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Earth exhaled, and the 'Great Dying' began

Gases from deep in Earth's crust are implicated in the planet's worst extinction event.

Earth's biggest mass extinction was triggered by the release of gases from the planet's own crust.

Some 252 million years ago, enormous amounts of lava poured out of volcanoes in Siberia, along with volatile gases such as chlorine and bromine.

The gases depleted the ozone layer, allowing dangerous levels of ultraviolet radiation to reach Earth's surface. As a result, more than 90% of all marine species went extinct, an event known as the Great Dying.



Lava ferries gases from within Earth's rocky shell to its surface; the huge volumes of gases freed by this process some 250 million years ago seriously damaged the ozone layer. Mint Images - Frans Lanting/Getty

Scientists have been unable to account for the precise source of the volatiles.

A team led by Michael Broadley at the French National Centre for Scientific Research in Vandoeuvre-Lès-Nancy compared Siberian rocks that formed before the eruption with others that formed from cooling lava after the eruption.

The older rocks contained levels of chlorine, bromine and iodine high enough to deplete most — or even all — of the globe's ozone layer. Those gases rose, with the lava, from deep in Earth's crust.

Eruptions that tap buried volatiles are more likely to cause a global environmental crisis than those that don't.

[Nature Geosci. \(2018\)](#)

<http://bit.ly/2PM1pJQ>

Jupiter had growth disorders

Jupiter seen to have grown in different, distinct phases

With an equator diameter of around 143,000 kilometers, Jupiter is the largest planet in the solar system and has 300 times the mass of the Earth. The formation mechanism of giant planets like Jupiter has been a hotly debated topic for several decades. Now, astrophysicists of the Swiss National Centre of Competence in Research (NCCR) PlanetS of the Universities of Bern and Zürich and ETH Zürich have joined forces to explain previous puzzles about how Jupiter was formed and new measurements. The research results were published in the magazine *Nature Astronomy*.



This is Jupiter's southern hemisphere photographed by NASA's Juno spacecraft. ©NASA/JPL-Caltech/SwRI/MSSS/GeraldEichstaedt/Sean Doran

"We could show that Jupiter grew in different, distinct phases," explains Julia Venturini, postdoc at the University of Zürich. "Especially interesting is that it is not the same kind of bodies that bring mass and energy," adds Yann Alibert, Science Officer of PlanetS and first author of the paper. First, the planetary embryo rapidly accreted small, centimeter-sized pebbles and quickly built a core during the initial one million years. The following two million years were dominated by slower accretion of larger, kilometer-sized rocks called planetesimals. They hit the growing planet with great energy, releasing heat. "During the first stage the pebbles brought the mass," Yann Alibert explains: "In the second phase, the planetesimals also added a bit of mass, but what is more important, they brought energy." After three million years, Jupiter had grown to a body of 50 Earth masses. Then, the third formation phase started

dominated by gas runaway accretion leading to today's gas giant with more than 300 Earth masses.

Solar system divided into two parts

The new model for Jupiter's birth matches the meteorite data that were presented at a conference in the US last year. At first, Julia Venturini and Yann Alibert were puzzled when they listened to the results. Measurements of the composition of meteorites showed that in the primordial times of the solar system the solar nebula was divided into two regions during two million years. It could therefore be concluded that Jupiter acted as a kind of a barrier when it grew from 20 to 50 Earth masses. During this period, the forming planet must have perturbed the dust disk, creating an over-density that trapped the pebbles outside of its orbit. Therefore, material from outward regions could not mix with material of the inner ones until the planet reached enough mass to perturb and scatter rocks inwards. "How could it have taken two million years for Jupiter to grow from 20 to 50 Earth masses?" asked Julia Venturini. "That seemed much too long," she explains: "That was the triggering question that motivated our study." A discussion by email started among NCCR PlanetS researchers of the Universities of Bern and Zürich and ETH Zürich and the following week the experts in the fields of astrophysics, cosmochemistry and hydrodynamics arranged a meeting in Bern. "In a couple of hours we knew what we had to calculate for our study," says Yann Alibert: "This was only possible within the framework of the NCCR, which links scientists from various fields."

Explanation for delayed growth

With their calculations, the researchers showed that the time the young planet spent in the mass range of 15 to 50 Earth masses was indeed much longer than previously thought. During this formation phase the collisions with the kilometer-sized rocks provided enough energy to heat the gaseous atmosphere of the young Jupiter and

prevented rapid cooling, contraction and further gas accretion. "Pebbles are important in the first stages to build a core quickly, but the heat provided by planetesimals is crucial to delay gas accretion so that it matches the timescale given by the meteorite data," the astrophysicists summarize. They are convinced that their results provide as well key elements for solving long-standing problems of the formation of Uranus and Neptune and exoplanets in this mass regime.

<http://bit.ly/2BUFDR2>

Clock drawing cognitive test should be done routinely in patients with high blood pressure

Easy way to find out if a patient with high blood pressure has cognitive impairment

Munich, Germany - A clock drawing test for detecting cognitive dysfunction should be conducted routinely in patients with high blood pressure, according to research presented today at ESC Congress 2018.¹

Patients with high blood pressure who have impaired cognitive function are at increased risk of developing dementia within five years. Despite this known link, cognitive function is not routinely measured in patients with high blood pressure.

"The ability to draw the numbers of a clock and a particular time is an easy way to find out if a patient with high blood pressure has cognitive impairment," said study author Dr Augusto Vicario of the

Figure 1: Normal, moderate, and severe cognitive impairment on the clock drawing test

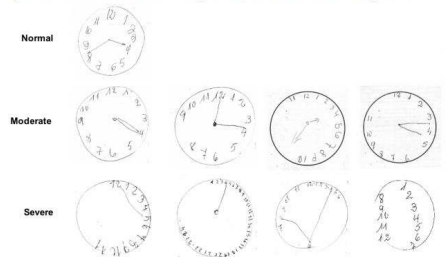
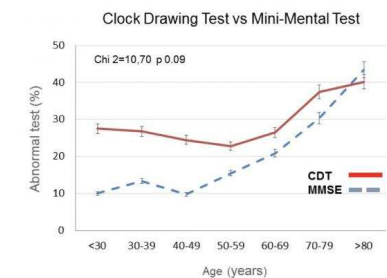


Figure 2: Clock drawing test versus Mini-Mental State Examination in patients with high blood pressure



Credit: European Society of Cardiology

Heart and Brain Unit, Cardiovascular Institute of Buenos Aires, Argentina. "Identifying these patients provides the opportunity to intervene before dementia develops."

The Heart-Brain Study in Argentina evaluated the usefulness of the clock drawing test compared to the Mini-Mental State Examination (MMSE) to detect cognitive impairment in 1,414 adults with high blood pressure recruited from 18 cardiology centres in Argentina. The average blood pressure was 144/84 mmHg, average age was 60 years, and 62% were women.

For the clock drawing test, patients were given a piece of paper with a 10 cm diameter circle on it. They were asked to write the numbers of the clock in the correct position inside the circle and then draw hands on the clock indicating the time "twenty to four". Patients were scored as having normal, moderate, or severe cognitive impairment (see figure 1). The MMSE has 11 questions and produces a score out of 30 indicating no (24-30), mild (18-23), or severe (0-17) cognitive impairment.

The researchers found a higher prevalence of cognitive impairment with the clock drawing test (36%) compared to the MMSE (21%). Three out ten patients who had a normal MMSE score had an abnormal clock drawing result. The disparity in results between the two tests was greatest in middle aged patients (see figure 2).

Dr Vicario said: "Untreated high blood pressure silently and progressively damages the arteries in the subcortex of the brain and stops communication between the subcortex and frontal lobe. This disconnect leads to impaired 'executive functions' such as planning, visuospatial abilities, remembering details, and decision-making. The clock drawing test is known to evaluate executive functions. The MMSE evaluates several other cognitive abilities but is weakly correlated with executive functions."

He continued: "Our study suggests that the clock drawing test should be preferred over the MMSE for early detection of executive

dysfunction in patients with high blood pressure, particularly in middle age. We think the score on the clock drawing test can be considered a surrogate measure of silent vascular damage in the brain and identifies patients at greater risk of developing dementia. In our study more than one-third of patients were at risk."

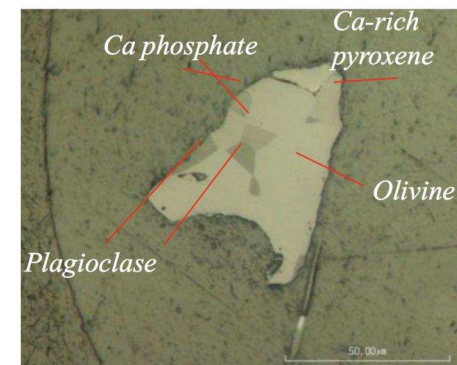
Dr Vicario concluded: "The clock drawing test should be adopted as a routine screening tool for cognitive decline in patients with high blood pressure. Further studies are needed to determine whether lowering blood pressure can prevent progression to dementia."

<http://bit.ly/2wtE8n0>

Particles collected by Hayabusa give absolute age of asteroid Itokawa

Japanese research group clarifies the chronology of near-Earth asteroid 25143 Itokawa

Understanding the origin and time evolution of near-Earth asteroids (NEAs) is an issue of scientific interest and practical importance because they are potentially hazardous to the Earth. However, when and how these NEAs were formed and what they suffered during their lifetime remain enigmas.



This is the cross section area of the particle collected from the asteroid Itokawa using Hayabusa spacecraft. Osaka University

Japanese scientists, including those from Osaka University, closely examined particles collected from the asteroid Itokawa by the spacecraft Hayabusa, finding that the parent body of Itokawa was formed about 4.6 billion years ago when the solar system was born and that it was destroyed by a collision with another asteroid about

1.5 billion years ago. Their research results were published in *Scientific Reports*.

