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Old age comes three years later for every generation
Half a century of data reveals population ageing can be described as a moving front.

Nick Carne reports.

The average age of death creeps out by about three years for each generation, research shows. The age at which we die has been slowly moving forward like a wave, and there is “no evidence” of an impending limit to how long we can live, new research suggests.

Both findings are sure to fire up ongoing debates.

In the past two years alone, [separate studies](#) have concluded that the maximum lifespan of humans is fixed or that it isn't, and – as the new research acknowledges – there is no clear agreement about the age pattern of old-age deaths.

Some argue that death numbers should become compressed at advanced ages, others that they should become more dispersed, and others still maintain that they are consistent, with little change in dispersion.

However, when researchers from Stanford University in the US and China's Huazhong University of Science and Technology analysed annual life-tables from the Human Mortality Database ([HMD](#)) for the 50 years between 1960 and 2010 in 20 industrialised countries, they concluded that old-age survival follows an advancing front.

The long-term speed of the front is approximately 0.12 years per calendar year, or about three years per human generation. Thus, age 68 today is equivalent, in terms of mortality, to age 65 a generation ago.

The male survival front has lower long-term speed and is more dispersed than the female one. Front behaviour was similar over the five decades for females and males in all of the countries studied.

“Our unexpected result underscores the plasticity of old-age human mortality, with deaths steadily delayed as societies develop, and

supports an ongoing increase in the age of transition to disability,” the researchers, led by Stanford's Wenyun Zuo, [write in a paper](#) published in the journal *Proceedings of the National Academy of Sciences*.

That last point, though not expanded on in detail, is perhaps the most important, because it raises the question of what “old” means in a modern society, and when support for the elderly should kick in. As the paper notes, Japanese females had a roughly 80% probability of living past age 60 years of age in 1960, past 70 by 1977, and past 80 by 2011

The researchers note that their results suggest endowments, biological or other, are principal determinants of old-age survival.

“The advancing survival front that we find suggests that the effects of inequality on mortality may be much smaller among old-aged adults than among younger adults,” they write.

“Our analyses use period life tables, not cohorts, and suggest that continued mortality improvement depends largely on period processes such as economic growth, investment and advances in health science research and practice, and increases in the age of transition to disability.”

The researchers cannot explain differences in the location and speed of the advancing front between genders or countries, but suggest that the surprising regularity of their findings should be used to improve mortality forecasts.

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A dog's color could impact longevity, increase health issues

New research led by the University of Sydney has revealed the life expectancy of chocolate Labradors is significantly lower than their black and yellow counterparts.

The study of more than 33,000 United Kingdom-based Labrador retrievers of all colours shows chocolate Labradors also have a

higher incidence of ear infections and skin disease. Its findings were published in the open access journal *Canine Genetics and Epidemiology* today.

Part of the University's VetCompass™ Programme, which collects and analyses electronic patient data on dogs, the research is being replicated in Australia, where Labradors are the most popular breed of dog.

In the UK, the median longevity of non-chocolate Labradors is 12.1 years, more than 10 percent longer than those with chocolate coats. The prevalence of ear inflammation (otitis externa) was twice as high in chocolate Labradors, who were four times more likely to have suffered from pyo-traumatic dermatitis (also known as hot-spot).

Lead author Professor Paul McGreevy, from the University's Faculty of Science, said the relationship between coat colour and disease came as a surprise to researchers. The UK findings may not hold in Australian Labradors, he said, but warrant investigation.

"The relationships between coat colour and disease may reflect an inadvertent consequence of breeding certain pigmentations," he said.

"Because chocolate colour is recessive in dogs, the gene for this colour must be present in both parents for their puppies to be chocolate. Breeders targeting this colour may therefore be more likely to breed only Labradors carrying the chocolate coat gene. It may be that the resulting reduced gene pool includes a higher proportion of genes conducive to ear and skin conditions."

Across the entire Labrador population, the most common health conditions found were obesity, ear infections and joint conditions.

"We found that 8.8 percent of UK Labradors are overweight or obese, one of the highest percentages among dog breeds in the VetCompass™ database," Professor McGreevy said.

The prevalence was higher among male dogs who had been neutered. Labrador retrievers under primary veterinary care in the UK was co-authored with colleagues from the London's Royal Veterinary

College (RVC), where the VetCompass™ programme™ began in 2007, as a collaboration with the University of Sydney. VetCompass Australia now operates as a consortium comprising all of Australia's veterinary schools, supported by the Australian Research Council.

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Oxygen-Rich Liquid Water May Exist on Mars

Brines suffused with the life-giving gas could offer hope for past and even present microbes on the Red Planet, according to a new study

By [Nola Taylor Redd](#)

The possibility of life on Mars may not be consigned to the distant past. New research suggests our neighboring world could hide enough oxygen in briny liquid water near its surface to support microbial life, opening up a wealth of potentially habitable regions across the entire planet. Although the findings do not directly measure the oxygen content of brines known to exist on the Red Planet, they constitute an important step toward determining where life could exist there today.

Aerobic respiration, which relies on oxygen, is a key component of present-day life on Earth. In this process, cells take in oxygen and break it down to produce energy to drive metabolism. Mars's very low levels of atmospheric oxygen have led many scientists to dismiss the possibility of aerobic respiration there today, but the new research brings this possibility back into play. The study appears in the October 22 edition of *Nature Geoscience*.

"Our work is calling for a complete revision for how we think about the potential for life on Mars, and the work oxygen can do, implying that if life ever existed on Mars it might have been breathing oxygen," says lead study author Vlada Stamenkovic, a researcher at NASA's Jet Propulsion Laboratory in California. "We have the potential now to understand the current habitability."

Although Mars is today a freeze-dried desert, it possesses abundant reserves of subsurface water ice, as well as some amount of liquid water in the form of brines. The brines' high salt content lowers the temperature at which they freeze, allowing them to remain liquid even on Mars's frigid surface. In their new study, Stamenkovic and his colleagues coupled a model of how oxygen dissolves in brines with a model of the Martian climate. Their results revealed that pools of salty liquid at or just beneath the surface could capture the meager amounts of oxygen from the Red Planet's atmosphere, creating a reservoir that microbes might metabolically utilize. According to the research, Martian brines today could hold higher concentrations of oxygen than were present even on the early Earth—which prior to about 2.4 billion years ago harbored only trace amounts of the gas in its air.

The study analyzed how slow shifts in Mars's tilt in relation to the sun (a well-studied phenomenon still unfolding today) would change the planet's average temperature, examining a slice of time spanning from 20 million years in the past to 10 million years in the future. This analysis showed that associated temperature changes across these lengthy periods of time could allow brines to absorb and retain oxygen from the thin Martian air.

And while the model-based results might seem quite speculative, they do align with otherwise-mysterious in-situ findings on Mars. NASA's Curiosity rover has identified rocks rich in the element manganese, which likely required significant oxygen to form. "Manganese deposition on Earth is really closely associated with life, both indirectly and directly," says Nina Lanza, a planetary geologist at Los Alamos National Research Laboratory in New Mexico. However, that does not mean Martian life created the manganese deposits; instead, it could simply be that Mars possessed much more atmospheric oxygen in the past than it does today—something supported by several other independent lines of evidence.

An oxygen-rich ancient Mars, in turn, would necessitate a thicker atmosphere—possibly thick enough to have allowed oceans of water to accumulate on the surface. That is the Martian history most researchers currently embrace, based on a wealth of observations from multiple missions.

But Stamenkovic says an ocean, an oxygen-rich atmosphere, or a warmer climate may not be required to create the deposits. It is also possible that the brines interacting with the rocks over millions of years could have formed manganese-rich rocks and could still create them today, eliminating the need for Mars to once have had Earth-like oceans and atmosphere. Lanza agrees that the manganese-rich rocks could have formed on an ocean-free Mars, but notes that further study is needed.

Steve Clifford, an expert in Martian hydrology at the Planetary Science Institute in Arizona who was not part of the project, is not ready to count out the role of oceans in forming Mars's brines. "You need the presence of water to have these brines," he says. Clifford points out that whatever water survives on Mars today—and researchers think there is enough to cover the entire surface with water at least half a kilometer if not a full kilometer deep—requires even more to have existed in earlier times, essentially assuring the Red Planet's somewhat watery past.

Regardless of how Mars's brines came to be, their existence and possible oxygenation suggest a potent, heretofore overlooked planetary niche for past and even present-day life. "The question of extant life is something that we might solve if we had the right tools on Mars," Stamenkovic says. "Looking for liquid water and brines in the Martian subsurface would be the first step; drilling would be another critical step."

But just because the brines might hold on to oxygen does not necessarily mean they constitute a planet-spanning refuge for any Martian microbes. For one thing, Stamenkovic and his colleagues

have not yet modeled the brines' actual formation or stability over time; instead they simply looked for regions in which the salty liquid could exist, based on measured Martian atmospheric pressures and a range of average annual estimated temperatures. Brines would require saltier conditions to form at the equator, which would cause them to absorb less oxygen and become less suitable habitats—but polar brines would be able to absorb enough oxygen to potentially support a wider variety of life forms, according to the study.

However, according to Edgard Rivera-Valentin, it would be difficult for salts near the surface to absorb water vapor from Mars's atmosphere to make the brine in the first place—a process known as deliquescence. Rivera-Valentin, a planetary scientist at the Texas-based Lunar and Planetary Institute who was not part of the study, says deliquescence is challenging even at the planet's poles. There water vapor is more abundant than at the equator, thanks to the presence of ice caps, but it is still scarce in the atmosphere due to freezing temperatures.

Instead, Rivera-Valentin says equatorial brines are more likely to form as subsurface water comes in contact with salt-rich minerals, rather than from salts interacting with atmospheric water vapor. According to Clifford, water-rock interactions throughout the planet are more likely to happen deep beneath the surface, where groundwater can dissolve the rocks around it while remaining isolated from the atmosphere for billions of years. "In the near-surface, it's a little bit harder to anticipate what the composition of brines would be or how saturated they would be," Clifford says. Rivera-Valentin also expressed concern that the brines might be too salty for life. "The types of brines that would form on Mars would kill it," he says. "Life as we know it on Earth would not be able to survive these brines—too salty and too cold."

Woodward Fischer, a geobiologist at the California Institute of Technology and a co-author on the paper, says that to find the salty

limit of life, one would have to know something about the energy budget of a cell. "We barely know that in certain very specific instances of laboratory [microbes] on Earth, and we have no idea [about it] on any other planet," he says. Fischer thinks scientists should avoid overly rigid constraints when it comes to imagining how alien, unearthly life might emerge and evolve.

If in fact briny, biologically friendly oases dot the Red Planet, they paradoxically could be bad news for future life-hunting missions there, rendering wide swaths of the planet potentially habitable—and thus off-limits for in-situ exploration, based on current interpretations of international law. Planetary protection protocols require stringent decontamination methods for spacecraft that land near "special regions" deemed likely to hold the conditions necessary for life—namely, the presence of a usable energy source and of liquid water. These protocols seek to prevent the accidental extinction or contamination of possible Martian life by invading microorganisms from Earth, and are also meant to keep our own planet safe from any Martian bugs that might someday hitch a ride to Earth on future sample-return missions. Presumably, if the bulk of the Martian surface and subsurface were to suddenly be seen as a "special region," exploration could still occur there via robots somehow completely purged of all potentially contaminating traces of Earthly biology.

Such strict requirements would drive up the already high cost of Martian exploration, but Stamenkovic remains optimistic. "I think there's a sweet spot where we can be curious and we can be explorers and not mess things up," he says. "We have to go for that."

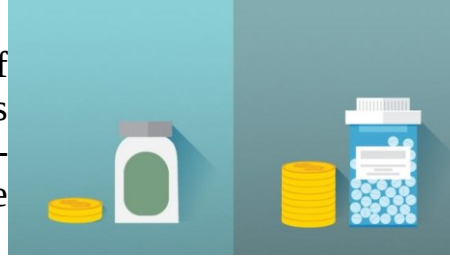
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Aspirin alone a good clot buster after knee surgery
Putting patients on aspirin following a knee replacement is a safe, cost-effective alternative to anticoagulants, U-M researchers find.

When it comes to preventing blood clots after a knee replacement, good old aspirin may be just as effective as newer, more expensive

drugs. That swap could help reduce the cost of caring for the nearly 1 million Americans who have a knee fixed each year, Michigan Medicine researchers say.

