curves of the galaxies, which in turn provide valuable information about the distribution of both baryonic (normal) and dark mass at the peak of cosmic galaxy formation, 10 billion years ago. They found that the rotation velocities of the stars in the outer regions of the galaxies decrease, which speaks against the existence of an invisible mass. Furthermore, the star disks appear to be thicker and more turbulent than those in today's galaxies. ([www.mpg.de/11170451](http://www.mpg.de/11170451))

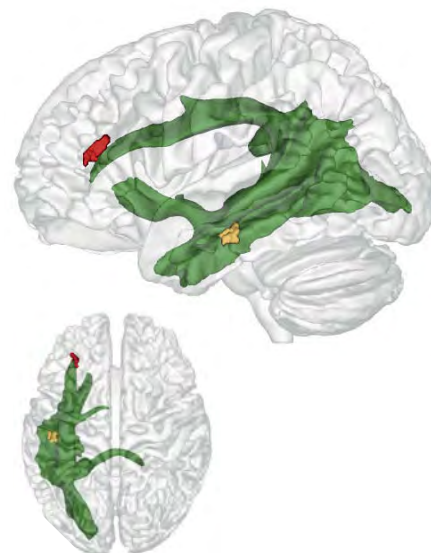
# A Connection to Others' Thoughts

Researchers discover brain structure that helps us understand others

At about the age of four, a child's brain undergoes an important change: it begins to understand that others have different thoughts than its own. It can now do what a three-year-old can't: put itself in someone else's shoes. According to scientists at the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig, this milestone in brain development is tied to the formation of a neural connection, the arcuate fasciculus. This bundle of nerve cell processes forms a link between two brain regions: one is located at the back of the temporal lobe of the cerebrum and helps the adult brain

think about other people and their thoughts. The second region is an area in the frontal lobe of the cerebrum that is involved in keeping things at different levels of abstraction, thus helping us distinguish between reality and someone else's thoughts. Only when these two brain regions are connected by the arcuate fasciculus can children start to understand what others think. ([www.mpg.de/11182982](http://www.mpg.de/11182982))

Beginning at age four, the arcuate fasciculus (green) forms a link between a region at the back of the temporal lobe (yellow) and a region in the frontal lobe of the cerebrum (red).



## Growth despite Fasting

A new diet developed for fruit flies improves development and fecundity without decreasing lifespan

There are many recommendations for living a long and healthy life, one of which is to eat less. But that can have unpleasant consequences: flies and mice that were put on a diet, for example, displayed slower development and lower fecundity. So a nutrition plan was sought that would provide the positive effects of a diet but without its negative side effects. A research group at the Max Planck Institute for Biology of Ageing has now developed a diet for fruit flies and mice based on the organisms' own amino acid profiles. Flies fed this diet had a lower calorie intake than flies fed a standard diet, and they lived just as long. Despite being on a diet, they develop faster, grow bigger in size and lay more eggs. The researchers therefore suspect that a diet precisely tailored to our amino acid profile would have a positive effect on human health. ([www.mpg.de/11160115](http://www.mpg.de/11160115))

In nature, the fruit fly *Drosophila melanogaster* feeds on ripe fruit. When fed a diet that precisely reflects the composition of amino acids in their bodies, the flies became satiated more quickly, but still grew faster.



## Older but Bolder

A study conducted at the Max Planck Institute for Human Development has shown that, contrary to popular belief, older people take greater risks in certain situations than younger people. In the study, participants had to choose between two options, each of which offered a different probability of winning or losing a larger or smaller sum of money. In each case, they knew their chances of success. Ultimately, the older participants were more likely than the younger ones to choose the riskier option – because they were more optimistic in their assessments of the possibility of winning and were thus more daring in their choices. The findings suggest that age differences in risk-taking behavior are strongly influenced by situation. Previous studies generally investigated the choice between a safe and a risky option and thus reached a different conclusion. The current study also showed that older participants made worse decisions than younger ones: they were less likely to choose the option with the higher expected monetary return, presumably because of their decreasing ability to process information and solve problems as quickly as younger people. ([www.mpg.de/11155381](http://www.mpg.de/11155381))