Focusing on a few micrometers of phosphate minerals, which are rarely found in Itokawa particles, the scientists performed precise isotope analyses of uranium (U) and lead (Pb) in Itokawa particles of about 50 μm in diameter using Secondary Ion Mass Spectrometry (SIMS).

Lead author Kentaro Terada says, "By combining two U decay series, ^{238}U - ^{206}Pb (with a half-life of 4.47 billion years) and ^{235}U - ^{207}Pb (with a half-life of 700 million years), using four Itokawa particles, we clarified that phosphate minerals crystalized during a thermal metamorphism age (4.64 ± 0.18 billion years ago) of Itokawa's parent body, experiencing shock metamorphism due to a catastrophic impact event by another body 1.51 ± 0.85 billion years ago."

It has been reported that the mineralogy and geochemistry of the Itokawa particles resemble those of LL (LL stands for Low (total) iron, Low metal) chondrites, which frequently fall to the Earth.

However, the shock ages of Itokawa particles obtained from this study (1.5 billion years ago) are different from previously reported shock ages of shocked LL chondrites (4.2 billion years ago).

This shows that the asteroid Itokawa had a time evolution different from that of the parent body of LL chondrites.

The results of this study established constraints on the timescale of the first samples collected from the asteroid, providing concrete figures (absolute age) to the evolution of the NEAs whose orbits are well known.

This will lead to the elucidation of the origins and histories of asteroids.

The article, "Thermal and impact histories of 25143 Itokawa recorded in Hayabusa particles" was published in *Scientific Reports*, <https://doi.org/10.1038/s41598-018-30192-4>.

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

Removable balloon is as good as permanent stent implant for opening small blocked arteries

One step closer towards treating small blocked arteries without a stent

Munich, Germany - A removable balloon is as good as a permanent stent implant for opening small blocked arteries, according to late breaking results from the BASKET-SMALL 2 trial presented in a Hot Line Session today at ESC Congress 2018¹ and simultaneously published in *The Lancet*.

Principal investigator Professor Raban Jeger, of the University Hospital Basel, Switzerland, said: "The results of this trial move us a step closer towards treating small blocked arteries without having to insert a permanent implant."

One of the standard treatments for opening blocked arteries is to insert an expandable metal tube (stent) covered with drugs via a catheter. The stent remains in the body permanently. In smaller arteries there is a risk that tissue will grow inside the stent and narrow it, causing the artery to become blocked a second time (in-stent restenosis), or that a blood clot will develop on the stent (stent thrombosis) and cause a heart attack or stroke.

Balloons covered with drugs, also inserted using a catheter, are approved in Europe to reopen stented arteries that have become blocked a second time. The balloon is removed after the procedure. BASKET-SMALL 2 is the largest randomised trial to examine whether drug coated balloons are as good as drug-eluting stents for opening small arteries that have become blocked for the first time. The effectiveness of the two treatments was evaluated by comparing the rate of major adverse cardiac events (MACE) at 12 months.

Between 2012 and 2017 the trial enrolled 758 patients with a first-time lesion in an artery smaller than 3 mm in diameter. The average age of study participants was 68 years, 72% had stable coronary

artery disease and 28% had an acute coronary syndrome (heart attack or unstable angina).

Patients were randomised to receive drug coated balloon angioplasty (382 patients) or second-generation drug-eluting stent implantation (376 patients). The balloon was coated with iopromide and paclitaxel, and the stents were covered with everolimus or paclitaxel.

After the procedure, patients were followed-up for 12 months for the occurrence of MACE, which included death from cardiac causes, non-fatal heart attack, and the need to reopen the artery due to it becoming blocked again (called target vessel revascularisation). Secondary endpoints included the single components of MACE at 12 months, and major bleeding at 12 months.

At 12 months, there was no difference in the rates of MACE between patients who received a stent (7.5%) and patients who underwent the balloon procedure (7.6%) ($p=0.918$). Professor Jeger said: "The BASKET-SMALL 2 trial met its primary endpoint of non-inferiority for major adverse cardiac events at 12 months. This is a long-awaited milestone in clinical evidence for the drug coated balloon technique, which so far has primarily been used for the treatment of in-stent restenosis."

There were no statistical differences between groups in the rates of the individual components of the primary endpoint at 12 months: rates of cardiac death were 3.1% versus 1.3% ($p=0.113$), rates of nonfatal heart attack were 1.6% versus 3.5% ($p=0.112$), and rates of target vessel revascularisation were 3.4% versus 4.5% ($p=0.438$) in the balloon versus stent groups, respectively. The rate of major bleeding at 12 months was similar in the balloon (1.1%) and stent (2.4%) groups ($p=0.183$).

"The potential benefits of a stent-free option to treat small blocked arteries are numerous," said Professor Jeger. "With no permanent implant left after the procedure, the problem of tissue growth and clot formation within the stent is eliminated. In addition, there may be no

need for prolonged treatment with anticlotting medicines, which has been controversial since it increases the risk of bleeding."

He concluded: "Drug coated balloon angioplasty has the possibility to become the standard treatment for small blocked arteries. We will continue to monitor patients in the trial for a further two years for major adverse cardiac events, stent thrombosis, and bleeding."

SOURCES OF FUNDING: Swiss National Foundation, Bern, Switzerland? Basel Cardiovascular Research Foundation, Basel, Switzerland; and B. Braun Medical AG, Sempach, Switzerland.

DISCLOSURES: Prof. Jeger has received lecture honoraria and travel support from B. Braun.

References and notes

1 "BASKET-SMALL 2 - Drug-Coated Balloons vs. Drug-Eluting Stents in Small Vessel Interventions" will be discussed during:

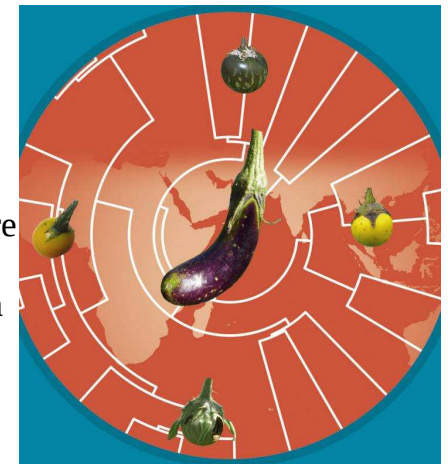
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How eggplants became Asian -- genomes and elephants tell the story

Only recently taxonomists have resolved the status of the wild species that are related to the cultivated eggplant -- surprisingly many of them are found in the savannas of Africa.

Élise Sanceaume

The evolutionary context of the eggplant was until recently very poorly known. Historical documents and genetic data have shown that the eggplant was first domesticated in Asia, but most of its wild relatives are from Africa. Researchers from the Natural History Museums of London (NHM) and Finland (University of Helsinki) managed to obtain the first well-supported hypothesis on the origin of the eggplant and its direct relatives.



In a study [published in the American Journal of Botany](#), researchers from the Natural History Museum of London (NHM) and the Finnish museum of natural history, University of Helsinki, have sequenced the plastomes of the eggplant and of 22 species directly related to the eggplant. By comparing the plastome DNA sequences, they hoped to reveal the evolutionary history of the eggplant and its wild relatives. The team obtained a well-supported hypothesis on the origin of the eggplant and its wild relatives, and showed how a single event gave rise to two lineages, one comprising an African group of species and the other the wild progenitor of the domesticated eggplant.

"Nearly all species of the group of the eggplant inhabit low land savannahs and more or less arid habitats; some species are very widespread across Africa. Our results suggest that there had been a dramatic expansion of the distribution range of the group over the last two million years." says the first author of the paper, Xavier Aubriot.

Eggplant's history has been obscure

The eggplant (*Solanum melongena*) is a species that is a member of the giant genus *Solanum* (around 1,400 species) within the nightshade family (Solanaceae). *Solanum* also accounts for two other globally important food crops, the tomato and the potato. But in contrast to these New World crops, the eggplant hails from Asia. Historical documents and genetic data have shown that the eggplant was first domesticated somewhere in the region of China and India. It is only recently, however, that taxonomists have resolved the status of the wild species that are related to the cultivated eggplant - surprisingly many of them are found in the savannahs of Africa.

"Understanding the evolutionary history of a group depends upon detailed research using the collections of museums like the NHM" says Sandra Knapp of the Natural History Museum, "Resolving the identities of the wild species allows us to work out where they occur,

which then allows us to dig deeper into the factors that determine their current status."

The team found that the group containing the relatives of the eggplant originated in northeastern Africa some two million years ago. Plants then dispersed both eastwards to tropical Asia and southwards to southern and western Africa. In tropical Asia, the dispersal event gave rise to a species that scientists call *Solanum insanum*. It is from populations of this wild species that the eggplant was later domesticated. What really startled the researchers was the fact that the dispersion of the group to Asia seemed to result from a single dispersal event from northern Africa to tropical Asia rather than a linear step-wise expansion from Africa to Asia.

Explaining the current wide distribution of eggplant relatives across Africa

Some of the African wild relatives of the eggplant have extremely wide distributions - *Solanum campylacanthum* occurs all along the eastern part of the continent, from Kenya to South Africa. During the investigation of the factors that could explain this pattern, it turned out that this could have something to do with the dispersion of the seeds. The African elephant and the impala, both inhabitants of African savannahs and with historical distribution ranges that encompass the continent, are both known to eat the fruits and disperse the seeds of these wild eggplant relatives. If today the range of African elephants is drastically reduced due to human activities, wild eggplant relatives may suffer as well. "If we want to secure eggplant production by tapping into the gene-pool of its wild relatives we have to protect African elephant populations." says Péter Poczai researcher of the Finnish museum of natural history, University of Helsinki.

"This study is actually a first step for deeper analyses" summarizes Aubriot. "Many important questions remain to be investigated - how did the eggplant group reach tropical Asia? Were there interactions

between early humans and wild eggplant relatives? What factors were involved in the domestication process of the eggplant from its wild progenitor, *Solanum insanum*? We are now working on getting a much improved sampling and new sources of data to shed more light on the complex and interesting origin of the eggplant."