After knee surgery, there's a risk of blood clots in the legs or lungs. So it's routine for patients to take clot-preventing drugs for some time afterward.



When it comes to preventing blood clots after a knee replacement, good old aspirin may be just as effective as newer, more expensive drugs. Michigan Medicine/Manifest

Some doctors choose powerful anti-clotting drugs like heparin (Lovenox) and rivaroxaban (Xarelto), but it hasn't been clear whether these expensive prescription drugs work any better than cheap, readily available aspirin.

"Aspirin alone may provide similar protection compared to anticoagulation treatments," says Brian R. Hallstrom, M.D., an orthopaedic surgeon and associate chair for quality and safety at the University of Michigan Department of Orthopaedic Surgery.

Hallstrom is the lead author of a new study published in *JAMA Surgery* that found few patients developed a blood clot after surgery, and those patients on aspirin fared just as well as those on anticoagulants.

Aspirin use growing

During the two-year study period from 2013 to 2015, aspirin use rose from 10 percent to 50 percent among the patients cared for by orthopaedic surgeons in the Michigan Arthroplasty Registry Collaborative Quality Initiative, a statewide effort to give patients the best possible recovery and outcomes after hip and knee replacements. Since then, the shift has become even more distinct: Aspirin prescribing has risen to 70 percent among Michigan surgeons, says

Hallstrom, who is co-director of the initiative and a health services researcher at U-M's Institute for Healthcare Policy and Innovation.

Based on the experience of 41,537 Michigan patients undergoing knee replacement, the study may further the debate about the routine use of aspirin for clot prevention.

A recent Canadian study looked at the issue, but the analysis had a caveat: Each of the more than 3,400 clinical trial patients received rivaroxaban the first five days after surgery. After that, they continued with the drug or switched to aspirin.

The new U-M study suggests patients may be adequately protected if they take aspirin alone from day one.

"This study is truly a real-world experience of what happened in Michigan when the majority of surgeons switched to aspirin," Hallstrom says. "The incidence of blood clots, pulmonary embolus and death did not increase despite this dramatic change in practice."

Shifting procedure and dialogue

Over the past decade, surgeons have turned away from powerful anticoagulants and toward aspirin used in addition to nondrug improvements such as compression devices for thwarting clots.

These days, most patients have a generally low risk of blood clots after knee replacement for a number of reasons. Those reasons include shorter surgical times, less invasive procedures and use of regional anesthesia that allows early mobilization after surgery, Hallstrom says. Some patients are even going home the same day.

"The most important way to prevent blood clots is getting moving," says Hallstrom, noting that people are at risk for blood clots when they sit or lie in one position for too long, such as on an airplane or a hospital bed. Still, pharmaceutical recommendations vary.

The critical care specialists who make up the American College of Chest Physicians favor heparin to reduce the risk of blood clots, while the American Academy of Orthopaedic Surgeons guidelines state that no one drug is better than another for preventing clots.

Advantages of aspirin

The U-M study involved patients undergoing knee replacement surgery at any of the 29 Michigan hospitals in the surgical quality group. One-third of the patients took aspirin alone; 54 percent took only an anticoagulant; and 13 percent took an aspirin/anticoagulant combination.

Over three months, just 1.16 percent of aspirin patients developed a serious blood clot. That was true for 1.42 percent of anticoagulant patients, according to the Michigan study. This was not statistically different. So, neither drug appeared better than the other -- but aspirin has some obvious advantages.

"Aspirin is easy to take and much less expensive," Hallstrom says. "Patients can get it over the counter for pennies, while the other anticoagulants require monitoring, injections, frequent dose adjustments and are extremely expensive."

The reported cost for a 30-day supply of rivaroxaban is approximately \$379 to \$450; heparin is estimated at \$450 to \$890. Although warfarin costs a few dollars for a 30-day supply, its cost approaches that of the other anticoagulants when doctor visits for monitoring are factored in, Hallstrom says.

In contrast, aspirin costs approximately \$2 a month.

The study suggests most patients can have just aspirin without increasing the risk for venous thromboembolism, but doctors need to consider factors such as a patient's history of clots, obesity and ability to mobilize after surgery when determining the best measure for clot prevention, Hallstrom adds.

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Scientists make new 'green' electronic polymer-based films with protein nanowires

UMass Amherst scientists have produced a new class of electronic materials that may lead to a "green," more sustainable future in biomedical and environmental sensing

AMHERST, Mass. - An interdisciplinary team of scientists at the University of Massachusetts Amherst has produced a new class of electronic materials that may lead to a "green," more sustainable future in biomedical and environmental sensing, say research leaders microbiologist Derek Lovley and polymer scientist Todd Emrick.

They say their new work shows it is possible to combine protein nanowires with a polymer to produce a flexible electronic composite material that retains the electrical conductivity and unique sensing capabilities of protein nanowires. [Results appear in the journal Small](#). Protein nanowires have many advantages over the silicon nanowires and carbon nanotubes in terms of their biocompatibility, stability, and potential to be modified to sense a wide range of biomolecules and chemicals of medical or environmental interest, says Lovley. However, these sensor applications require that the protein nanowires be incorporated into a flexible matrix suitable for manufacturing wearable sensing devices or other types of electronic devices.

As Lovley explains, "We have been studying the biological function of protein nanowires for over a decade, but it is only now that we can see a path forward for their use in practical fabrication of electronic devices." Postdoctoral research Yun-Lu Sun, now at the University of Texas at Austin, discovered the proper conditions for mixing protein nanowires with a non-conductive polymer to yield the electrically conductive composite material. He demonstrated that although the wires are made of protein, they are very durable and easy to process into new materials.

"An additional advantage is that protein nanowires are a truly 'green,' sustainable material," Lovley adds. "We can mass-produce protein nanowires with microbes grown with renewable feedstocks. The manufacture of more traditional nanowire materials requires high energy inputs and some really nasty chemicals." By contrast, he says, "Protein nanowires are thinner than silicon wires, and unlike silicon

are stable in water, which is very important for biomedical applications, such as detecting metabolites in sweat."

Emrick adds, "These electronic protein nanowires bear surprising resemblance to polymer fibers and we're trying to figure out how to combine the two most effectively."

In their proof-of-concept study, the protein nanowires formed an electrically conductive network when introduced into the polymer polyvinyl alcohol. The material can be treated with harsh conditions, such as heat, or extreme pH such as high acidity, that might be expected to ruin a protein-based composite, but it continued to work well.

The conductivity of the protein nanowires embedded in the polymer changed dramatically in response to pH. "This is an important biomedical parameter diagnostic of some serious medical conditions," Lovley explains. "We can also genetically modify the structure of the protein nanowires in ways that we expect will enable detection of a wide range of other molecules of biomedical significance."

The electrically conductive protein nanowires are a natural product of the microorganism *Geobacter* discovered in Potomac River mud by Lovley more than 30 years ago. *Geobacter* uses the protein nanowires to make electrical connections with other microbes or minerals. He notes, "Material science experts like Todd Emrick and Thomas Russell on our team deserve the credit for bringing protein nanowires into the materials field. It's not just about mud anymore."

In this work supported by UMass Amherst campus funds for exploratory research, next steps for the collaborative materials-microbiology team include scaling up production of nanowire-polymer matrices, Lovley says.

He points out, "Materials scientists need a lot more nanowires than we're used to making. We're were making thimblefuls for our biological studies. They need buckets full, so we are now

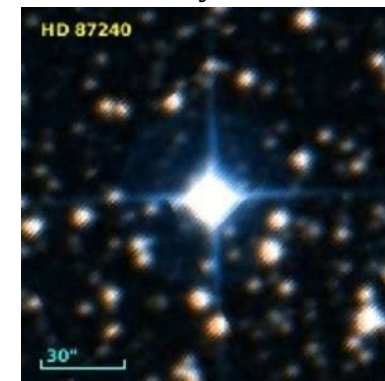
concentrating on producing larger amounts and on tailoring the nanowires so they'll respond to other molecules." The researchers have also applied for a patent on the idea of a conductive polymer made with protein nanowires.

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HD 87240 is a chemically peculiar star with an overabundance of heavy elements, study suggests
Unusually rich in silicon, rare-earth elements, platinum and mercury

by Tomasz Nowakowski, Phys.org

European astronomers have conducted a chemical study of the star HD 87240, a member of the open cluster NGC 3114. The new research, which determined the abundances of several elements in HD 87240's atmosphere, suggests that the object is a chemically peculiar star showcasing an overabundance of heavy elements. The finding is reported in a paper published October 10 on arXiv.org.



HD 87240. Digitized Sky Survey.

Located some 7,200 light years away in the constellation Carina, NGC 3114 is a sparse, young (about 160 million years old) open cluster. Although the cluster is very difficult to study, due to the high number of field stars from the Galactic disc, it has been a subject of numerous observations since 1963.

Now, a team of astronomers from Paris Observatory and Space Research Institute of Austrian Academy of Sciences, has performed a chemical study of one of NGC 3114's [stars](#), namely HD 87240, which was classified by previous observations as an Ap Si star – a magnetic chemically peculiar star (CP star) with an overabundance of silicon (Si).

For their research, the astronomers used the data collected by European Southern Observatory's (ESO) Very Large Telescope (VLT) in Chile. HD 87240 was observed by VLT's Ultraviolet and Visual Echelle Spectrograph (UVES) in its high-resolution mode on October 26, 2017.

"We have used the code ATLAS9 to compute a model atmosphere for HD 87240 for the effective temperature and surface gravity derived from Stromgren's photometry. A grid of synthetic spectra has been computed using SYNSPEC49 and adjusted to the UVES spectrum of HD 87240 to determine the abundances of several chemical elements using the latest critically evaluated atomic data from NIST," the researchers wrote in the paper.

Analysis of UVES data allowed the team to determine chemical abundances for 39 elements in the atmosphere of HD 87240. The astronomers found that this star is significantly overabundant in [heavy elements](#), especially when it comes to platinum (Pt) and mercury (Hg) – about 10,000 times the solar abundances.

Moreover, HD 87240 was found to be unusually rich in silicon (around 10 times the solar abundance) and in the so-called rare-earth elements like cerium (Ce), praseodymium (Pr) and neodymium (Nd) – at a level of at least five times the solar abundances. HD 87240 also displays solar abundances of carbon, nitrogen and oxygen, as well as scandium (Sc) and vanadium (V). However, the star turns out to be underabundant in light elements such as helium or sulfur.

According to the paper, the derived chemical abundances suggest that HD 87240 should be reclassified as a chemically peculiar late B star with overabundances of silicon, platinum and mercury.

"The derived abundance pattern of HD 87240 departs strongly from the solar composition which definitely shows that HD 87240 is not a superficially normal late B star but is definitely a new CP star. (...) Hence we propose that HD 87240 be reclassified as a Bp SiPtHg star (not as an Ap Si as it currently is)," the researchers concluded.

More information: Elemental abundances of HD 87240, member of the young open cluster NGC 3114, arXiv:1810.04540 [astro-ph.SR] arxiv.org/abs/1810.04540

<http://bit.ly/2JjqBob>

Cacao analysis dates the dawn of domesticated chocolate trees to 3,600 years ago

Study finds selection of certain traits also encouraged bad ones

PULLMAN, Wash. - Researchers analyzing the genomes of cultivated cacao trees have traced their origin to a "single domestication event" some 3,600 years ago. The discovery opens a new front in a long-running argument regarding when and where humans started growing the source of chocolate.

"This evidence increases our understanding of how humans moved and established in America," said Omar Cornejo, a Washington State University population geneticist and lead author of an article on the study in [Communications Biology](#), an open-access journal from the publishers of Nature. "It is important in itself because it gives us a timeframe for asking questions that are perhaps trickier: How long did it take to make a good cacao? How strong was the process of domestication? How many plants were necessary to domesticate a tree?"

The study, which involved 18 scientists from 11 institutions, also found that cacao's domestication ended up selecting for flavor, disease resistance and the stimulant theobromine. However, that came at the cost of retaining genes that lowered crop yields.

Researchers sequenced the *Theobroma cacao* genome in 2010. That laid out what Cornejo refers to as an archetype of the cacao genome, while this study, by sequencing 200 plants, teases out variations in the genome that can reveal the plant's evolutionary history.