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

More patients survive sudden cardiac arrest with new EMS technique that uses a breathing tube
Study funded by NIH showed a change in use of breathing tube can save more lives

A new study showed that a change in the type of breathing tube paramedics use to resuscitate patients with sudden cardiac arrest can significantly improve the odds of survival and save thousands of lives. More than 90 percent of Americans who experience sudden cardiac arrest die before, or soon after, reaching a hospital.

"During resuscitation, opening the airway and having proper access to it is a key factor for the survival of someone who goes into cardiac arrest outside of a hospital," said George Sopko, M.D., M.P.H., program director in the NHLBI's Division of Cardiovascular Sciences and coauthor of the study. "But one of the burning questions in prehospital emergency care has been, 'Which is the best airway device?'"

Funded by the National Heart, Lung, and Blood Institute (NHLBI), part of the National Institutes of Health, this study is the largest of its kind to test oxygen delivery methods used by firefighters, emergency medical service (EMS) providers and paramedics. It is the first to show that a particular airway intervention can positively affect patient survival rates. The findings were published online in the *Journal of the American Medical Association*.

"This study demonstrated that just by managing the airway well in the early stage of resuscitation, we could save more than 10,000 lives every year," said Sopko.

EMS providers treat the majority of the 400,000 out-of-hospital cardiac arrests each year. For more than three decades, their standard-of-care technique for resuscitation has been endotracheal intubation -- the insertion of a plastic tube into the trachea to maintain an open airway. They use this technique in hopes that mirroring the care given by in-hospital physicians will produce better patient outcomes.

"While identical to techniques used by doctors in the hospital, intubation in these severe and stressful prehospital settings is very difficult and fraught with errors," said Henry E. Wang, M.D., professor and vice chair for research in the Department of Emergency Medicine at McGovern Medical School at The University of Texas Health Science Center at Houston. Wang was the study's lead author.

Today, however, new devices such as laryngeal tubes, offer simpler alternatives to opening and accessing an airway. These tubes are easier to use, and the trial showed that cardiac arrest patients treated with this alternative had a higher survival rate.

Usually caused by a heart attack, sudden cardiac arrest occurs when the heart suddenly or unexpectedly stops beating, cutting off blood flow to the brain and other vital organs. The vast majority of out-of-hospital cardiac arrests occur at home, and only about 10 percent of people survive, according to the American Heart Association.

The Pragmatic Airway Resuscitation Trial was a multicenter research study conducted by the Resuscitation Outcomes Consortium. It compared survival rates among 3,000 adults with cardiac arrest who were treated by paramedic crews from 27 EMS agencies, in Birmingham, Alabama; Dallas-Fort Worth; Milwaukee; Pittsburgh; and Portland, Oregon. Approximately half of the patients received the newer laryngeal tube treatment, while the other half received traditional endotracheal intubation.

Overall, patients in the laryngeal tube group had significantly better outcomes. For instance, 18.3 percent of patients survived three days in the hospital and 10.8 percent survived to reach hospital discharge. For the group with traditional endotracheal intubation, the survival numbers were 15.4 and 8.1 percent, respectively. Also, the proportion of patients surviving with good brain function was higher in the laryngeal tube group.

Study H.E. Wang et al. Effect of a Strategy of Initial Laryngeal Tube Insertion vs. Endotracheal Intubation on 72-Hour Survival in Adults with Out-of-Hospital Cardiac Arrest: A Randomized Clinical Trial. Journal of the American Medical Association. August 28, 2018. DOI: 10.1001/jama.2018.7044

<http://bit.ly/2Phlo1P>

Writing a 'thank you' note is more powerful than we realize, study shows

Improves well-being for not only letter writers but recipients as well

AUSTIN, Texas -- New research from The University of Texas at Austin proves writing letters of gratitude, like Jimmy Fallon's "Thank You Notes," is a pro-social experience people should commit to more often. The gesture improves well-being for not only letter writers but recipients as well.

[Published in Psychological Science](#), research conducted by assistant professor of marketing in the McCombs School of Business at UT Amit Kumar and Nicholas Epley at The University of Chicago asked participants, in three different experiments, to write a letter of gratitude to someone who's done something nice for them and then anticipate the recipient's reaction. In each experiment, letter writers overestimated how awkward recipients would feel about the gesture and underestimated how surprised and positive recipients would feel. "We looked at what's correlating with people's likelihood of expressing gratitude -- what drives those choices -- and what we found is that predictions or expectations of that awkwardness, that

anticipation of how a recipient would feel -- those are the things that matter when people are deciding whether to express gratitude or not," said Kumar.

Kumar says anxiety about what to say or fear of their gesture being misinterpreted causes many people to shy away from expressing genuine gratitude. "I don't think it's a societal thing," said Kumar. "It's more fundamental to how the human mind works and a well-established symmetry about how we evaluate ourselves and other people. When we're thinking about ourselves, we tend to think about how competent we are, and whether we are going to be articulate in how we're expressing gratitude."

Kumar says what is significant about the research and its results is that thank-you notes and letters of gratitude should be written and sent more often. "What we saw is that it only takes a couple of minutes to compose letters like these, thoughtful ones and sincere ones," said Kumar. "It comes at little cost, but the benefits are larger than people expect."

<http://bit.ly/2LAjU0k>

The more pesticides bees eat, the more they like them ***Bumblebees acquire a taste for pesticide-laced food as they become more exposed to it, a behaviour showing possible symptoms of addiction.***

This study of bumblebee behaviour indicates that the risk of pesticide-contaminated food entering bee colonies may be higher than previously thought, which can have impacts on colony reproductive success.

In research [published today in Proceedings of the Royal Society B](#), a team from Imperial College London and Queen Mary University of London (QMUL) have shown that bumblebee colonies increasingly feed on pesticide-laced food (sugar solution) over time.

The researchers tested the controversial class of pesticides the 'neonicotinoids', which are currently one of the most widely used

classes of pesticides worldwide, despite the near-total ban in the EU. The impact of neonicotinoids on bees is hotly debated, and the ban is a decision that has received mixed views.

Lead researcher Dr Richard Gill, from the Department of Life Sciences at Imperial, said: "Given a choice, naïve bees appear to avoid neonicotinoid-treated food. However, as individual bees increasingly experience the treated food they develop a preference for it.

"Interestingly, neonicotinoids target nerve receptors in insects that are similar to receptors targeted by nicotine in mammals. Our findings that bumblebees acquire a taste for neonicotinoids ticks certain symptoms of addictive behaviour, which is intriguing given the addictive properties of nicotine on humans, although more research is needed to determine this in bees."

The team tracked ten bumblebee colonies over ten days, giving each colony access to its own foraging arena in which bees could choose feeders that did or did not contain a neonicotinoid.

They found that while the bees preferred the pesticide-free food to begin with, over time they fed on the pesticide-laced food more and visited the pesticide-free food less. They continued to prefer the pesticide-laced food even when the positions of the feeders were changed, suggesting they can detect the pesticide inside the food.

Lead author Dr Andres Arce, from the Department of Life Sciences at Imperial, said: "Many studies on neonicotinoids feed bees exclusively with pesticide-laden food, but in reality, wild bees have a choice of where to feed. We wanted to know if the bees could detect the pesticides and eventually learn to avoid them by feeding on the uncontaminated food we were offering.

"Whilst at first it appeared that the bees did avoid the food containing the pesticide, we found that over time the bumblebees increased their visits to pesticide-laden food. We now need to conduct further

studies to try and understand the mechanism behind why they acquire this preference."

Dr Gill added: "This research expands on important previous work by groups at Newcastle and Dublin Universities. Here, we added a time dimension and allowed the bees to carry out more normal foraging behaviour, to understand the dynamics of pesticide preference. Together these studies allow us to properly assess the risks of exposure and not just the hazard posed.

"Whilst neonicotinoids are controversial, if the effects of replacements on non-target insects are not understood, then I believe it is sensible that we take advantage of current knowledge and further studies to provide guidance for using neonicotinoids more responsibly, rather than necessarily an outright ban."

<https://go.nature.com/2N3wDqN>

Artificial intelligence nails predictions of earthquake aftershocks

A neural-network analysis outperforms the method scientists typically use to work out where these tremors will strike.

[Alexandra Witze](#)

A machine-learning study that analysed hundreds of thousands of earthquakes beat the standard method at predicting the location of aftershocks.

Scientists say that the work provides a fresh way of exploring how changes in ground stress, such as those that occur during a big earthquake, [trigger the quakes that follow](#). It could also help researchers to develop new methods for assessing seismic risk.

"We've really just scratched the surface of what machine learning may be able to do for aftershock forecasting," says Phoebe DeVries, a seismologist at Harvard University in Cambridge, Massachusetts. She and her colleagues report their findings¹ on 29 August in *Nature*. Aftershocks occur after the main earthquake, and they can be just as damaging — or more so — than the initial shock. A magnitude-7.1

earthquake near Christchurch, New Zealand, in September 2010 didn't kill anyone: but a [magnitude-6.3 aftershock](#), which followed more than 5 months later and hit closer to the city centre, resulted in 185 deaths.

Seismologists can generally predict how large aftershocks will be, but they struggle to forecast where the quakes will happen. Until now, most scientists used a technique that calculates how an earthquake changes the stress in nearby rocks and then predicts how likely that change would result in an aftershock in a particular location. This stress-failure method can explain aftershock patterns successfully for many large earthquakes, but it doesn't always work².

There are large amounts of data available on past earthquakes, and DeVries and her colleagues decided to harness them to come up with a better prediction method. "Machine learning is such a powerful tool in that kind of scenario," DeVries says.