The researchers looked at "the prince of cocoas," Criollo -- rare, flavorful and the first to be domesticated. They found that it was domesticated in Central America 3,600 years ago, but originated in the Amazon basin, near the modern-day border of southern Colombia

and northern Ecuador, from an ancient germplasm known as Curaray. Chances are it was introduced to Central America by traders, said Cornejo.

The tree's population at the time consisted of between 437 and 2,674 individual trees, and most likely about 738 trees. The time of domestication 3,600 years ago, with margins of 2,481 and 10,903 years ago, is consistent with traces of theobromine found in Olmec pottery and large-scale analyses of ancient and modern human DNA that put colonization of the Americas at roughly 13,000 years ago.

The researchers also saw support for a hypothesis that domestication carries a cost as growers, in choosing plants with desirable traits, can ultimately make plants that accumulate counterproductive genes-- "deleterious mutations"--making them less fit.

Insights from the study could help identify genes behind specific traits that breeders can emphasize, including yield.

"What we would like to have is a way to combine plants from populations with high productivity -- like Iquitos -- with plants of Criollo origin, while retaining all these desirable traits that make Criollo cacao be the best in the world," said Cornejo.

Cornejo worked on the study at both WSU, where he used the high-performance computational power of the Center for Institutional Research Computing for the analyses, and Stanford University, where he was a post-doc in the lab of Carlos Bustamante, a co-author on the paper, where the sequencing of the data was done. Funding for the research came from Mars, Incorporated, which has undertaken a large effort to sequence and study the cacao genome.

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NASA brings a Hubble gyro back to life after a seven-year hibernation

"Gyro rates now look normal in both high and low mode."

[Eric Berger](#) - 10/23/2018, 6:49 AM

After NASA's Hubble Space Telescope [entered](#) "safe" mode about two weeks ago, its operations team has been scrambling to bring a balky gyroscope back online. Now, the space agency says it believes it has fixed the problem.

[Enlarge](#) / *Hubble Space Telescope above Earth, photographed during STS-125, Servicing Mission 4, May 2009. [NASA](#)*



"The Hubble operations team plans to execute a series of tests to evaluate the performance of the gyro under conditions similar to those encountered during routine science observations, including moving to targets, locking on to a target, and performing precision pointing," [NASA said](#) in a news release. "After these engineering tests have been completed, Hubble is expected to soon return to normal science operations."

Ground operators put the telescope into a stable configuration earlier this month after one of the three active gyros that help point the telescope failed. According to NASA, the gyro that failed last week had been exhibiting end-of-life behavior for about a year, and its failure was not unexpected.

Hubble has three pairs of two gyroscopes, with each pair consisting of a primary and back-up gyroscope. Moreover, in each pair, one of the gyroscopes is of an "old" design, while the other is an "enhanced" (or newer) design intended to last for a longer period of time.

After the failure this month, all three of the "old" design gyros have stopped working. This left NASA with two enhanced gyros that were functioning normally and one that had acted up more than seven years ago before being taken out of service at that time. The Hubble telescope can operate on just a single gyro, but three working ones are optimal for normal operations.

Back to science, soon

During the last two weeks, operators have been trying to bring this third, previously balky gyro back online. And they're now reporting some success.

Within the gyroscope is a wheel spinning rapidly inside a sealed cylinder, and some blockage in the fluid around this cylinder appeared to be causing erroneously high spin rates. A series of maneuvers—including turns in opposite directions—seems to have cleared any blockage.

"Following the October 18 maneuvers, the team noticed a significant reduction in the high rates, allowing rates to be measured in low mode for brief periods of time," NASA reports. "On October 19, the operations team commanded Hubble to perform additional maneuvers and gyro mode switches, which appear to have cleared the issue. Gyro rates now look normal in both high and low mode." Now, the space agency plans to test the gyro under conditions like those during routine science activities. Once these tests are done, the telescope should resume normal science observations.

The Hubble Space Telescope has been in operation since its launch in 1990.

<http://bit.ly/2qfcVl2>

Noble metal-free catalyst system as active as platinum***Discovery of an alloy made up of five elements that is noble metal-free and as active as platinum***

The industry has been traditionally deploying platinum alloys as catalysts for oxygen reduction, which is for example essential in fuel cells or metal-air batteries. Expensive and rare, that metal imposes strict restrictions on manufacture.

Researchers at Ruhr-Universität Bochum (RUB) and Max-Planck-Institut für Eisenforschung have discovered an alloy made up of five elements that is noble metal-free and as active as platinum. They

[published their paper in the journal Advanced Energy Materials](#) on October 21, 2018.

New neighbours form active centres

The catalytic properties of non-noble elements and their alloys are usually rather poor. To the researchers' surprise, one alloy made up of five almost equally balanced components offer much better properties. This is because of the so-called high entropy effect. It causes multinary alloys to maintain a simple crystal structure.

"Through the interaction of different neighbouring elements, new active centres are formed that present entirely new properties and are therefore no longer bound to the limited properties of the individual elements," explains Tobias Löffler, PhD student at the RUB Chair of Analytical Chemistry - Center for Electrochemical Sciences headed by Professor Wolfgang Schuhmann. "Our research has demonstrated that this alloy might be relevant for catalysis."

Generating alloy nanoparticle libraries

Searching for an alternative to platinum, researchers at the RUB Chair of Materials for Microtechnology headed by Professor Alfred Ludwig deployed a special method to generate an alloy nanoparticle library of five source elements. Their atoms blend in plasma and form nanoparticles in a substrate of ionic liquid. The liquid is placed in small cavities on a carrier.

If the nanoparticles are located in the vicinity of the respective atom source, the percentage of atoms from that source is higher in the respective particle. In the centre of the carrier, all five elements are present in more or less equal quantities.

"This combinatorial process enables us to precisely control the composition of the alloy nanoparticles anywhere in the material library," says Alfred Ludwig.

Optimised composition

Headed by Professor Christina Scheu, the research team at the Max-Planck-Institut für Eisenforschung analysed the thus generated

nanoparticles using transmission electron microscopy. RUB chemists determined their catalytic activity and compared it with that of platinum nanoparticles.

In the process, they identified a system made of up five elements where the high entropy effect results in catalytic activity for an oxygen reduction that is similar to that of platinum. By optimising the composition further, they successfully improved the overall activity.

Far-reaching consequences for electrocatalysis

"These findings may have far-reaching consequences for electrocatalysis in general," surmises Wolfgang Schuhmann. The researchers are hoping to adapt the properties for any required reactions by taking advantage of the almost infinite number of possible combinations of the elements and modifications of their composition. "Accordingly, the application will not necessarily be limited to oxygen reduction," says Ludwig. The research team has already applied for a patent.

However, as the interplay of the elements is not fully understood, the researchers cannot develop any specific catalysts as yet. "This research project lays the foundation for further studies to gain a better understanding of the process, and it introduces high-entropy alloys made up of multiple elements as a new catalyst category," point out the researchers.

Funding

The project was funded by the Federal Ministry of Education and Research (NEMEZU, FKZ 03SF0497B and Mangan (FKZ 03EK3548)) and by the German Research Foundation (LU1175/23-1, SCHE634/21-1, Exploring Multinary Nanoparticles by Combinatorial Sputtering into Ionic Liquids and Advanced Transmission Electron Microscopy) as well as under the umbrella of the Transregio Collaborative Research Centre 247 and the Cluster of Excellence Ruhr explores Solvation, short Resolv (EXC1069).

Original publication

Tobias Löffler, Hajo Meyer, Alan Savan, Patrick Wilde, Alba Garzón Manjón, Yen Ting Chen, Edgar Ventosa, Christina Scheu, Alfred Ludwig, Wolfgang Schuhmann: Discovery of a multinary noble metal free oxygen reduction catalyst, in: Advanced Energy Materials, 2018, DOI: 10.1002/aenm.201802269.

<http://bit.ly/2qc6nDU>

Breakthrough test screens for all known bacterial infections

The precision medicine platform developed at the Center for Infection and Immunity is 1,000 times more sensitive than conventional screening methods and can detect signs of antibiotic resistance

Scientists at the Center for Infection and Immunity (CII) in the Columbia University Mailman School of Public Health have developed the first diagnostic platform that can simultaneously screen for all known human pathogenic bacteria as well as markers for virulence and antibiotic resistance. A study in the journal mBio provides details on the performance of the BacCapSeq platform.

"Once approved for clinical use, BacCapSeq will give physicians a powerful tool to quickly and precisely screen for all known pathogenic bacteria, including those that cause sepsis, the third leading cause of death in the United States," says first author Orchid M. Allicock, PhD, a post-doctoral researcher at CII. "This platform is 1,000 times more sensitive than traditional unbiased testing, at a level comparable to tests that screen one bacterium at a time."

Currently, the most common method used to test for sepsis can take as long as three days, and even longer to provide information on antibiotic resistance. While physicians wait for a result, they usually prescribe broad spectrum antibiotics, a practice that contributes to the growth of antibiotic resistance. BacCapSeq provides results in 70 hours, but the researchers believe that the platform will become faster with advances in computing power.

Each year, antibiotic-resistant infections claim 100,000 lives in the United States, and 700,000 globally, with the highest burden in the developing world, according to World Economic Forum estimates. The direct annual impact of antibiotic resistance in the U.S. is \$20-35 billion with an additional \$35 billion in lost productivity,

according to the U.S. Center for Disease Control and Prevention. Absent an effective response to limit further growth in antimicrobial resistance, the challenge will continue to increase. The World Bank issued a report in 2017 projecting an impact on the GDP between \$1.1 trillion and \$3.4 trillion.

BacCapSeq contains 4.2 million genetic probes used to detect the signature DNA of all 307 pathogenic bacteria, as well as biomarkers for antibiotic resistance and virulence. Each probe binds to a corresponding sequence; when a particular bacterium and biomarker is present in a sample, a magnetic process "pulls out" its unique sequences, which can then be used to identify the bacterium and its characteristics. To date, even the most advanced multiplexed polymerase chain reaction systems are only able to screen for up to 19 pathogenic bacteria, and none can assess virulence and antimicrobial resistance.

In the study, the researchers assess the performance of BacCapSeq in several ways: using nucleic acid from blood spiked with DNA from several different bacteria, blood spiked with bacterial cells, blood culture samples, and blood samples from patients with unexplained sepsis. In each case, the platform performance exceeded traditional methods, sometimes detecting infections that were missed by the alternative method. In one case, the test implicated the bacterium *Gardnerella vaginalis*, which is only rarely associated with significant disease, as the cause of unexplained sepsis in an individual with HIV/AIDS.

BacCapSeq is a complement to VirCapSeq, a similar test developed at CII that screens for all known human viral infections. Recent published studies have reported on that test's performance in Tanzania and Uganda. A test for differential diagnosis of fungal infections is in development.

"Microbiological intelligence must be an integral component of precision medicine," says W. Ian Lipkin, MD, director of CII and the

John Snow Professor of Epidemiology at Columbia Public Health. "Accurate, early differential diagnosis of infectious diseases and knowledge of drug sensitivity profiles will reduce mortality, morbidity, and health care costs."

Co-authors include Cheng Guo, Lokendra V. Chauhan, Joel Garcia, Adam Price, Stephen Morse, Nischay Mishra, and Thomas Brieze at CII and/or Columbia Mailman; and Anne-Catrin Uhlemann and Susan Whittier at Columbia University Irving Medical Center. The study was supported by the National Institute of Allergy and Infectious Diseases of the National Institutes of Health (Center for Research in Diagnostics and Discovery grant AI109761) and the Bill and Melinda Gates Foundation (OPP1163230).

<http://bit.ly/2JlMkf1>

Rewilding landscapes can help to solve more than one problem

Urbanisation, biodiversity loss, climate change: just some of the worldwide problems 'rewilding' - i.e. restoring food chains by returning 'missing' species to the landscape - can help tackle.

Researcher Liesbeth Bakker (NIOO-KNAW) has edited a theme issue of the world's oldest life sciences journal, *Phil Trans B*, on rewilding, together with a Danish expert. The issue is now available online.

When animals become extinct or disappear from an area, their unique role in nature is often lost. "There is increasing evidence that this global wildlife loss does not only imply the loss of charismatic animals, but also the functions they have in ecosystems", argues ecologist Liesbeth Bakker (NIOO-KNAW).