Neural networking

The scientists looked at more than 131,000 mainshock and aftershock earthquakes, including some of the most powerful tremors in recent history, such as the [devastating magnitude-9.1 event that hit Japan](#) in March 2011. The researchers used these data to train a neural network that modelled a grid of cells, 5 kilometres to a side, surrounding each main shock. They told the network that an earthquake had occurred, and fed it data on how the stress changed at the centre of each grid cell. Then the scientists asked it to provide the probability that each grid cell would generate one or more aftershocks. The network treated each cell as its own little isolated problem to solve, rather than calculating how stress rippled sequentially through the rocks.

When the researchers tested their system on 30,000 mainshock-aftershock events, the neural-network forecast predicted aftershock locations more accurately than did the usual stress-failure method. Perhaps more importantly, DeVries says, the neural network also

hinted at some of the physical changes that might have been happening in the ground after the main shock. It pointed to certain parameters as potentially important — ones that describe stress changes in materials such as metals, but that researchers don't often use to study earthquakes.

The findings are a good step towards examining aftershocks with fresh eyes, says Daniel Trugman, a seismologist at the Los Alamos National Laboratory in New Mexico. "The machine-learning algorithm is telling us something fundamental about the complex processes underlying the earthquake triggering," he says.

The latest study won't be the final word on aftershock forecasts, says Gregory Beroza, a geophysicist at Stanford University in California. For instance, it doesn't take into account a type of stress change that happens as seismic waves travel through Earth. But "this paper should be viewed as a new take on aftershock triggering", he says. "That's important, and it's motivating."

doi: 10.1038/d41586-018-06091-z

<https://go.nature.com/2MHkU8x>

United States woefully unprepared for nuclear strike, say scientists

Health system lacks capacity to respond to attacks that use high-powered modern weapons.

[Sara Reardon](#)

The United States is not prepared to deal with the aftermath of a major nuclear attack, despite North Korea's [efforts to develop nuclear weapons](#) and the increasing tensions between nations overall. That was the blunt assessment of public-health experts who participated in a meeting last week on nuclear preparedness, organized by the National Academies of Sciences, Engineering, and Medicine.

The gathering is "an acknowledgement that the threat picture has changed, and that the risk of this happening has gone up", says Tener

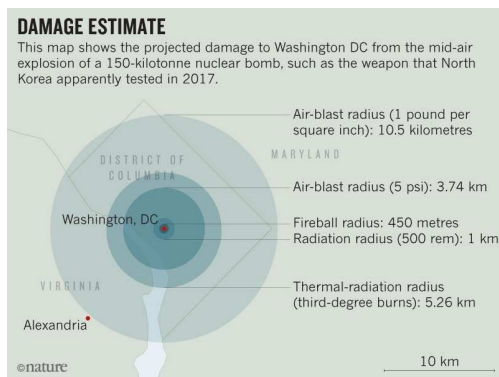
Veenema, who studies disaster nursing at Johns Hopkins University in Baltimore, Maryland, and co-chaired the conference in Washington DC .

Since the fall of the Soviet Union in 1991, the United States's research and preparedness efforts for a nuclear strike have focused largely on the possibility of a terrorist attack with a relatively small, improvised 1-kilotonne weapon or a 'dirty bomb' that sprays radioactive material.

But [North Korea is thought to have advanced thermonuclear weapons](#) — each more than 180 kilotonnes in size — that would cause many more casualties than would a dirty bomb (see 'Damage estimates'). “Now that thermonuclear is back on the table, we're back to people saying, ‘We can't deal with this,’” says Cham Dallas, a public-health researcher at the University of Georgia in Athens.

Veenema says that the science academies decided to do a study in November 2017, three months after North Korean leader Kim Jong-un threatened to launch a nuclear weapon at the US territory of Guam. The academies wanted to bring together the different

government, academic and private sectors that would be involved in the medical response to a nuclear attack, Veenema adds. The academies' committee plans to release a report in December that lays out how the United States could plug the gaps in its response capabilities.



Source: nuclearsecrecy.com/nukemap

The US government's spending on nuclear-weapons research and response has dropped drastically over the past few decades — as has the number of health workers with training in radiation medicine and

management. According to a 2017 study¹ by Dallas, more than half of emergency medical workers in the United States and Japan have no training in treating radiation victims.

The same study suggests that even trained medical professionals might be too frightened to enter a nuclear-fallout zone or to treat radiation victims at the scene — Dallas's group found that 33% of medical professionals said they would not be willing to respond in such a scenario.

Compounding these concerns, treatments for radiation exposure and burns might not be available in sufficient quantities in the aftermath of a nuclear attack. James Jeng, a burn surgeon at Mount Sinai Health System in New York City, says that the detonation of a nuclear bomb can leave behind hundreds of thousands of burn victims. The best treatment for such injuries is skin grafting, he says, but there are only about 300 burn surgeons in the United States who know how to perform the procedure. It might also be difficult to quickly transport enough donor skin to treatment sites, Jeng adds.

North Korea's threat to Guam last year made clear to public-health officials there how limited their response capabilities are, says Patrick Lujan, emergency-preparedness manager for the Guam Department of Public Health and Social Services. Guam, an island of 163,000 people, has only three hospitals and no burn units. “We realized there's just so much you can do, being on an island,” Lujan says. *Nature* 560, 538-539 (2018) doi: 10.1038/d41586-018-06077-x

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

Researcher Links Diplomats' Mystery Illness to Radiofrequency/Microwave Radiation

Symptoms and experiences strongly match known effects of pulsed radiofrequency/microwave electromagnetic radiation

August 29, 2018 | Scott LaFee

Writing in advance of the September 15 issue of [Neural Computation](#), Beatrice Golomb, MD, PhD, professor of medicine at

University of California San Diego School of Medicine, says publicly reported symptoms and experiences of a “mystery illness” afflicting American and Canadian diplomats in Cuba and China strongly match known effects of pulsed radiofrequency/microwave electromagnetic (RF/MW) radiation.

Her conclusions, she said, may aid in the treatment of the diplomats (and affected family members) and assist U.S. government agencies seeking to determine the precise cause. More broadly, Golomb said her research draws attention to a larger population of people who are affected by similar health problems.

“I looked at what’s known about pulsed RF/MW in relation to diplomats’ experiences,” said Golomb. “Everything fits. The specifics of the varied sounds that the diplomats reported hearing during the apparent inciting episodes, such as chirping, ringing and buzzing, cohere in detail with known properties of so-called ‘microwave hearing,’ also known as the Frey effect.

“And the symptoms that emerged fit, including the dominance of sleep problems, headaches and cognitive issues, as well as the distinctive prominence of auditory symptoms. Even objective findings reported on brain imaging fit with what has been reported for persons affected by RF/MW radiation.”

Beginning in 2016, personnel at the U.S. Embassy in Havana, Cuba (as well as Canadian diplomats and family members) described hearing strange sounds, followed by development of an array of symptoms. The source of the health problems has not been determined. Though some officials and media have described the events as “sonic attacks,” some experts on sound have rejected this explanation. In May of this year, the State Department reported that U.S. government employees in Guangzhou, China had also experienced similar sounds and health problems.

Affected diplomats and family members from both locations were medically evacuated to the U.S. for treatment, but despite multiple

government investigations, an official explanation of events and subsequent illnesses has not been announced. At least two early published studies examining available data were inconclusive.

In her paper, scheduled to be published September 15 in *Neural Computation*, Golomb compared rates of described symptoms among diplomats with a published 2012 study of symptoms reported by people affected by electromagnetic radiation in Japan. By and large, she said the cited symptoms — headache, cognitive problems, sleep issues, irritability, nervousness or anxiety, dizziness and tinnitus (ringing in the ears) — occurred at strikingly similar rates.

Some diplomats reported hearing loss. That symptom was not assessed in both studies so rates could not be compared, but Golomb said it is widely reported in both conditions. She also noted that previous brain imaging research in persons affected by RF/ EMR “showed evidence of traumatic brain injury, paralleling reports in diplomats.”

David O. Carpenter, MD, is director of the Institute for Health and the Environment at the University of Albany, part of the State University of New York. He was not involved in Golomb’s study. He said evidence cited by Golomb illustrates “microwave hearing,” which results “from heating induced in tissue, which causes ‘waves’ in the ear and results in clicks and other sounds.” Reported symptoms, he said, characterize the syndrome of electrohypersensitivity (EHS), in which unusual exposure to radiofrequency radiation can trigger symptoms in vulnerable persons that may be permanent and disabling.

“We have seen this before when the Soviets irradiated the U.S. Embassy in Moscow in the days of the Cold War,” he said.

Golomb, whose undergraduate degree was in physics, conducts research investigating the relationship of oxidative stress and mitochondrial function — mechanisms shown to be involved with RF/EMR injury — to health, aging, behavior and illness. Her work

is wide-ranging, with published studies on Gulf War illness, statins, antibiotic toxicity, ALS, autism and the health effects of chocolate and trans fats, with a secondary interest in research methods, including placebos.

Golomb said an analysis of 100 studies examining whether low-level RF produced oxidative injury found that 93 studies concluded that it did. Oxidative injury or stress arises when there is an imbalance between the production of reactive oxygen species (free radicals) and the body's detoxifying antioxidant defenses. Oxidative stress has been linked to a range of diseases and conditions, from Alzheimer's disease, autism and depression to cancer and chronic fatigue syndrome, as well as toxic effects linked to certain drugs and chemicals. More to the point, Golomb said, oxidative injury has been linked to the symptoms and conditions reported in diplomats.

The health consequences of RF/MW exposure is a matter of on-going debate. Some government agencies, such as the National Institute of Environmental Health Sciences and the National Cancer Institute, publicly assert that low- to mid-frequency, non-ionizing radiation like those from microwaves and RF is generally harmless. They cite studies that have found no conclusive link between exposure and harm.

But others, including researchers like Golomb, dispute that conclusion, noting that many of the no-harm studies were funded by vested industries or had other conflicts of interest. She said independent studies over decades have reported biological effects and harms to health from nonionizing radiation, specifically RF/MW radiation, including via oxidative stress and downstream mechanisms, such as inflammation, autoimmune activation and mitochondrial injury.