The consequences can be disastrous. Wildfires, for instance, have been an increasingly serious problem: without large herbivores to eat the plant material more of it remains, meaning more 'fuel' for such fires.

"Since the world-wide expansion of modern humans began", explains Bakker, "humans have overexploited large vertebrates. From the Late Pleistocene extinctions of terrestrial megafauna to the current poaching of elephants and rhinos."

From debate to data

If we are to restore nature, the role of these animals in the food web is crucial. One approach to obtaining a healthy food web (again) is by reintroducing 'missing' species. 'It's called trophic rewilding,' says Bakker. "There are other kinds of rewilding as well."



Bison in the Kennemerduinen National Park, The Netherlands. Staffan Widstrand/Rewilding Europe

An example of the ripple-effect caused by trophic rewilding is the reintroduction of wolves in Yellowstone National Park in the United States in the 1990s, which is even said to have changed the course of some rivers. The wolves brought down the deer/elk population, river banks suffered less erosion, and with the rivers fixed in their course more biodiversity-rich pools formed.

The story has become part of the rather romantic and fashionable image attached to rewilding. But while plenty of people may dabble or express opinions, "scientific data on the effects of explicit rewilding efforts have until now remained scarce", says Bakker. The theme issue of *Phil Trans B* which she and Danish researcher Jens-Christian Svenning (University of Aarhus) have guest-edited is meant to change that.

Elk and bison

In the theme issue, researchers from all over the world share their data. Among their findings is that in the Arctic, large herbivores such as reindeer and muskoxen can actually mitigate the impact of rising temperatures.

Other examples demonstrate a similarly positive impact. Replacing ruminant livestock with non-ruminant wildlife will reduce the emission of methane - a greenhouse gas - in rangeland farming,

beavers can enhance wetland plant diversity, and re-introductions of native carnivores can be an effective method for suppressing invasive carnivores and invasive herbivores.

Bakker adds: "Climate change doesn't form an impediment to the reintroduction of large animals in most cases. In the Netherlands, for instance, species such as the European bison and the elk feel right at home." She hopes rewilding will become an increasingly 'transdisciplinary' field, in which scientific and practical applications keep pace with each other and there's room for ecology, sociology, geography and economics.

Successful recipe

"These studies demonstrate that trophic rewilding is a promising tool to mitigate negative impacts of global change on ecosystems and their functioning", concludes Bakker. In due time it may even help to provide solutions for other global issues as well, including urbanisation and biodiversity loss. "But it's also clear that implementing trophic rewilding alone will not solve these problems." Altered land-use - e.g. providing more space for rivers to follow their natural temporal and spatial dynamics - plays an important role in recipes for successful rewilding. So does scale. "Generally, it emerges that large-scale trophic rewilding produces the best results, whereas in human-dominated, fragmented landscapes a certain level of management of ecosystems may still be needed."

But even under these circumstances, concludes Bakker, "a gradual increase in naturalness of ecosystems over time is achievable." And that's even true for the Netherlands, which despite its small size and issues of overpopulation and overexploitation continues to be one of the trailblazers for rewilding.

Theme issue:

'Trophic rewilding: consequences for ecosystems under global change', guest editors Liesbeth Bakker and Jens-Christian Svenning, Philosophical Interactions of the Royal Society B, volume 373, issue 1761, 5 December 2018 (online now: 10.1098/rstb/373/1762),

<http://rstb.royalsocietypublishing.org/content/373/1761>. NB. During Open Access Week, starting 22 October, all articles are being made available as Open Access.

Editorial overview:

Trophic rewilding: impact on ecosystems under global change, Elisabeth S. Bakker & Jens-Christian Svenning, <http://rstb.royalsocietypublishing.org/content/373/1761/20170432>

<http://bit.ly/2RksWBX>

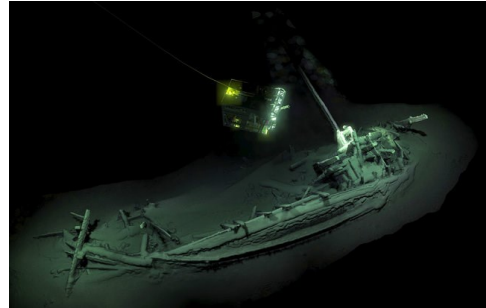
World's Oldest Intact Shipwreck Found at the Bottom of the Black Sea

Ship has been sitting undisturbed since 400 B.C.

By [Stephanie Pappas, Live Science Contributor](#)

The oldest intact shipwreck ever has been found resting on the bottom of the Black Sea.

Protected by the oxygen-free water at the seafloor, the ship has been sitting undisturbed since 400 B.C., researchers from the Black Sea Maritime Archaeology Project (Black Sea MAP) [announced Tuesday](#) (Oct. 23).



This ancient Greek vessel, described as the world's oldest intact shipwreck, was discovered at the bottom of the Black Sea off the coast of Bulgaria. It dates back to the year 400 B.C. Black Sea Maritime Archeology Project/EPA-EFE/Shutterstock

It is a Greek vessel that looks like something the [mythical hero Odysseus](#) could have sailed — literally. According to the researchers, a very similar vessel is painted on the side of the [British Museum's "Siren Vase,"](#) which depicts Odysseus chained to the mast of his ship as it sails past the sweet-voiced sirens.

"A ship, surviving intact, from the Classical world, lying in over 2 kilometers [1.2 miles] of water, is something I would never have believed possible," University of Southampton archaeologist Jon Adams, leader of the Black Sea MAP, said in the statement. "This

will change our understanding of shipbuilding and seafaring in the ancient world."

Fascinating find

The ship was discovered in the fall of 2017, on the third of three survey trips to the Black Sea. Led by Adams, Lyudmil Vagalinsky of the Bulgarian Academy of Science and Kalin Dimitrov of the Center of Underwater Archaeology in Bulgaria, the research team surveyed 770 square miles (2,000 square kilometers) of the seabed during all three seasons.

The investigations turned up more than 60 shipwrecks, including some previously reported to date [back to the Ottoman and Byzantine empires](#). The Black Sea has only a narrow connection to the Mediterranean Sea, so it drains poorly. And the Black Sea is fed by freshwater from the surrounding land, which floats on top of the saltier water closer to the bottom. This salty layer is extremely low in oxygen, which keeps wood-eating microbes away from shipwrecks on the seafloor. For that reason, even centuries-old ships look as if they went down yesterday. [[Gallery: Shipwrecks of the Black Sea](#)]

The Greek vessel sits about 1.2 miles (2 km) deep. The researchers used radiocarbon dating to show that the wreck dates back more than 2,400 years. The ship rests on its side, its mast and prow clearly visible and unbroken.

Rising waters

The main goal of the Black Sea MAP is to understand changes that have occurred since the last ice age, when the sea was much lower. Because the area has been a hub of civilization, the shipwrecks at the bottom form time capsules, revealing who used the sea for commerce and how they built their vessels.

The researchers have also excavated a settlement on the Bulgarian side of the sea near the Ropotamo River. The site tells a story of the Black Sea as melting glaciers raised sea levels and forced humans to

adapt. In the lowest layers of the excavation, about 8.2 feet (2.5 meters) below the current seafloor, are timbers and hearth fragments from a Bronze Age settlement, [the researchers previously reported](#). But by the Byzantine era (A.D. 330 -1453), the site was inundated, and ceramics revealed that people used the spot as a safe harbor. By the Ottoman era (A.D. 1299-1920), the spot was a deeper anchorage for trading vessels.

<https://nyti.ms/2O8jP5i>

Lavender's Soothing Scent Could Be More Than Just Folk Medicine

In mice, researchers found that some components of lavender odor had effects on anxiety similar to taking Valium.

By [JoAnna Klein](#)

Lavender bath bombs; lavender candles; deodorizing lavender sachets for your shoes, car or underwear drawer; lavender diffusers; lavender essential oils; even lavender chill pills for [humans](#) and [dogs](#). And from Pinterest: [370 recipes for](#) lavender desserts.

Take a deep breath. Release.

People like lavender. We've been using this violet-capped herb since at least medieval times. It smells nice. But Google "lavender" and results hint at perhaps the real fuel for our obsession: "tranquillity," "calm," "relaxation," "soothing," and "serenity." Lavender has purported healing powers for reducing stress and anxiety. But are these effects more than just folk medicine?

Yes, said [Hideki Kashiwadani](#), a physiologist and neuroscientist at Kagoshima University in Japan — at least in mice.

"Many people take the effects of 'odor' with a grain of salt," he said in an email. "But among the stories, some are true based on science."

In [a study published Tuesday in the journal Frontiers in Behavioral Neuroscience](#), he and his colleagues found that sniffing linalool, an alcohol component of lavender odor, was kind of like popping a Valium. It worked on the same parts of a mouse's brain, but without

all the dizzying side effects. And it didn't target parts of the brain directly from the bloodstream, as was thought. Relief from anxiety could be triggered just by inhaling through a healthy nose.

Their findings add to a [growing body of research](#) demonstrating anxiety-reducing qualities of lavender odors and suggest a new mechanism for how they work in the body. Dr. Kashiwadani believes this new insight is a key step in developing lavender-derived compounds like linalool for clinical use in humans.

Breaking big stories requires support.

Dr. Kashiwadani and his colleagues became interested in learning how linalool might work for anti-anxiety [while testing its effects on pain relief](#) in mice. In this earlier study, they noticed that the presence of linalool seemed to calm mice.

In this study, they exposed mice to linalool vapor, wafting from filter paper inside a specially made chamber to see if the odor triggered relaxation. Mice on linalool were more open to exploring, indicating they were less anxious than normal mice. And they didn't behave like they were drunk, as mice on benzodiazepines, a drug used to treat anxiety, or injected with linalool did

But the linalool didn't work when they blocked the mice's ability to smell, or when they gave the mice a drug that blocks certain receptors in the brain. This suggested that to work, linalool tickled odor-sensitive neurons in the nose that send signals to just the right spots in the brain — the same ones triggered by Valium.

Though he hasn't tested it in humans, Dr. Kashiwadani suspects that linalool may also work on the brains of humans and other mammals, which have similar emotional circuitry. This matters, because anxiety disorders affect nearly a fifth of all adults in the United States, and a lot of the drugs used to treat them come with side effects, sometimes less tolerable than the anxiety itself. Who wouldn't prefer to simply take a whiff of lavender and feel at peace with no impairment?

Of course, we are far from this, said Dr. Kashiwadani. Linalool is also just one part of lavender scent, like cumin is one part of curry. It's also unclear how linalool would work in humans. For example, what's the dose? And how would you take it?

Until then, don't go crazy with the lavender, folks. Dr. Kashiwadani said that with continuous exposure, the olfactory system gets used to the odor and responds less. Permeating your room with purple peace potion, unfortunately, may not displace your anxieties forever.

<http://bit.ly/2RkNn1A>

A type of moss could prove to be more medically effective than hemp

Until now, it was thought that cannabis was the only plant that produces THC

Currently, the medicinal use of cannabinoids, extracted from cannabis, is a subject of debate around the world. In Switzerland, more and more people are advocating for increased research into cannabis. Today, tetrahydrocannabinol (THC) is used in the medical field to deal with certain types of pain, muscle cramps, dizziness and loss of appetite.



Liverwort (*Radula perrottetii*). University of Bern/Stefan Fischer

However, it is an illegal narcotic and, accordingly, can trigger side effects. THC in its pure form was first isolated from cannabis in 1964 by Raphael Mechoulam at the Weizmann Institute of Science in Israel.

Until now, it was thought that cannabis was the only plant that produces THC. However, as early as 1994, [Japanese phytochemist Yoshinori Asakawa had discovered a substance](#) in the liverwort plant *Radula perrottetii* which was related to THC and had named this

natural substance "perrottetinene". In this natural product, the individual atoms are linked together in a manner similar to that of THC, however they differ in their three-dimensional structure and further exhibit an additional benzyl group.

A few years ago, Jürg Gertsch from the Institute of Biochemistry and Molecular Medicine at the University of Bern discovered that liverworts were being advertised as so-called "legal highs" on the internet. At the time, nothing was known about the pharmacological effects of this substance. Together with chemists from Erick Carreira's team from the Department of Chemistry at the ETH Zürich, Gertsch's research team in Bern biochemically and pharmacologically compared THC and perrottetinene.