Golomb compared the situation to persons with peanut allergies: Most people do not experience any adverse effect from peanut

exposure, but for a vulnerable subgroup, exposure produces negative, even life-threatening, consequences.

In her analysis, Golomb concludes that “of hypotheses tendered to date, (RF/MW exposure) alone fits the facts, including the peculiar ones” regarding events in Cuba and China. She said her findings advocate for more robust attention to pulsed RF/MW and associated adverse health effects.

“The focus must be on research by parties free from ties to vested interests. Such research is needed not only to explain and address the symptoms in diplomats, but also for the benefit of the small fraction – but large number — of persons outside the diplomatic corps, who are beset by similar problems.”

This study was unfunded.

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

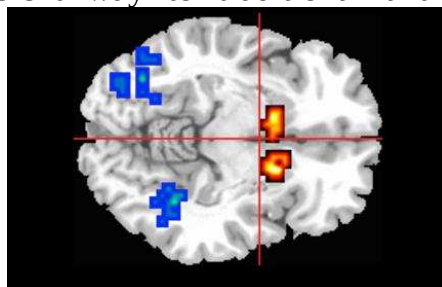
Cannabis extract helps reset brain function in psychosis ***Single dose of cannabidiol can help reduce brain function abnormalities in people with psychosis***

Research from King's College London has found that a single dose of the cannabis extract cannabidiol can help reduce brain function abnormalities seen in people with psychosis. Results from a new MRC-funded trial, [published in JAMA Psychiatry](#), provide the first evidence of how cannabidiol acts in the brain to reduce psychotic symptoms.

Cannabidiol, also referred to as CBD, is a non-intoxicating compound found in cannabis. A purified form of cannabidiol has recently been licensed in the USA as a treatment for rare childhood epilepsies, and a [2017 King's College London trial](#) has demonstrated cannabidiol has anti-psychotic properties. However, exactly how cannabidiol may work in the brain to alleviate psychosis has remained a mystery.

"The mainstay of current treatment for people with psychosis are drugs that were first discovered in the 1950s and unfortunately do not work for everyone," says [Dr Sagnik Bhattacharyya](#), from the Institute of Psychiatry, Psychology & Neuroscience (IoPPN). "Our results have started unravelling the brain mechanisms of a new drug that works in a completely different way to traditional anti-psychotics."

The researchers studied a group of 33 young people who had not yet been diagnosed with psychosis but who were experiencing distressing psychotic symptoms, along with 19 healthy controls.



Red/yellow areas show activity in the caudate, a brain area affected in people with psychosis. Credit: King's College London

A single dose of cannabidiol was given to 16 participants while the other 17 received a placebo.

All participants were studied in an MRI scanner while performing a memory task which engages three regions of the brain known to be involved in psychosis.

As expected, the brain activity in the participants at risk of psychosis was abnormal compared to the healthy participants.

However, among those who had cannabidiol, the abnormal brain activity was less severe than for those who received a placebo, suggesting cannabidiol can help re-adjust brain activity to normal levels. The influence of cannabidiol on these three brain regions could underlie its therapeutic effects on psychotic symptoms.

Intriguingly, [previous research from King's College London](#) shows cannabidiol appears to work in opposition to tetrahydrocannabinol (THC); the ingredient in cannabis responsible for getting users high which has been strongly linked to the development of psychosis. THC can be thought of as mimicking some of the effects of psychosis,

while cannabidiol has broadly opposite neurological and behavioural effects.

Dr Bhattacharyya and colleagues at IoPPN are now launching the first large scale, multi-centre trial to investigate whether cannabidiol can be used to treat young people at high risk of developing psychosis. The trial is supported by a £1.85 million grant from an NIHR and MRC partnership.

Some estimates suggest that in England alone, over 15,000 people present with early symptoms of psychosis every year.

Despite symptoms that can be extremely severe, there are currently no treatments that can be offered to patients at high risk of psychosis because current anti-psychotic drugs can have serious side-effects.

"There is an urgent need for a safe treatment for young people at risk of psychosis," says Dr Bhattacharyya.

"One of the main advantages of cannabidiol is that it is safe and seems to be very well tolerated, making it in some ways an ideal treatment. If successful, this trial will provide definitive proof of cannabidiol's role as an antipsychotic treatment and pave the way for use in the clinic."

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

A recipe for regenerating nerve fibers across complete spinal cord injury

What if it were possible to regenerate severed nerve fibers across spinal cord injury?

The adult mammalian body has an incredible ability to heal itself in response to injury. Yet, injuries to the spinal cord lead to devastating conditions, since severed nerve fibers fail to regenerate in the central nervous system. Consequently, the brain's electrical commands about body movement no longer reach the muscles, leading to complete and permanent paralysis.

But what if it were possible to bridge the gap in the severed spinal cord? What if it were possible to regenerate severed nerve fibers across spinal cord injury?

In a collaboration led by EPFL (Ecole polytechnique fédérale de Lausanne) in Switzerland and UCLA (University of California at Los Angeles) in the USA, scientists have now understood the underlying biological mechanisms required for severed nerve fibers to regenerate across complete spinal cord injury, bridging that gap in mice and rats for the first time.

Their recipe targets three components for nerve fiber growth to occur. Without one or the other, the recipe simply does not succeed in regenerating new axons in the spinal cord. This three-pronged recipe was designed to reproduce the conditions underlying the growth of nerve fibers during development, leading to a robust regeneration of severed nerve fibers through and beyond a complete spinal cord injury.

"Our aim was to replicate, in adults, the conditions that encourage the growth of nerve fibers during development," explains senior author Grégoire Courtine of EPFL. "We have understood the combinations of biological mechanisms that are necessary to enable severed nerve fiber regrowth across complete spinal cord injuries in adult mammals."

By analogy, if nerve fibers were trees, then the terminal branches of the axons can be viewed as the tree's branches. If the main branches of the tree are cut, little branches may sprout spontaneously along the remaining trunk of the tree. But the cut branches do not grow back.

The same is true for neurons in adults: new branches of severed axons can sprout and make connections above an injury, but the severed part of the axon does not regrow. The 3-pronged recipe uncovered by the scientists changes that, making it possible to regenerate entire axons.

"We've regrown forests of axons," adds Courtine.

To recreate the spatiotemporal conditions of a developing nervous system, the scientists deliver a sequence of growth factors, proteins or hormones, to fulfill the three essential parts of the recipe: reactivate the genetic program for axons to grow; establish a permissive environment for the axons to grow in; and a chemical slope that marks the path along which axons are encouraged to regrow. Within 4 weeks, the axons regrow by several millimeters.

The new axons are able to transmit electricity - and thus neural signals - across the lesion, but this regained connectivity is not enough to restore walking. The rodents remained paralyzed, as anticipated by the scientists, since new circuits are not expected to be functional without the support of rehabilitation strategies.

"We dissected the mechanistic requirements for axon regeneration in the spinal cord, but it doesn't translate into function," explains lead author Mark Anderson of EPFL and UCLA. "Now we need to investigate the requirements so that the axons make the appropriate connections with locomotor circuits below the injury. This will entail rehabilitation with electrical stimulation to integrate, tune and functionalize the new axons so that the rodents can walk again."

Speculating about applications in humans is still premature. For example, the first component of the recipe that stimulates the growth of neurons happens two weeks before injury, so for now, more research must be done for the recipe to be clinically translatable.

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

Children's bone cancers could remain hidden for years before diagnosis

Complex genetic rearrangements found which could inform treatment

Scientists have discovered that some childhood bone cancers start growing years before they are currently diagnosed. Researchers at the Wellcome Sanger Institute and Hospital for Sick Children (SickKids), Canada discovered large-scale genetic rearrangements in

Ewing Sarcomas and other children's cancers, and showed these can take years to form in bone or soft tissue.

This study will help unravel the causes of childhood cancers and raises the possibility of finding ways to diagnose and treat these cancers earlier in the future.

[Reported in the journal Science](#) today (31st August 2018), the research also showed that cancers with the complex genetic rearrangements were more aggressive and could benefit from more intense treatment than other cancers. This will help doctors decide on the best treatment for each patient.

Ewing sarcoma is a rare cancer found mainly in bone or soft tissue of young teenagers as they grow, and is the second most commonly diagnosed bone cancer in children and young people.

Treatment involves chemotherapy, surgery to remove the affected part of the bone if possible and radiotherapy. However, this harsh regime has hardly changed for the last 40 years and fails about one third of patients.

Cancer is a genetic disease and in Ewing sarcoma, two specific genes, EWSR1 and ETS, are fused together. To understand the genetic events leading to this, researchers sequenced and analysed the genomes of 124 tumours. They discovered that in nearly half of the cases, the main gene fusion occurred when the DNA completely rearranged itself, forming complex loops of DNA.

Dr Adam Shlien, one of the lead authors on the paper, Associate Director of Translational Genetics and Scientist in Genetics & Genome Biology, and co-Director of the SickKids Cancer Sequencing (KiCS) program at SickKids, said: "Many childhood sarcomas are driven by gene fusions, however until now we have not known how or when these key events occur, or whether these processes change at relapse. We found dramatic early chromosomal shattering in 42 per cent of Ewing sarcomas, not only fusing two

critical genes together, but also disrupting a number of important areas."

The earlier a cancer is diagnosed, the easier it is to treat, but until now it was thought that Ewing sarcoma was very fast growing. Surprisingly, the researchers found that the complex DNA rearrangements that cause Ewing sarcoma had occurred years before the tumour was diagnosed. This offers possibilities of finding ways to screen for these cancers to treat them earlier.

Dr Sam Behjati one of the lead authors on the paper from Wellcome Sanger Institute and University of Cambridge Department of Pediatrics, said: "In principle this study provides evidence that Ewing sarcoma could be detectable earlier, possibly even before it reveals itself as disease. If we could detect these childhood cancers sooner, when tumours are smaller, they would be much easier to treat. Further research is needed, but this possibility of finding a way to diagnose Ewing sarcomas earlier could help patients in the future." The researchers discovered that Ewing Sarcomas with these complex genetic rearrangements were more aggressive than those with simple gene-fusions, and that any relapses needed different treatments. Understanding this could help clinicians offer the best treatment options for each patient.