Using animal models, they were able to demonstrate that perrottetinene reaches the brain very easily and that, once there, it specifically activates cannabinoid receptors. It even demonstrates a stronger anti-inflammatory effect in the brain than THC, something which makes perrottetinene particularly interesting when you consider its potential medical application "It's astonishing that only two species of plants, separated by 300 million years of evolution, produce psychoactive cannabinoids," says Gertsch. The study was [published in the journal Science Advances](#).

Perrottetinene is less psychoactive than THC

Low doses of THC have great therapeutic potential when it comes to treating various chronic illnesses. However, to date, THC is rarely used therapeutically. This is because, in higher doses, the substance has a strong psychoactive effect and is an illegal--and thus controlled--narcotic.

Andrea Chicca, a member of scientific staff in Jürg Gertsch's group, sees a potential for development in the therapeutic use of perrottetinene or similar substances: "This natural substance has a weaker psychoactive effect and, at the same time, is capable of inhibiting inflammatory processes in the brain."

In particular, in contrast to THC, perrottetinene inhibits the prostaglandins in the brain which are factors causing inflammation. In doing so, perrottetinene has an effect on cannabinoid receptors which is similar to that of the endocannabinoids produced by our own bodies. However, according to the researchers, more studies are necessary, for example in pre-clinical models of chronic and inflammatory pain.

Transdisciplinary cannabinoid research

Large amounts of this bioactive substance were required for the pharmacological investigations. The collaboration with the chemists in Erick Carreira's group from the ETH Zurich was fundamental for this research project, because it would have been impossible to isolate the natural substance from the liverwort, which only grows in Japan, New Zealand and Costa Rica. To this end, Erick Carreira's group developed a new synthesis method specifically for controlling the three-dimensional structure on a molecular level.

"The present study is a prime example of how new synthetic concepts can make a contribution towards enriching our pharmacological knowledge of biologically-active natural substances", said Michael Schafroth in recognition of the ETH Zurich's work.

As a PhD student under Professor Carreira, Schafroth focused on new synthesis methods for cannabinoids. "Both solid fundamental research in the field of biochemical and pharmacological mechanisms as well as controlled clinical studies are required to carry out cannabinoid research", says Gertsch. To achieve this, researchers from various disciplines are working together.

<http://bit.ly/2ObSpLY>

New Caledonian crows can create compound tools
The birds are able to combine individual parts to form a long-distance reaching aid

An international team of scientists from the Max Planck Institute for Ornithology in Seewiesen, Germany, and the University of Oxford have revealed that New Caledonian crows are able to create tools by combining two or more otherwise non-functional elements, an ability so far observed only in humans and great apes.



This is a new Caledonian crow with a stick tool. Auguste von Bayern

The new study shows that these birds can create long-reaching tools out of short combinable parts - an astonishing mental feat. Assemblage of different components into novel functional and manoeuvrable tools has, until now, only been observed in apes, and anthropologists regard early human compound tool manufacture as a significant step in brain evolution. Children take several years before creating novel tools, probably because it requires anticipating properties of yet unseen objects. Such anticipation, or planning, is usually interpreted as involving creative mental modelling and executive functions.

The study demonstrates that this species of crow possess highly flexible abilities that allow them to solve complex problems involving anticipation of the properties of objects they have never seen. 'The finding is remarkable because the crows received no assistance or training in making these combinations, they figured it out by themselves,' says Auguste von Bayern, first author of the study from the Max-Planck-Institute for Ornithology and University of Oxford.

Famous for the use of tools

The New Caledonia crows (*Corvus moneduloides*) from the South Pacific are of the same species as Betty, who became famous in 2002

as the first animal shown to be able to create a hooked tool by bending a pliable material. Researchers had already been able to show how this remarkable species were able to use and make tools in the wild and in captivity, but they had never previously been seen to combine more than one piece to make a tool.

Alex Kacelnik from the University of Oxford says: 'The results corroborate that these crows possess highly flexible abilities that allow them to solve novel problems rapidly, but do not show how they do it. It is possible that they use some form of virtual simulation of the problem, as if different potential actions were played in their brains until they figure out a viable solution, and then do it. Similar processes are being modelled on artificial intelligences and implemented in physical robots, as a way to better understand the animals and to discover ways to build machines able to reach autonomous creative solutions to novel problems.'

The researchers presented eight New Caledonian crows with a puzzle box they had never encountered before, containing a small food container behind a door that left a narrow gap along the bottom. Initially, the scientists left some sufficiently long sticks scattered around, and all the birds rapidly picked one of them, inserted it through the front gap, and pushed the food to an opening on the side of the box. All eight birds did this without any difficulty. In the next steps, the scientists left the food deep inside the box but provided only short pieces, too short to reach the food. These short pieces could potentially be combined with each other, as some were hollow and others could fit inside them.

Without any help or demonstration, four of the crows partially inserted one piece into another and used the resulting longer compound pole to reach and extract the food. At the end of the five-step investigation, the scientists made the task more difficult by supplying even shorter combinable parts, and found that one

particular bird, 'Mango', was able to make compound tools out of three and even four parts.

Although the authors explain that the mental processes by which the birds achieve their goals have not yet been fully established, the ability to invent a tool is interesting in itself. Few animals are capable of making and using tools, and also in human development the capacity only emerges late. While children start using tools reliably when they are about 18 months old, they only invent novel tools suited to solve a given problem reliably when they are at least five years old. Archaeological findings indicate that such compound tools arose only late in human cultural evolution (probably around 300,000 years ago in the Middle Palaeolithic) and might have coevolved with planning abilities, complex cognition and language. The crows' ability to construct novel compound tools does not imply that their cognitive mechanisms equal those of humans or apes, but helps to understand the cognitive processes that are necessary for physical problem solving.

Original publication A.M.P. von Bayern, S. Danel, A.M.I. Auersperg, B. Mioduszevska, A. Kacelnik. [Compound tool construction by New Caledonian crows](#). *Scientific Reports* volume 8, Article number: 15676 (2018)

<http://bit.ly/2qgKLq>

Deaths due to tainted herbal medicine under-recorded

A University of Adelaide forensic pathologist is [warning that potentially harmful substances found in herbal medicines](#) may be playing a bigger role in deaths of 'health tourists' than previously thought.

Professor Roger Byard is calling for closer checks during post-mortems for the presence of drugs and adulterants that originate from herbal remedies.

"There is a possibility that harmful materials found in herbal medicines are either contributing to, or causing, deaths of overseas travellers," says Professor Byard.

"These factors should be considered in all medical and legal cases involving recent overseas travel, particularly to Asian destinations." As part of health and wellness tourism, Western travellers to many Asian countries now often visit herbal centres. Free health checks may be performed at these centres and herbal products are offered for sale. They offer hope to a growing number of people looking for a cure for their health problems.

"This type of health tourism is based upon learning about and consuming traditional medicinal herbs and is an important part of the worldwide medical tourism industry," says Professor Byard.

"Patients wrongly believe that they are being treated without using harmful chemicals or drugs.

Studies have found some herbal remedies have been adulterated with approved or banned drugs and even toxic heavy metals. Adulterants have been linked to a range of side effects of varying severity including hyper tension, heart problems, psychiatric disorders and in some instances even deaths.

"The composition of many of these products is uncertain, there may be contaminants and pharmaceutical additives, and their interaction with prescription medications is unpredictable," says Professor Byard.

"However, the potential role and impact of herbal medicines, and possible adulterants within them, is usually not considered in medicolegal cases.

"Forensic facilities may be missing the presence of harmful or toxic substances when carrying out post mortem assessments not because the substances aren't there but because pathologists may not be looking for them.

"When considering cases in which a person has died after taking herbal medicines sourced from overseas, forensic pathologists need to take extra care to consider the possibility that adulterants have played a role in the person's demise," says Professor Byard.

<https://nyti.ms/2PXA32V>

Spinal Cord Repaired in the Womb, in First Surgery of its Kind in U.K.

A team of surgeons has repaired the spinal cords of two babies while they were still in their mothers' wombs, the first surgery of its kind in Britain.

By [Ceylan Yeginsu](#)

LONDON — The operations were carried out over the summer at University College Hospital in London by 30 surgeons to treat spina bifida, a condition in which the spinal column and spinal cord do not develop properly in the womb, causing a gap in the spine.

"This results in changes to the brain, as well as severe permanent damage to the nerves on the lower half of the body," Dominic Thompson, a neurosurgeon at the Great Ormond Street Hospital in London who was involved in the surgery, [said Thursday in a statement](#).

The surgery is usually performed after birth, but research has shown that the earlier the condition is treated, the greater the chances of healthy mobility. Those born with spina bifida are often unable to walk and have to undergo a series of operations to drain fluid from their brain.

The prenatal surgery involved opening the uterus, exposing the spina bifida and closing the defect without delivering the baby. Previously, mothers-to-be in Britain had to travel to the United States, Belgium or Switzerland to receive the prenatal surgery or to wait for the baby to be born.

The babies who had the surgery this summer, and their mothers, were doing well, according to a spokeswoman for [University College London Hospitals](#).

Prof. Anna David, a fetal medicine consultant at the Institute for Women's Health at University College London, said that it took three

years to bring the procedure to Britain, where more than 200 children are born with spina bifida each year.

“Our resolve to offer this service was based on the findings of a large, multicenter, randomized control trial in the U.S., which compared prenatal closure to postnatal closure, and the observation that fetal surgery could be safely reproduced in Europe by proper training,” Professor David said in an email.

The United States trial showed that prenatal closing of the defect resulted in a 50 percent reduction in the need for a surgical shunt — a device that relieves pressure on the brain caused by fluid accumulation — in newborns. The procedure can have long-term risks and complications. The prenatal procedure also showed a significant improvement in the babies’ motor function at 30 months of age.

“Long-term follow-up of children that have undergone prenatal closure in the womb suggests that brain function, mobility and total independence were higher in nonshunted than shunted children aged 5,” Prof. Paolo De Coppi of the U.C.L. Great Ormond Street Institute of Child Health, said in the study.

The surgery will be made available for suitable patients at the Center for Prenatal Therapy at University College London Hospitals and Great Ormond Street. It takes about 90 minutes and carries a risk of premature labor.

The British government is preparing a consultation on whether to add folic acid to flour to help reduce birth defects like spina bifida. Research from the Scientific Advisory Committee on Nutrition suggests that folic acid significantly reduces the risk of fetal abnormalities.

The public health minister, Steve Brine, announced on Tuesday that the government would consider evidence about the benefits of folic acid fortification, as well as the practicality and safety.

Women who are trying to become pregnant are advised to take a daily supplement of 400 micrograms of folic acid before they conceive or during the first 12 weeks of their pregnancy, but many women with unplanned pregnancies miss out on the nutrients, government research has found.

Plans to fortify flour with folic acid are aimed at reaching those with the lowest intake, including younger women from deprived backgrounds.

“All women should be able to access the nutrients they need for a healthy pregnancy,” Mr. Brine said in a statement. “And in turn, reduce the risk of devastating complications.”

<http://bit.ly/2OWqTOo>

“Moral Machine” reveals deep split in autonomous car ethics

Huge experiment illustrates the challenge in deciding who dies in the brave new world of self-driving vehicles.

Andrew Masterson reports.

An experimental online platform designed to explore moral protocols for autonomous vehicles attracted almost 40 million responses, and the results point to massive problems for roboticists, ethicists, manufacturers and policy-makers striving to find a consensus.

The exercise, dubbed the Moral Machine experiment, was conducted by a team of researchers led by Edmond Awad from the Massachusetts Institute of Technology in the US, and results are [reported and discussed](#) in the journal *Nature*.

The aim of the experiment was to provide some meat on the bones of an urgent ethical discussion.

Self-driving vehicles are likely to become commonplace in cities across the world in only a few years. Although the technological challenges inherent in designing such cars and trucks are being rapidly overcome, the ethical issues they create are a long way from

being resolved – and, indeed, may not actually be resolvable in a way that accords with current moral paradigms.

Certainly, say Awad and his colleagues, they are never going to be solved by simplistic maxims such as those contained in Isaac Asimov’s oft-cited laws of robotics.