Dr. David Malkin, co-lead author, Staff Oncologist, Scientist and co-Director of the SickKids Cancer Sequencing (KiCS) program, said: "As an increasing and diverse number of tumour genome sequences become available, we may be able to define further rearrangement processes that underlie fusion genes and thus unravel the causes of fusion-driven human cancers. Our goal is to better understand these cancers in an attempt to improve treatment and outcomes."

Notes for editors:

Publication: Nathaniel Anderson et al. (2018) Rearrangement bursts generate canonical fusions in bone and soft tissue tumors. [Science. DOI : 10.1126/science.aan5360](https://doi.org/10.1126/science.aan5360)

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

CRISPR halts Duchenne muscular dystrophy progression in dogs

First use of CRISPR gene editing to halt the progression of Duchenne muscular dystrophy (DMD) in a large mammal

DALLAS - Scientists for the first time have used CRISPR gene editing to halt the progression of Duchenne muscular dystrophy (DMD) in a large mammal, according to a study by UT Southwestern that provides a strong indication that a lifesaving treatment may be in the pipeline.

The research published in *Science* documents unprecedented improvement in the muscle fibers of dogs with DMD - the most common fatal genetic disease in children, caused by a mutation that inhibits the production of dystrophin, a protein critical for muscle function.

Researchers used a single-cut gene-editing technique to restore dystrophin in muscle and heart tissue by up to 92 percent of normal levels. Scientists have estimated a 15 percent threshold is needed to significantly help patients. "Children with DMD often die either because their heart loses the strength to pump, or their diaphragm becomes too weak to breathe," said Dr. Eric Olson, Director of UT Southwestern's Hamon Center for Regenerative Science and Medicine. "This encouraging level of dystrophin expression would hopefully prevent that from happening."

DMD, which affects one in 5,000 boys, leads to muscle and heart failure, and premature death by the early 30s. Patients are forced into wheelchairs as their muscles degenerate and eventually onto respirators as their diaphragms weaken. No effective treatment exists, though scientists have known for decades that a defect in the dystrophin gene causes the condition.

The *Science* study establishes the proof-of-concept for single-cut gene editing in dystrophic muscle and represents a major step toward

a clinical trial. Already Dr. Olson's team has corrected DMD mutations in mice and human cells by making single cuts at strategic points of the mutated DNA.

The latest research applied the same technique in four dogs that shared the type of mutation most commonly seen in DMD patients. Scientists used a harmless virus called adeno-associated virus (AAV) to deliver CRISPR gene-editing components to exon 51, one of the 79 exons that comprise the dystrophin gene.

CRISPR edited the exon, and within several weeks the missing protein was restored in muscle tissue throughout the body, including 92 percent correction in the heart and 58 percent in the diaphragm, the main muscle needed for breathing.

"Our strategy is different from other therapeutic approaches for DMD because it edits the mutation that causes the disease and restores normal expression of the repaired dystrophin," said Dr. Leonela Amoasii, lead author of the study and Assistant Instructor of Molecular Biology in Dr. Olson's lab. "But we have more to do before we can use this clinically."

The lab will next conduct longer-term studies to measure whether the dystrophin levels remain stable and to ensure the gene edits do not have adverse side effects.

Dr. Olson hopes the next step beyond dogs is a clinical trial, which would be among several that UT Southwestern's gene therapy center aims to launch in the coming years to address numerous deadly childhood diseases.

In the meantime, Dr. Olson's recent work has spawned a biotechnology company, Exonics Therapeutics Inc., which is working to further optimize and bring this technology to the clinic. Exonics intends to extend the approach to additional DMD mutations, as well as other neuromuscular diseases. Exonics has licensed the technology from UT Southwestern.

About the study

Dr. Olson is Professor and Chair of Molecular Biology at UT Southwestern. He holds the Pogue Distinguished Chair in Research on Cardiac Birth Defects, the Robert A. Welch Distinguished Chair in Science, and the Annie and Willie Nelson Professorship in Stem Cell Research. He is also the scientific founder of Exonics Therapeutics, launched in February 2017 to advance and commercialize his research.

The study was supported, in part, by Exonics Therapeutics Inc. and grants from the National Institutes of Health, the Senator Paul D. Wellstone Muscular Dystrophy Cooperative Research Center, and the Robert A. Welch Foundation.

Dr. Olson's team collaborated with the Royal Veterinary College. The RVC's dog colony program was supported by grants from the Wellcome Trust, Muscular Dystrophy UK, and Duchenne Ireland.

Disclosure statements: Dr. Eric Olson is a scientific co-founder of, and consultant for, Exonics Therapeutics, and has license and investment interests with the company. Dr. Leonela Amoasii is a consultant for Exonics Therapeutics and is listed as co-inventor, along with Dr. Olson, of the strategy presented in the study.

The study includes other disclosures.

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

Presence of new or worsened bedsores tied to poorer outcomes in inpatient rehab facilities

First-of-its-kind study shows the federally-mandated pressure ulcer quality indicator is a valuable measure of care

BUFFALO, N.Y. -- A new study from the University at Buffalo has shown that the presence of new or worsened bedsores is an effective indicator of the quality of care for rehab patients. The study is the first to examine whether this metric is, in fact, is associated with outcome of care in inpatient rehabilitation settings. New or worsened bedsores is a quality metric instituted as part of the Patient Protection and Affordable Care Act (ACA). The ACA requires that medical institutions be evaluated on their quality of care.

Bedsores, also known as pressure ulcers, cost the U.S. health care system between \$9.1 billion and \$11.6 billion per year, according to the U.S. Department of Health and Human Services' Agency for Healthcare Research and Quality, the lead federal agency charged with improving the safety and quality of the nation's health care system.

Previous studies have shown an association between the presence of bedsores and a variety of outcomes for patients in acute care hospitals and long-term care facilities. However, the association between pressure injury development and rehabilitation outcomes hasn't been examined previously.

Margaret DiVita, who conducted the research as a doctoral student in epidemiology at UB, is now an associate professor at SUNY Cortland. Using data from the Uniform Data System for Medical Rehabilitation, she examined the records for nearly 500,000 Medicare patients discharged between January 2013 and September 2014 -- after this mandated measure of quality was implemented. The study was [published in the Archives of Physical Medicine and Rehabilitation](#).

"We looked at how good a proxy measure of quality the new or worsened pressure ulcer measure was, in particular to see if it was associated with poorer outcomes for rehabilitation patients. We found that it was indeed associated with lower quality outcomes: less gain in function during treatment, and lower likelihood of leaving rehab to go to a community setting," said Jo Freudenheim, the paper's senior author and chair of the Department of Epidemiology and Environmental Health in the UB School of Public Health and Health Professions.

"The focus of this paper is on an important question for the regulation of medical care. How do you measure whether someone is getting good care? In this case we were focused on the inpatient rehab facilities," Freudenheim said. "We looked at one of the ways that quality is measured as part of the ACA--whether patients get a new pressure ulcer during their stay or, if they have one already, if it gets worse during their stay."

While outcomes were poorer for those with new or worsened pressure ulcers, more than half of these patients were able to be discharged to a community setting. "A pressure injury prior to

admission or greater likelihood of developing worse pressure injury are not appropriate grounds for denial of access to inpatient rehabilitation care," the researchers write.

Compared to the control group, patients with a new or worsened bedsore tended to have a lower change score on the Functional Independence Measure (FIM), a basic indicator of patient disability, and to have, on average, longer rehabilitation stay. In this study, about 1 percent of patients experienced new or worsened bed sores during their rehabilitation stay.

The study, which was published in the August issue of the print journal, was made available online in April 2018 ahead of peer-review.

In addition to DiVita and Freudenheim, co-authors on the paper include Carl Granger, a professor in the Department of Neurology in the Jacobs School of Medicine and Biomedical Sciences at UB; Richard Goldstein, an assistant professor of pediatrics at Harvard Medical School; and Paulette Niewczyk, associate professor of health promotion at Daemen College in Buffalo.

<https://wb.md/2ooJY5j>

Recall of Hypertension Meds Containing Wrong Drug **Blood pressure medication bottles actually contained a heart failure drug**

Aaron Gould Sheinin

Accord Healthcare has issued a recall for a blood pressure medication because the bottles that were shipped actually contain a heart failure drug, according to a notice on the US Food and Drug Administration (FDA) website.

Accord Healthcare has recalled one lot of 12.5-mg hydrochlorothiazide tablets because the 100-count bottle was discovered to contain 100 spironolactone tablets. The company says it does not believe any other lots are involved in the mix-up. Taking spironolactone instead of hydrochlorothiazide could cause potassium levels to spike, which could cause life-threatening problems.

A pharmacist first alerted Accord to the problem, the FDA noted. Accord said it has received no reports of injuries because of the problem.

The hydrochlorothiazide tablets are light orange or peach in color, are round, and have an "H" on one side and a "1" on the other. The FDA said that if patients have a hydrochlorothiazide prescription and the pills in the bottle do not match that description, or they are unsure, they can return them to their pharmacy or physician.

If patients are certain their bottle contains the wrong pills, they should return them to their pharmacy, the FDA said.

Patients or healthcare professionals can also contact Accord at 855-869-1081 or email rxrecalls@inmar.com.

Hydrochlorothiazide is used to treat high blood pressure. Spironolactone is used to treat congestive heart failure, cirrhosis of the liver, severe heart failure, and other conditions.

More information about the recall is available on the [FDA website](#).

<http://bit.ly/2Cbvqs2>

Latest study reveals sharp rise in essay cheating globally, with millions of students involved

Landmark paper charts rapid increase in use of essay mills

A breakthrough study by Swansea University has revealed that the use of contract cheating, where students pay someone else to write their assignments, is rising rapidly around the world.

For the study, [published in Frontiers in Education](#), Professor Phil Newton from Swansea University, analysed 71 survey samples from 65 studies dating back as far as 1978, covering 54,514 participants.

Because the products of essay-mills are designed to be difficult to detect, it is hard to develop objective measures of contract cheating.

This new study therefore systematically reviewed findings from prior 'self-report' research papers; questionnaire based studies wherein students were asked if they had ever paid someone else to undertake work for them.

The findings of the research show that as many as one in seven recent graduates may have paid someone to undertake their assignment for them, potentially representing 31 million students across the globe.

Across the sample, contract cheating was self-reported by a historic average of 3.5% of students, but this was shown to be increasing significantly over time. In studies from 2014 to present, the percentage of students admitting to paying someone else to undertake their work was 15.7%. Cheating, in general, also appeared to be on the rise according to the studies reviewed.

Professor Newton suggests that the data he found is actually likely to underestimate levels of contract cheating, for the simple reason that students who engage in contract cheating are less likely to volunteer to participate in surveys about cheating.

Essay-mills are currently legal in the UK, although they are banned in the USA and New Zealand, while other countries are actively developing legislation. Professor Newton warns: "The UK risks becoming a country where essay-mills find it easy to do business".

Commenting on the results of his research, Professor Newton, director of learning and teaching at Swansea University Medical School, says:

"These findings underscore the need for legislation to tackle essay-mills, alongside improvements in the way students are assessed and awareness-raising of the fundamentals of academic integrity. We need to utilise assessment methods that promote learning and at the same time reduce the likelihood that contract cheating can happen".

A proposal for a new law emerged from previous research by Professor Newton, in collaboration with Professor Michael Draper from the Hillary Rodham Clinton School of Law at Swansea University. The proposal came from their earlier study, which concluded that existing UK laws would not be effective in tackling Essay Mills. There is currently an active petition calling for the government to introduce a new law.

Both Professor Newton and Professor Draper were authors of a report issued by the Quality Assurance Agency (QAA) last year, which contained advice and guidance for higher education providers

and staff on many different approaches to contract cheating. Earlier research from Professor Newton showed that academic integrity is not a topic that is routinely covered in teacher training programmes for staff and that students have a poor understanding of the consequences of engaging in contract cheating.

Professor Newton's study, 'How Common is Commercial Contract Cheating in Higher Education and is it Increasing? A Systematic Review', is [published in *Frontiers in Education*](http://bit.ly/2PoE8MT).

<http://bit.ly/2PoE8MT>

Eating in 10-hour window can override disease-causing genetic defects, nurture health

Salk scientists discover that periods of fasting can protect against obesity and diabetes

LA JOLLA - Scientists at the Salk Institute found that mice lacking the biological clocks thought to be necessary for a healthy metabolism could still be protected against obesity and metabolic diseases by having their daily access to food restricted to a 10-hour window.

The work, which [appeared in the journal *Cell Metabolism* on August 30, 2018](#), suggests that the health problems associated with disruptions to animals' 24-hour rhythms of activity and rest--which in humans is linked to eating for most of the day or doing shift work--can be corrected by eating all calories within a 10-hour window.

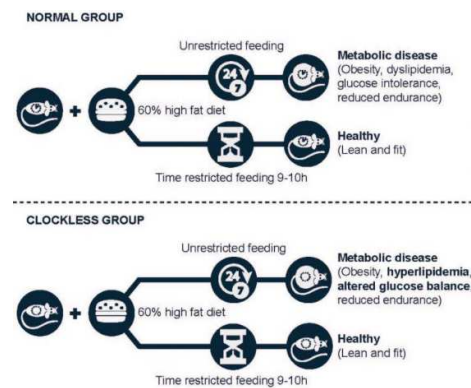
"For many of us, the day begins with a cup of coffee first thing in the morning and ends with a bedtime snack 14 or 15 hours later," says Satchidananda Panda, a professor in Salk's Regulatory Biology Laboratory and the senior author of the new paper.

"But restricting food intake to 10 hours a day, and fasting the rest, can lead to better health, regardless of our biological clock."

Every cell in mammals' bodies operates on a 24-hour cycle known as the circadian rhythm--cellular cycles that govern when various genes are active. For example, in humans, genes for digestion are more active earlier in the day while genes for cellular repair are more active at night.

Previously, the Panda lab discovered that mice allowed 24-hour access to a high-fat diet became obese and developed a slew of metabolic diseases including high cholesterol, fatty liver and diabetes. But these same mice, when restricted to the high-fat diet for a daily 8- to 10-hour window became lean, fit and healthy.

This graphic illustrates how eating within a 10-hour window protects mice from metabolic disease regardless of whether their bodies have functional circadian clocks. Salk Institute



The lab attributed the health benefits to keeping the mice in better sync with their cellular clocks--for example, by eating most of the calories when genes for digestion were more active.

In the current study, the team aimed to better understand the role of circadian rhythms in metabolic diseases by disabling genes responsible for maintaining the biological clock in mice, including in the liver, which regulates many metabolic functions.

The genetic defects in these clock-less mice make them prone to obesity, diabetes, fatty liver disease and elevated blood cholesterol. These diseases further escalate when the animals are allowed to eat fatty and sugary food.

To test whether time-restricted eating could benefit these "clock-less" mice, Panda's team put them on one of two high-fat diet regimes: one group had access to food around the clock, the other had access to the same number of calories only during a 10-hour window.

As the team expected, the group that could eat at any time became obese and developed metabolic diseases. But the group that ate the

same number of calories within a 10-hour window remained lean and healthy--despite not having an internal "biological clock" and thereby genetically programmed to be morbidly sick. This told the researchers that the health benefits from a 10-hour window were not just due to restricting eating to times when genes for digestion were more active.

"From the previous study, we had been under the impression that the biological clock was internally timing the process of turning genes for metabolism on and off at predetermined times," says Amandine Chaix, a staff scientist at Salk and the paper's first author.

"And while that may still be true, this work suggests that by controlling the animals' feeding and fasting cycles, we can basically override the lack of an internal timing system with an external timing system."

According to the researchers, the new work suggests that the primary role of circadian clocks may be to tell the animal when to eat and when to stay away from food. This internal timing strikes a balance between sufficient nutrition during the fed state and necessary repair or rejuvenation during fasting.

When this circadian clock is disrupted, as when humans do shift work, or when it is compromised due to genetic defects, the balance between nutrition and rejuvenation breaks down and diseases set in. As we age, our circadian clocks weaken. This age-dependent deterioration of circadian clock parallels our increased risk for metabolic diseases, heart diseases, cancer and dementia.

But the good news, say the researchers, is that a simple lifestyle such as eating all food within 10 hours can restore balance, stave off metabolic diseases and maintain health.

"Many of us may have one or more disease-causing defective genes that make us feel helpless and destined to be sick. The finding that a good lifestyle can beat the bad effects of defective genes opens new hope to stay healthy," says Panda.

The lab next plans to study whether eating within 8-10 hours can prevent or reverse many diseases of aging, as well as looking at how the current study could apply to humans.

Their website, mycircadianclock.org, allows people anywhere in the world to sign up for studies, download an app and get guidance on how to adopt an optimum daily eating-fasting cycle.

By collecting daily eating and health status data from thousands of people, the lab hopes to gain a better understanding of how a daily eating-fasting cycle sustains health.

Other authors included Terry Lin, Hiep D. Le and Max W. Chang of Salk.

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<http://bit.ly/2MIil65>

Allergists warn that chigger bites may cause allergic reaction to red meat

Chigger bites may also cause a relatively rare allergic reaction to red meat known as alpha-gal

WINSTON-SALEM, N.C. - Chiggers, redbugs, harvest mites (ツツガムシ) - whatever you call them, they are pesky little bugs whose bites cause really itchy rashes, usually around the ankles and waistline.

In addition to being uncomfortable and annoying, these bites may also cause a relatively rare allergic reaction to red meat known as alpha-gal, according to doctors at Wake Forest Baptist Medical Center.

Although the medical community has known for the past five to 10 years that ticks can cause this allergy, case studies from Wake Forest Baptist and the University of Virginia (U.Va.) suggest that chigger

bites also may be responsible. The paper is [published in the current issue of The Journal of Allergy and Clinical Immunology: In Practice](#).

"If a patient comes in telling me they ate red meat for dinner and then hours later woke up with anaphylaxis, I suspect an alpha-gal allergy," said lead author Russell Scott Traister, M.D., Ph.D., assistant professor of pulmonary, critical care, allergy and immunologic diseases at Wake Forest Baptist.

"With those symptoms, doctors usually ask if the person has had a tick bite recently. But we started seeing patients with the same symptoms who said they hadn't had a tick bite, only chigger bites."

This allergy is a reaction to a carbohydrate molecule on mammalian meat - beef, pork, venison, etc. - called alpha-gal. However, unlike most allergic reactions that happen within minutes, a reaction to alpha-gal occurs after three to six hours. The only cure is to avoid all mammalian meat, Traister said.

In addition to case studies seen at Wake Forest Baptist, Traister cited results reported by U.Va. from 311 patients who had answered a questionnaire about exposure to tick or chigger bites before developing an alpha-gal allergy. Of the 301 who reported either tick or chigger bites in the past 10 years, 5.5 percent reported a history of chigger bites, but no tick exposure.

Further studies are needed to determine if the alpha-gal molecule is in the gastrointestinal tracts of chiggers to confirm that they, as well as ticks, can cause mammalian meat allergy.

"In the meantime, we want allergists to be aware that patients may report chigger bites, and based on that fact alone should not dismiss alpha-gal sensitization as a possible diagnosis," Traister said.

Co-authors are: Lindsey P. Stoltz, M.D., Leslie M. Cristiano, M.D., of Wake Forest Baptist; Ashley P.G. Dowling, Ph.D., of the University of Arkansas; and Jeffrey M. Wilson, M.D., Ph.D., and Thomas A.E. Platts-Mills, M.D., Ph.D., of the University of Virginia.