“Asimov’s laws were not designed to solve the problem of universal machine ethics, and they were not even designed to let machines distribute harm between humans,” they write.

“They were a narrative device whose goal was to generate good stories, by showcasing how challenging it is to create moral machines with a dozen lines of code.” However, they add, “we do not have the luxury of giving up on creating moral machines”.

The nub of the ethical dilemma is inherent in the question of what an autonomous car should do when a circumstance arises in which harm is unavoidable. If a vehicle is barreling along the road and something – a child, an adult, an animal – suddenly steps out in front of it, what should it do? Should it swerve to avoid the pedestrian (or animal) and thus injure or kill its passengers, or should it preserve its passengers and harm or kill the pedestrian?

And are there other factors that might affect that choice: the species, age, gender or social status of any of the players in the drama, for instance?

These, as the researchers point out, are not choices that can be wholly made by either ethicists or manufacturers. To work out, they have to accord with the moral positions of humanity – a consensus, the experimental results show, that may not exist and may be impossible to create.

In the Moral Machine game, users were required to decide whether an autonomous car careened into unexpected pedestrians or animals, or swerved away from them, killing or injuring the passengers.

The scenario played out in ways that probed nine types of dilemmas, asking users to make judgements based on species, the age or gender

of the pedestrians, and the number of pedestrians involved. Sometimes other factors were added. Pedestrians might be pregnant, for instance, or be obviously members of very high or very low socio-economic classes.

All up, the researchers collected 39.61 million decisions from 233 countries, dependencies, or territories.

On the positive side, there was a clear consensus on some dilemmas. “The strongest preferences are observed for sparing humans over animals, sparing more lives, and sparing young lives,” Awad and colleagues report. “Accordingly, these three preferences may be considered essential building blocks for machine ethics, or at least essential topics to be considered by policymakers.”

The four most spared characters in the game, they report, were “the baby, the little girl, the little boy, and the pregnant woman”.

So far, then, so universal, but after that divisions in decision-making started to appear and do so quite starkly. The determinants, it seems, were social, cultural and perhaps even economic.

Awad’s team noted, for instance, that there were significant differences between “individualistic cultures and collectivistic cultures” – a division that also correlated, albeit roughly, with North American and European cultures, in the former, and Asian cultures in the latter.

In individualistic cultures – “which emphasise the distinctive value of each individual” – there was an emphasis on saving a greater number of characters. In collectivistic cultures – “which emphasise the respect that is due to older members of the community” – there was a weaker emphasis on sparing the young.

Given that car-makers and models are manufactured on a global scale, with regional differences extending only to matters such as which side the steering wheel should be on and what the badge says, the finding flags a major issue for the people who will eventually have to program the behaviour of the vehicles.

“Because the preference for sparing the many and the preference for sparing the young are arguably the most important for policymakers to consider, this split between individualistic and collectivistic cultures may prove an important obstacle for universal machine ethics,” write the researchers, with admirable understatement.

Policy-makers are not, they are quick to add, beholden to reflect the preferences of the Moral Machine’s 40-million-user cohort. Indeed, to do so would result in some appalling decisions, given that the results also show weak “but clear” preferences for sparing “women over men, athletes over overweight persons, or executives over homeless persons”.

Awad and colleagues hope that the results of their experiments will provide another level of solid data for the people in laboratories, factories and governments who will have to eventually sign off on a code of ethics for autonomous cars.

But it is not, they note, a matter that can be delayed. Indeed, they conclude their report on an ominous note.

“Never in the history of humanity have we allowed a machine to autonomously decide who should live and who should die, in a fraction of a second, without real-time supervision,” they write.

“We are going to cross that bridge any time now, and it will not happen in a distant theatre of military operations; it will happen in that most mundane aspect of our lives, everyday transportation. Before we allow our cars to make ethical decisions, we need to have a global conversation to express our preferences to the companies that will design moral algorithms, and to the policymakers that will regulate them.”

<https://bbc.in/2yBhTNW>

'The food supplement that ruined my liver'

Jim McCants took green tea capsules in a drive to get healthy in middle age. His doctors now say they left him needing an urgent liver transplant, writes the BBC's Tristan Quinn.

It should have been one of the happiest days of his life. But Jim McCants looks back on his youngest son's high school graduation with mixed emotions. As he sat down next to his wife Cathleen in the university auditorium, just outside Dallas, Texas, she turned to look at him.

"She said 'Do you feel OK?'" Jim recalls. "I said, 'Yeah I feel fine, why?' 'Your face is yellow, your eyes are yellow, you look terrible.' When I looked in the mirror it was shocking."

It was shocking partly because Jim, then 50, had been working on improving his lifestyle and losing weight, focusing on eating more healthily and taking regular exercise.

"My dad had a heart attack at aged 59 and he did not make it," says Jim. "There's a lot that he missed out on with us and I was determined to do what I can to take care of myself as best I can, so that I don't miss out."

But soon after his son's graduation, Jim was admitted to hospital with a suspected liver injury.

Trying to identify the cause of Jim's liver injury, those treating him ruled out alcohol.

"For the last 30 years I drank maybe a six-pack of beer a year, no wine. So alcohol was not a big part of my life," Jim says.

They also ruled out prescription drugs - he wasn't taking any at the time - and smoking, something he had never done.

"Then my hepatologist drilled in to, 'What about any over-the-counter supplements?'" says Jim.

As part of his mid-life health kick, Jim had started taking a green tea supplement because he had heard it might have cardiac benefits. These supplements have grown in popularity in recent years, often breathlessly promoted online for their antioxidant benefits, and their supposed ability to aid weight loss and prevent cancer.

"I felt fine then," remembers Jim, who lives in Prosper, north of Dallas. "I was walking or running 30-to-60 minutes, five or six days

a week." He was working as a finance manager but hoped to retrain as a physician assistant. "I was taking two or three classes at a time at nights and at weekends," he recalls.

He had been taking the green tea supplement for two to three months when he became ill. According to Jim's medical record this is the presumed cause of his liver injury. "It was shocking because I'd only heard about the benefits," remembers Jim. "I'd not heard about any problems."

After his admission to hospital, Jim went into a "holding pattern", waiting for the results of a series of blood tests to establish the seriousness of his liver injury. Then, about three weeks after his wife had first noticed he looked ill, one of his liver doctors delivered the news he had been fearing: "She said you need a liver transplant. This has to happen fast. You have days - you don't have a week."

Jim was stunned.

"I was thinking this looks very bleak for me. It really crystallises what's important in life. I wasn't there thinking about projects at work. I was thinking of different people that were important to me for different reasons."

What is it about green tea supplements that might cause harm at certain doses to some people? Scientists do not know for certain. Because green tea has been drunk for thousands of years, supplements consisting of its concentrated form are regulated in the US and Europe as foods, not medicines. That means that specific safety testing has not been required, so the scientific picture of how green tea supplements might affect our health is incomplete.

"If you are drinking modest amounts of green tea you're very safe," says Prof Herbert Bonkovsky, director of liver services at Wake Forest University School of Medicine in North Carolina, who has been tracking injuries linked to green tea supplements for nearly 20 years. "The greater risk comes in people who are taking these more concentrated extracts."

Concern has focused on a potentially toxic ingredient called Epigallocatechin-3-gallate or EGCG, the most abundant of the naturally occurring compounds with antioxidant properties in green tea, called catechins. There are likely to be a number of factors that might make an individual susceptible to harm from EGCG including genetics, and the way supplements are used.

"Usually people are taking these green tea extracts trying to lose weight, so they're often not eating," Dr Bonkovsky explains. "We know from animal studies that fasted animals absorb a much higher percentage of the catechins than do fat animals. There may well be other factors of other drugs, other chemicals, use of alcohol that are also important as modifying factors."

Antioxidants

Antioxidants are a group of vitamins and other compounds that for many have taken on miraculous properties, helping to drive the global market for supplements of all kinds, now worth more than £100bn per year.

Antioxidants ward off "free radicals", molecules produced in our cells as they turn oxygen and food into energy. Just as oxygen and water corrode iron, too many free radicals can damage our cells.

In the 1950s, Prof Denham Harman theorised that free radicals drove the process by which the body ages and could lead to disease.

But some scientists now believe that free radicals at certain levels may be beneficial for human health, and argue that the orthodox view of the last half century that antioxidants are an unalloyed good is outdated.

While millions of people take green tea supplements safely, at least 80 cases of liver injury linked to green tea supplements have been reported around the world, ranging from lassitude and jaundice to cases requiring liver transplants. Those harmed after taking green tea pills have included teenagers, like 17-year-old Madeline Papineau

from Ontario, Canada who developed liver and kidney injury, and an 81-year-old woman diagnosed with toxic acute hepatitis.

[A recent investigation by the European Food Safety Authority into the safety of green tea](#) concluded that catechins from green tea drinks are "generally safe", but when taken as supplements catechin doses at or above 800mg per day "may pose health concerns". The EFSA could not identify a safe dose on the basis of available data and called for more research to be carried out.

The day after Jim was told he needed a liver transplant, amazingly he was told a suitable liver had been found. "I was elated. The phone call that there was a match gave me hope that there would be something positive on the other side of this for me," he says.

The liver transplant saved Jim's life. But four years later he still has serious health problems including kidney disease that may require dialysis and a transplant in the future. He sees his liver and kidney doctors twice a year, and lives with chronic abdominal pain.

"My life before was pretty active. And now it's much more sedentary and I struggle with fatigue," he says.

It's a "tremendous blessing", as he puts it, that his managers allow him to work from home. "I may need a lie down for 20 or 30 minutes during the day. I'm able to just let my manager know I'm going offline, I'll be back."

Jim is pursuing a lawsuit against the American firm Vitacost, which sold the green tea supplement he took. "I'm hoping that they make the decision to put a very strong warning label on the product, on the website, let people know before they buy it," he says.

Vitacost did not want to comment on the legal case, but said: "We take the safety of our Vitacost brand supplements very seriously and stand behind the quality of our products."

Four years on, Jim reflects on how his life and that of his family changed after he took a green tea supplement.

"I didn't expect harm. I expected that I might waste my money, I may take these and they don't do a bit of good. I can accept that risk," he says. "But the risk that it could cause my liver to fail, that's a risk that's too high for somebody to take."

<http://bit.ly/2OcIJ3R>

New peptide destroys Zika virus in brain for first time *Engineered peptide thought to be able to disrupt the lipid structure of Zika virus' coat*

By [Gege Li](#) 25 October 2018

An engineered peptide has emerged as a viable drug candidate to treat Zika and other mosquito-borne viruses as it's the first therapy of its kind that is able to enter the brain to fight infection.

Disrupting the lipid envelope of Zika virus particles has previously been shown to halt infection by reducing viral load and spread – but only in *in vitro* experiments. The breakthrough *in vivo* has come about thanks to a novel antiviral engineering strategy that uses D-amino acids.

The engineered peptide is thought to be able to disrupt the lipid structure of the Zika virus' coat

Researchers from Singapore, Brazil and Belgium engineered an α -helical peptide from a D-enantiomer amino acid called AH-D that targets the highly curved membrane of small enveloped viruses such as Zika. The peptide can cross the blood–brain barrier to reach the brain, something that is notoriously difficult to do. This is a critical feature as the virus can cause neurodegeneration and brain damage.

‘We realised that in this specialised engineered form, in a few cases the peptides can actually cross the central nervous system in a very efficient way,’ says [Nam-Joon Cho](#) of Nanyang Technological University, Singapore, who led the work. ‘I believe it happened to be this peptide’s conformation that allowed it to do this and most importantly attack the virus in the brain.’

Cho's team thinks the specific surface topology of AH-D allowed it to interact with the lipid membrane of virus particles, while the peptide's amphipathicity allowed it to cross the blood-brain barrier. Why some amphipathic peptides can cross this barrier while others can't is still unknown, says Cho.

AH-D was highly effective at tackling the virus: not only could it rupture the virus' lipid envelope much quicker than the L-isomer equivalent, it also worked against other neurotropic viruses *in vitro* such as Dengue and Chikungunya which have a similar structure to Zika. The peptide showed just as much promise in Zika virus-infected mice, reducing viral load and inflammation in the brain and protecting against death.

[Avindra Nath](#), a physician at the National Institute of Neurological Disorders and Stroke in the US, is impressed. 'Both their *in vitro* and mouse model data looks very encouraging,' he says. He adds that it's 'surprising' such a large 27 amino acid peptide can cross the blood-brain barrier but its size means 'immune responses could be developed against it which would then negate its effects'.

As to why this technique hasn't been used in the past, Cho puts it down to their unconventional yet powerful approach to characterising AH-D's potency. 'We used a unique type of assay where we can simultaneously monitor the interaction of the drug candidate with up to 1000 model virus particles with single-particle analysis,' he explains. 'I'm hoping that the antiviral attributes will mean the mechanism is more widely adopted as it demonstrates a new way to approach the problem.'

References J Jackman et al, Nat. Mater., 2018, DOI: [10.1038/s41563-018-0194-2](https://doi.org/10.1038/s41563-018-0194-2)

<http://bit.ly/2JINuqX>

Late night snacker? Make it cottage cheese

New research shows protein before bed supports metabolism, muscle recovery

TALLAHASSEE, Fla. -- Eager to eat a snack before bedtime? A protein-filled snack like cottage cheese is the way to go, say Florida State University researchers.

Associate Professor of Nutrition, Food and Exercise Sciences Michael Ormsbee and former FSU graduate student Samantha Leyh found that consuming 30 grams of protein about 30 minutes before bed appears to have a positive effect on muscle quality, metabolism and overall health. And for those who have sworn off eating at night, there is no gain in body fat.

Their findings are published in the *British Journal of Nutrition*.

Study participants -- active young women in their early 20s -- ate samples of cottage cheese 30 to 60 minutes before bedtime. Researchers specifically wanted to see if this food may have an impact on metabolic rate and muscle recovery.

This is one of the first nutrition studies where participants consumed a whole food as opposed to a protein shake or some form of supplement.

"Until now, we presumed that whole foods would act similarly to the data on supplemental protein, but we had no real evidence," Ormsbee said. "This is important because it adds to the body of literature that indicates that whole foods work just as well as protein supplementation, and it gives people options for presleep nutrition that go beyond powders and shaker bottles."

Leyh, who is now a research dietitian with the Air Force, said the results serve as a foundation for future research on precise metabolic responses to whole food consumption.

"While protein supplements absolutely have their place, it is important to begin pooling data for foods and understanding the role they can play in these situations," Leyh said. "Like the additive and synergistic effects of vitamins and minerals when consumed in whole food form such as fruits or veggies, perhaps whole food sources may follow suit. While we can't generalize for all whole foods as we have

only utilized cottage cheese, this research will hopefully open the door to future studies doing just that."

Ormsbee said that his research team will start examining more presleep food options and longer-term studies to learn more about the optimal food choices that can aid individuals in recovery from exercise, repair and regeneration of muscle and overall health.

"There is much more to uncover in this area of study," he said.

Other researchers contributing to this research are FSU graduate student Brandon Willingham, former graduate student Daniel Baur and Professor of Nutrition, Food and Exercise Sciences Lynn Panton.

<http://bit.ly/2RkMUMJ>

Survey: Few women told by doctor that breastfeeding can reduce cancer risk

Only 16 percent of women learned about the link between breastfeeding and breast cancer risk reduction from a medical professional

A new survey shows that although nearly 60 percent of breastfeeding mothers knew about the link between breastfeeding and breast cancer risk reduction, just 16 percent say they learned this from a medical professional.

This is concerning, says study principal investigator Bhuvana Ramaswamy, MD, because women should be informed that breastfeeding can reduce breast cancer risk and improve mother's health. Epidemiological studies show strong correlation between prolonged breastfeeding and reduced risk of developing triple negative breast cancer, an aggressive form of breast cancer. This knowledge is especially relevant for African American women considering whether to breastfeed, who are two times more likely to develop triple negative breast cancer when compared with women of other ethnicities.

"We have a duty as a medical community to ensure our patients have reliable knowledge," said Ramaswamy, breast medical oncology

division director at The Ohio State University Comprehensive Cancer Center - Arthur G. James Cancer Hospital and Richard J. Solove Research Institute (OSUCCC - James). "When it comes from a professional, medical information is much more likely to affect people's choices. When it comes to breast cancer specifically, prevention is the best outcome."

For this study, OSUCCC - James researchers conducted a survey of 724 women who had at least one live birth. Survey respondents were recruited through the Ohio State University Wexner Medical Center primary care practices and a national clinical research registry.

While a majority of respondents - 92 percent - reported that they had chosen to breastfeed, only 56 percent of all respondents noted that they were aware of the link between prolonged breastfeeding and breast cancer risk reduction prior to making the decision. Among those that did not breastfeed, 59 percent say that knowledge of this risk reduction would have impacted their decision to breastfeed.

The data was published in the medical journal *Breastfeeding Medicine*.

Ongoing Research:

This survey was part of larger research effort at the OSUCCC - James exploring the specific mechanisms of how breastfeeding reduces a woman's risk for breast cancer.

Previous studies suggest that giving birth and breastfeeding lowers a woman's overall risk of developing breast cancer, with the most recent data pointing to breastfeeding being protective specifically against triple-negative breast cancers. African-American/black women have a disproportionately high rate of developing aggressive triple-negative breast cancer while also having higher birth rates and lower rates of breastfeeding. Research has also shown that women native to Africa have higher rates of breastfeeding and lower rates of breast cancer. The reasons how breastfeeding affect breast cancer

risk remain unclear but research suggests that it may be related to pro-inflammatory processes coordinated by STAT3 activation.

Ramaswamy is leading a basic science study that will test the hypothesis that an overarching biologic mechanism of altered STAT3 activation triggering a proliferative/inflammatory environment in the breast tissue that did not undergo gradual involution following pregnancy and prolonged breastfeeding results in a higher risk for breast cancer. Knowledge gained in this study is expected to enhance knowledge of the biological mechanisms underlying the connection between breastfeeding and breast cancer risk, particularly difficult-to-treat triple-negative breast cancers. This will also help identify prevention strategies for mothers who are unable to breastfeed. The ongoing study is funded by Pelotonia, a grassroots cycling event that has raised more than \$156 million for cancer research conducted at the OSUCCC - James.

<http://bit.ly/2Q0lOdD>

Mind's quality control center found in long-ignored brain area

Cerebellum checks and corrects thoughts, movement

The cerebellum can't get no respect. Located inconveniently on the underside of the brain and initially thought to be limited to controlling movement, the cerebellum has long been treated like an afterthought by researchers studying higher brain functions.

But researchers at Washington University School of Medicine in St. Louis say overlooking the cerebellum is a mistake. Their findings, published Oct. 25 in *Neuron*, suggest that the cerebellum has a hand in every aspect of higher brain functions -- not just movement, but attention, thinking, planning and decision-making.

"The biggest surprise to me was the discovery that 80 percent of the cerebellum is devoted to the smart stuff," said senior author Nico Dosenbach, MD, PhD, an assistant professor of neurology, of occupational therapy and of pediatrics. "Everyone thought the

cerebellum was about movement. If your cerebellum is damaged, you can't move smoothly -- your hand jerks around when you try to reach for something. Our research strongly suggests that just as the cerebellum serves as a quality check on movement, it also checks your thoughts as well -- smoothing them out, correcting them, perfecting things."

Dosenbach is a founding member of the Midnight Scan Club, a group of Washington University neuroscientists who have taken turns in an MRI scanner late at night, scanning their own brains for hours to generate a massive amount of high-quality data for their research. A previous analysis of Midnight Scan Club data showed that a kind of brain scan called functional connectivity MRI can reliably detect fundamental differences in how individual brains are wired.

Postdoctoral researcher and first author Scott Marek, PhD, decided to apply a similar analysis to the cerebellum. In the better-known cerebral cortex -- the crumpled outer layer of the brain -- wiring maps have been drawn that connect distant areas into networks that govern vision, attention, language and movement. But nobody knew how the cerebellum is organized in individuals, partly because a quirk of MRI technology means that data obtained from the underside of the brain tend to be low quality. In the Midnight Scan Club dataset, however, Marek had access to more than 10 hours of scans on each of 10 people, enough to take a serious look at the cerebellum.

Using the cortex's networks as a template, Marek could identify the networks in the cerebellum. Notably, the sensory networks are missing -- vision, hearing and touch -- and only 20 percent of the cerebellum is devoted to movement, roughly the same amount as in the cerebral cortex. The remaining 80 percent is occupied by networks involved in higher-order cognition: the attention network; the default network, which has to do with daydreaming, recalling memories and just idly thinking; and two networks that oversee executive functions such as decision-making and planning.

"The executive function networks are way overrepresented in the cerebellum," Marek said. "Our whole understanding of the cerebellum needs to shift away from it being involved in motor control to it being more involved in general control of higher-level cognition."

The researchers measured the timing of brain activity and found that the cerebellum was consistently the last step in neurologic circuits. Signals were received through sensory systems and processed in intermediate networks in the cerebral cortex before being sent to the cerebellum. There, the researchers surmise, the signals undergo final quality checks before the output is sent back to the cerebral cortex for implementation.

"If you think of an assembly line, the cerebellum is the person at the end who inspects the car and says, 'This one is good; we'll sell it,' or 'This one has a dent; we have to go back and repair it,'" Dosenbach said. "It's where all your thoughts and actions get refined and quality controlled."

People with damage to their cerebellum are known to become uncoordinated, with an unsteady gait, slurred speech and difficulty with fine motor tasks such as eating. The cerebellum also is quite sensitive to alcohol, which is one of the reasons why people who have had too many drinks stumble around. But the new data may help explain why someone who is inebriated also shows poor judgment. Just as a person staggers drunkenly because his or her compromised cerebellum is unable to perform the customary quality checks on motor function, alcohol-fueled bad decisions might also reflect a breakdown of quality control over executive functions.

Marek also performed individualized network analyses on the 10 people in the data set. He found that while brain functions are arranged in roughly the same pattern in everyone's cerebellum, there is enough individual variation to distinguish brain scans performed on any two participants. The researchers are now investigating

whether such individual differences in cerebellar networks correlate with intelligence, behavior, personality traits such as adaptability, or psychiatric conditions.

"Many people who are looking at links between brain function and behavior just ignore the cerebellum," Dosenbach said. "They slice off that data and throw it away, because they don't know what to do with it. But there are four times as many neurons in the cerebellum as in the cerebral cortex, so if you're leaving out the cerebellum, you've already shot yourself in the foot before you started. The promise of imaging the whole human brain at once is to understand how it all works together. You can't see how the whole circuit works together when you're missing a major piece of it."

<http://bit.ly/2RjfePw>

The world's largest campodeid dipluran named after the mythological giant Daidarabotchi

The insect-like animal is also the first subterranean representative of its family in Japan

Amongst the fauna thriving in the subterranean spaces below the surface of the earth's crust, the insect-like diplurans and, precisely, those in the campodeid family are one of the best-known groups, currently comprising almost 150 species. However, not a single subterranean member of the family had been known from Japan until very recently.

As part of a [project](#) at the [National Council of Technological and Scientific Development](#), the research team of Dr. Rodrigo Lopes Ferreira, [Universidade Federal de Lavras](#), Brasil, and Dr. Kazunori Yoshizawa, [Hokkaido University](#), Japan, conducted an expedition to a total of 11 carbonate caves in the southern Japanese islands of Kyushu and Shikoku. Out of these, they managed to collect

dipluran specimens from three touristic sites and sent them to Dr. Alberto Sendra from the [Research group in Soil Biology and Subterranean Ecosystems](#) at [Alcala University](#), Spain, for identification.



Last year, lead author Dr. Alberto Sendra and his colleagues Prof. Boris Sket, [University of Ljubljana](#), and Prof. Pavel Stoev, National Museum of Natural History, Bulgaria, [described](#) another fascinating cave-dwelling campodeid dipluran. Discovered in Eastern Turkmenistan, the species, whose name ([Turkmenocampa mirabilis](#)) refers to its wondrous peculiarity, was the first of in the order of Diplura found in Central Asia. Further, it was the first strictly subterranean terrestrial creature recorded in the country.

Original source: Sendra A, Yoshizawa K, Ferreira RL (2018) New oversize troglotic species of Campodeidae in Japan (Diplura). *Subterranean Biology* 27: 53-73. <https://doi.org/10.3897/subtbiol.27.28575>

<http://bit.ly/2D6u7li>

People overestimate benefits, and underestimate risks, of medical interventions

From major heart surgery to a course of minor drugs, people overestimate the benefits and underestimate the risks of a variety of medical procedures, according to new research.

The giant newly described species Pacificampa daidarabotchi, discovered in the Mejiro-do cave, Kyushu, Japan. Rodrigo Lopes Ferreira

To the amazement of the scientists, it turned out that they had collected specimens of two previously unrecognised species of well-adapted subterranean campodeid diplurans.

Moreover, one of the new species (*Pacificampa daidarabotchi*), identified exclusively from the Mejiro-do cave located near an active quarry in Kyushu, proved to be the largest known dipluran in the family Campodeidae. Measuring about 10 mm in length, the creature looks gigantic next to any other campodeid, which, most often, are only half as big.

Inspired by the peculiar size of the former, the researchers decided to name it after the giant yōkai creature Daidarabotchi, known from Japanese mythology. According to one of the legends, Daidarabotchi once lifted up the mountains of Fuji and Tsukuba in order to weigh them. By accident, he split the peak of Tsukuba in the process.

Another remarkable finding from the same study is that the genus, where both new species were assigned - *Pacificampa* - serves as yet another example of the former physical connection between Asia and America some millennia ago. In their paper, the scientists note that the genus demonstrates close affinities with a genus known from North America.

"We hope that this discovery could stop the destruction of the land nearby and preserve for the future the subterranean habitat of these remarkable gigantic species," say the researchers in conclusion.

Published in the journal *Risk Analysis*, the study of 376 adults was led by Professor Yaniv Hanoch from the University of Plymouth School of Psychology, together with Jonathan Rolison from the University of Essex and Alexandra Freund from the University of Zurich.

In several hypothetical scenarios, participants were asked to imagine that their doctor had recommended a treatment - a drug, dental surgery, ear surgery, kidney operation, or to take a newly developed medication - in order to treat an eye infection, a gum infection, a hole in their eardrum, a benign growth, and a life-threatening blood disorder, respectively.

In each scenario, they were provided with precise information about the probability of success (e.g. saving a tooth) or the probability of the risks (e.g. liver damage). The treatments and side effects were taken from medical studies, but the probabilities of their happening were devised by the study authors for the research only.

Participants were then asked to indicate how likely they believed that they were to experience one of the benefits or risks by moving a pointer on a scale from 0% to 100%.

Results showed that on average, people perceived the benefit as higher than the benefit midpoint - in the case of the tooth, the perceived likelihood of benefit was 48%, compared with the midpoint of 45%.

In addition, the perceived risk of the side effects - in the case of the dental procedure, a possible gum infection - was perceived to be 46%, compared to the risk midpoint (or average) of 50%.

The biggest difference was regarding a kidney operation for a benign growth, where the perceived risk of the possible side effect, paralysis (43%) was significantly lower than the actual risk (53%).

Lead author Professor Yaniv Hanoch, Professor of Decision Science at the University of Plymouth, said: "These were really interesting results. By presenting participants with a wide range of medical scenarios - including minor and serious ones, as well as physical, psychological, and dental - our findings lend support to a growing body of evidence regarding unrealistic optimism.

"From an applied perspective, these results suggest that clinicians may need to ensure that patients do not underestimate risks of medical interventions, and that they convey realistic expectations about the benefits that can be obtained with certain procedures.

"It would be good to carry out further studies on a larger population and also explore if and how clinicians can help manage expectations."

Dr Jonathan Rolison, Senior Lecturer in Psychology at the University of Essex, said: "Participants in the study were given a likelihood range (e.g. 20%-40%) that they would experience the benefits or side effects of a treatment. On average, participants were overly optimistic about the treatment outcomes, underestimating their chances of experiencing the side effects of a treatment and overestimating their chances of experiencing its benefits.

"The findings have worrying consequences for clinical practice. Patients are encouraged to make informed decisions, which may

involve deciding on a cancer treatment. Our study shows that patients may have unrealistic expectations about such treatment options."

The full study is entitled *Reaping the Benefits and Avoiding the Risks: Unrealistic Optimism in the Health Domain* and is [available to view in the journal Risk Analysis \(doi: 10.1111/risa.13204\)](https://doi.org/10.1111/risa.13204).

<https://on.natgeo.com/2EPR79Y>

Vegetarian dinosaur may have actually eaten meat, skull suggests

Steak knife-like teeth in the most complete *Pachycephalosaur* jaw ever found look suspiciously like those of a carnivore.

By John Pickrell

Pachycephalosaur, the delicately built, 15-foot-long, [dome-headed dinosaur](#) that lived alongside *Tyrannosaurus* and *Triceratops*, is a staple of children's books and popular culture—

one usually depicted as a benign plant eater. But the discovery of a new skull with the most complete jaw and set of teeth yet found for the species dumfounded scientists when it was revealed at the [Society of Vertebrate Paleontology meeting](#) in Albuquerque, New Mexico, earlier this week.



A reconstruction of the fossil skull of the *Pachycephalosaur* that has theropod-like teeth. Photograph by Brian Boyle, Royal Ontario Museum

This juvenile [Pachycephalosaur](#), like all known specimens of its kind, had broad, leaf-shaped teeth toward the back of its jaw, suited to shredding rough plant matter, fruits, and seeds.

But in the front portion of its jaw—a part of the species never found fossilized before—this specimen bared sharp, triangular, blade-like teeth that look more like those seen in carnivores such as *Tyrannosaurus* and *Velociraptor*. It is unclear if the species had these

teeth temporarily during its youth, or if they were a permanent fixture for the dinosaur.

The fact that *Pachycephalosaurus* had these teeth during at least some stage of its development is fascinating, comments [Steve Brusatte](#), a paleontologist at the University of Edinburgh in the U.K., who attended the talk in Albuquerque.

“I’ve studied [carnivorous] theropods for 15 years, and I’m pretty sure if you handed me a tooth like that, I would say that’s a theropod tooth,” he says. “It had the combination of a beak with these very sharp, steak knife-like serrated teeth ... They must have been eating some kind of meat. Why else would you have steak knives at the front of your mouth?”

Dinosaur development

The discovery was presented by [Mark Goodwin](#) of the University of California Museum of Paleontology in Berkeley, who, alongside [David Evans](#) of the Royal Ontario Museum in Toronto, Canada, has unearthed and [studied many new *Pachycephalosaurus* specimens](#) in recent years.

*An illustration shows what the juvenile *Pachycephalosaurus* might have looked like in life. Its head exhibits pronounced cranial ornaments, bumps, and nodes along the entire back surface of its flat skull.* Illustration by Kari Scannella

Goodwin’s work last caused controversy in 2009 when he presented evidence—now widely accepted—that two species of dinosaur found in the Hell Creek Formation of the western U.S. were not, in fact, species in their own right, but actually juvenile forms of *Pachycephalosaurus*. These creatures, previously named *Stygimoloch* and *Dracorex*, appeared markedly different from adults.



They were covered with bumps and horns as part of their complex head ornamentation, but did not yet possess the large domes of a full-grown *Pachycephalosaurus*, hence the previous confusion.

The remarkably complete new skull of a *Dracorex*-like juvenile was discovered in eastern Montana and donated to the Royal Ontario Museum. It dates back 66 to 68 million years ago, in the late Cretaceous, shortly before the asteroid impact that [ultimately exterminated the non-avian dinosaurs](#). It is one of 71 mostly fragmentary fossils that Goodwin and Evans are studying to better understand how *Pachycephalosaurus* developed as it grew from youth to adulthood.

At the paleontology meeting in Albuquerque, Goodwin also revealed another finding from the pair’s research: that the style and complexity of the head ornamentation of *Pachycephalosaurus* appears not only to have changed during an individual’s maturation, but also during the two million years of evolution recorded in the rocks of the Hell Creek Formation. This adds further complexity to the picture first put forward in 2009.

Diet du jour

Finding teeth that “look, to all intents and purposes, like theropod teeth” in the new skull was a great surprise, Goodwin says. He speculates that these animals may have been opportunistic eaters and at least partly carnivorous, perhaps changing their diet seasonally as many bears do today.

Maybe *Pachycephalosaurus* filled a general omnivore role, suggests Brusatte, “eating bushes and ferns, but also some small mammals, frogs, salamanders, lizards, and maybe even small dinosaurs.”

Confirming the dinosaur’s dietary preferences will require more concrete evidence of exactly what it ate, and there are several ways the scientists might go about finding that out. One way would be to do an analysis of the ratio of carbon isotopes in this pachycephalosaur’s tooth enamel. This chemical signature can

provide information about the composition of an animal's diet—as can a study of the minute pits and scratches on the surface of the teeth. Another method would be to look at bite marks on other fossil bones from the Hell Creek Formation, to see if any of them match the shape and size of the newly found teeth.

This research could have broader implications as well. [Philip Currie](#), a paleontologist at the University of Alberta in Canada, says he is keen to reexamine numerous puzzling ‘theropod’ teeth found isolated in rocks of the same age over many years. In light of the new discovery, he wonders if these mystery teeth may in fact belong to *Pachycephalosaurus*.

Evans agrees: “If these teeth were found isolated from a jaw—and doubtless many have been—they could easily be mistaken for the teeth of small carnivorous dinosaurs.”

“It is especially crazy that these teeth at the front of the jaw may also have been reinforced at least partially by a beak,” Currie says. “We have always been somewhat mystified by what these animals were eating, but I think the teeth at the back of the jaws clearly show it’s an herbivore. The question is why it would need carnivore-like teeth at the front?”



The adult and presumably mature Pachycephalosaurus, seen illustrated here, has a wider frontoparietal dome with reduced ornamentation along the rear of the skull. Illustration by Kari Scannella

Most scientists like to place dinosaurs into neat categories, says Danny Anduza of the [University of California Museum of Paleontology](#), who has himself helped excavate several *Pachycephalosaurus* fossils. “What makes this study so exciting is

that the authors use new evidence to challenge some of those assumptions.”

He says the work also highlights the importance of continued fieldwork. “Even after all these years of collecting, the discovery of just one new specimen can change the way we look at a dinosaur group,” Anduza says. “I think that's pretty inspiring. It's a reminder to get out into the field as often as possible, and to always look over the next hill.”

<http://bit.ly/2qh0oxK>

Does the US discard too many transplantable kidneys? Study provides evidence that some kidneys discarded in the U.S. are a lost opportunity that could have benefitted some patients

San Diego, CA - Comparing transplant data between countries may help address the global organ shortage, according to a study that will be presented at ASN Kidney Week 2018 October 23-October 28 at the San Diego Convention Center. The study provides evidence that some kidneys discarded in the United States are a lost opportunity that could have benefitted some patients.

Approximately 2,000 donated kidneys are discarded in the United States each year, despite a serious shortage of organs for transplantation. By studying transplant data from the United Network for Organ Sharing and from the French Organ Procurement Agency from 2004 to 2014, Olivier Aubert, MD, PhD, Alexandre Loupy, MD, PhD (Paris Translational Research Center for Organ Transplantation), and their colleagues compared kidney quality and outcomes between the United States and France.

During this period, 156,089 kidneys in the United States and 29,984 kidneys in France were procured for transplant. A much higher proportion of transplanted French kidneys were considered higher-risk organs (as measured by the kidney donor profile index, KDPI) compared with US organs. During the decade, the KDPI of US kidneys only increased modestly, while in France, a steadily rising

KDPI reflected a trend of more aggressive organ use. Models predicted that many transplanted French kidneys would have had a high probability of discard in the US system. If US centers adopted greater willingness to accept kidneys from older donors and other higher-risk donor groups, this change would provide an additional 132,445 allograft life-years to US transplant candidates over 10 years. "The global shortage of organs for transplantation is a major public health concern. In the US alone, approximately 100,000 individuals are waiting for a kidney transplant," said Dr. Loupy. "New, creative solutions to address this concern are needed. By comparing transplant practices in two countries, we provide fresh evidence that older deceased donor organs are a valuable underutilized resource." Dr. Aubert noted that international comparisons of transplant practice offer a natural experiment "so that the successful innovations in each country can be rapidly identified and exported. Transplantation could benefit from additional studies that cross borders, as this one did."

Study: "Exploring the Viability of Kidneys Discarded in the US: A Comparison of Kidney Utilization Patterns and Outcomes in the US and France"