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

How Could a Diabetes Drug Cause Severe Genital Infections?

Drugs may increase the risk of the genitals becoming infected with "flesh-eating" bacteria

By Kimberly Hickok, Reference Editor

People with type 2 diabetes who take a certain class of drugs have a very troubling side effect to worry about: The drugs may increase the risk of the genitals becoming infected with "flesh-eating" bacteria. On Wednesday (Aug. 29), the U.S. Food and Drug Administration (FDA) issued [a warning](#) about sodium-glucose cotransporter-2 (SGLT2) inhibitors, which are commonly prescribed medications for treating [type 2 diabetes](#). Over a five-year period, the drugs have been linked to a dozen rare cases of genital infections that cause the skin to die, a condition called necrotizing fasciitis. All 12 patients who developed the infection were hospitalized, and one died, according to the FDA.

More specifically, the drugs have been linked to cases of a [flesh-eating bacteria](#) infection that affects the perineum, or the area of skin between the anus and the vulva or scrotum. When this type of infection affects this part of the body, it's referred to as Fournier's gangrene, a rare but potentially fatal condition, [according to the Mayo Clinic](#).

The infection is more common in men than women, and it can spread to other parts of the body, Dr. Amesh Adalja, a senior scholar at the Johns Hopkins University Center for Health Security, [told SELF](#). "It can rapidly progress and involve the entire genital area and even the abdominal wall," he said.

There have been enough instances of these severe infections that the FDA now requires all SGLT2 inhibitors to include a warning about this risk in their prescribing information. Medications in this class include canagliflozin, dapagliflozin, empagliflozin and ertugliflozin.

The drugs are available as single-ingredient medications or in combinations, such as with metformin, [the FDA said](#).

How do the infections happen?

Type 2 diabetes occurs when the body can't remove sugar from the bloodstream, because cells fail to respond to insulin, the hormone that helps move sugar into the cells. SGLT2 inhibitors work to lower [blood sugar](#) by causing the kidneys to remove sugar from the body through urine. This stabilizes blood sugar levels.

So, how can this lead to infections? Anywhere there is higher blood sugar, there's an increased chance of bacterial infection, Jamie Alan, an assistant professor of pharmacology and toxicology at Michigan State University, told SELF. "We have bacteria all over us, and one of the foods that bacteria likes is [sugar]," Alan said. She explained that eliminating more sugar through urine means there is more of bacteria's favorite food in the genital area, so this spot becomes a rather inviting environment for them.

The bacteria become a problem only if there is an [entry point to infect](#), such as a small cut from shaving or a skin ulcer near the genitals. And that's exactly what happens, Adalja told SELF. The infections are serious and often require many surgeries to remove all the infected tissues, Adalja said. (All 12 patients described in the FDA warning required surgery.)

The FDA warning instructs patients taking the drugs to seek medical attention right away if they experience any signs of swelling, itching or irritation in the genitals area or have a fever above 100.4 degrees Fahrenheit (38 degrees Celsius) and [generally don't feel well](#). The bacteria that cause necrotizing fasciitis can spread quickly, so it's important to seek treatment immediately.

But the infections are rare, and it's unwise to stop taking medications without talking it over with a doctor, Alan told SELF. There are other options for treating type 2 diabetes, she said, but practicing good hygiene can help minimize the risk of necrotizing fasciitis.

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

Fake, Low Quality Drugs Come at High Cost

About one in eight essential medicines in low- and middle-income countries may be fake or contain dangerous mixes of ingredients that put patients' lives at risk, a research review suggests.

Researchers examined data from more 350 previous studies that tested more 400,000 drug samples in low- and middle-income countries.

Overall, roughly 14 percent of medicines were counterfeit, expired or otherwise low quality and unlikely to be as safe or effective as patients might expect.

"Low-quality medicines can have no or little active pharmaceutical ingredient [and] can prolong illness, lead to treatment failure and contribute to drug resistance," said lead study author Sachiko Ozawa of the University of North Carolina at Chapel Hill.

"Or it may have too much active ingredient and cause a drug overdose," Ozawa said by email. "If it is contaminated or has other active ingredients, then the medication could cause poisoning, adverse drug interactions or avertable deaths."

Much of the research to date on counterfeit or otherwise unsafe medicines has focused on Africa, and about half of the studies in the current analysis were done there.

Almost one in five medications tested in Africa were fake or otherwise potentially unsafe, researchers report in JAMA Network Open.

A seized counterfeit hydrocodone tablets in the investigation of a rash of fentanyl overdoses in northern California is shown in this Drug Enforcement Administration (DEA) photo released on April 4, 2016.



Another third of the studies were done in Asia, where about 14 percent of medicines tested were found to be counterfeit or otherwise unsafe.

Antibiotics and antimalarials were the most tested drugs in the analysis. Overall, about 19 percent of antimalarials and 12 percent of antibiotics were falsified or otherwise unsafe.

While fake or improperly made medicines undoubtedly harm patients, the current analysis couldn't tell how many people suffered serious side effects or died as a result of falsified drugs.

Researchers did try to assess the economic impact of counterfeit or improperly made medicines and found the annual cost might run anywhere from \$10 billion to \$200 billion.

While the study didn't examine high-income countries, drug quality concerns are by no means limited to less affluent nations, Ozawa said.

"Even in high-income countries, purchasing cheaper medicines from illegitimate sources online could result in obtaining substandard or falsified medicines," Ozawa said. "Verify the source before you buy medications, and make policymakers aware of the problem so they can work to improve the global supply chain of medicines."

The study wasn't a controlled experiment designed to prove whether or how counterfeit or poorly made medicines directly harm patients, however. And economic impact was difficult to assess from smaller studies that often didn't include detailed methodology for calculating the financial toll.

The report "provides important validation of what is largely already known," Tim Mackey of the Global Health Policy Institute in La Jolla, California, writes in an accompanying editorial.

"It is important to note that although the study is comprehensive, its narrow scope means it only provides a snapshot of the entire problem, as it is limited to studies conducted in low- and middle-income countries and to those medicines classified as essential by the World Health Organization."

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

New findings confirm that Bronze Age Babylonians really loved beer

Chemical analyses finds Mesopotamian brewing was widespread, and quaffing styles were more varied than thought.

Andrew Masterson reports.

The ancient Mesopotamians really didn't mind a beer, new chemical analysis has shown. Many Bronze Age textual and pictorial sources attest to the consumption of beer in

Mesopotamia – the oft-described “cradle of civilisation” between the Tigris and Euphrates Rivers in the Middle East – from as early as 4000 BCE.



A clay tablet from Iraq, around 2500 BCE, showing people drinking beer from a single vessel, using straws. Courtesy of the Oriental Institute of the University of Chicago

[References deciphered](#) from third millennium BCE cuneiform texts show that the Mesopotamians were as sophisticated in their tastes as today's hipster craft-brew fans, choosing between several different types, including golden beer, sweet dark beer and red beer.

Unambiguous chemical and archaeological evidence, however, has remained scarce. The identification of building remains as breweries, large vats as beer-making pots, and bowls as drinking vessels have been based mostly – say a team of archaeologists led by Elsa Perruchini from the University of Glasgow in Scotland – on “educated guesswork”.

[In a paper](#) published in the *Journal of Archaeological Science*, Perruchini and her colleagues present the results of organic residue analyses performed on a variety of objects recovered from a site called Khani Masi, located along the upper reaches of the

Sirwan/Diyala River in what is today the autonomous Kurdish region of Iraq. The site dates to between 1500 and 1000 BCE.

The findings not only confirm many of the tentative text-based identifications of breweries and brewing equipment, but also extend considerably the range of vessels used to quaff the results – supplying, in the process, an insight into how drinking culture changed over the centuries.

Just as importantly, the analysis shows definitively that the Mesopotamians used barley as the central ingredient of their beers. While not entirely unexpected, the confirmation was welcome.

After all, brewing has emerged more than once in ancient history, revealing that there is more than one way to make a decent drop. The Chinese, for instance, used rice, and the Peruvians used corn. The ancient Egyptians, like the Mesopotamians, preferred barley – as, indeed, do most modern-day brewers.

This last fact was particularly fortuitous for Perruchini and her colleagues, because they were able to use samples of modern beers as controls. Every chemical detected in the archaeological artefacts – such as benzoic, butanedioic, pimelic, suberic or azelaic acids, for example – that was also found in the modern beers sharpened the possibility that the scientists were detecting the molecular echoes of an ancient brew.

Mass spectroscopy, for instance, detected a triterpene called squalene. By itself, it could have come from human skin, but its presence with many other beer-related chemicals increased the likelihood that it derived from another common source: germinated barley grains.

The scientists' painstaking analyses confirmed that several vats and large vessels were indeed used for the brewing and drinking of beer, in line with textual and pictorial sources. However, they also discovered that the good folk of Khani Masi were much more flexible – or a lot less fussy – when it came to beer-drinking habits than previously thought.

There is plenty of evidence to suggest that for the Mesopotamians drinking was a communal affair.

“Most studies of ancient Mesopotamian beer have associated its consumption with medium to large jars, from which the beverage was collectively sipped using long straws, sometimes with metal filters attached to the top,” the researchers note.

There is considerable iconographic and archaeological evidence to suggest that the Mesopotamians owned hand-held drinking vessels, ranging from small cups capable of holding between 100 and 200 millilitres (about the volume of a glass of wine) and larger “Kassite” goblets, which held about 600 millilitres.

The standard assumption was that these smaller vessels were used for drinking wine – an individual rather than shared practice.

Analyses by Perruchini and colleagues contradict that conventional position. Results suggest that they too were used to drink beer.

This, they say, indicates a change in cultural practice.

“In social terms the association of both small to very small drinking cups and the medium-sized solid-footed goblets with beer suggests a shift from late third and early second millennium BCE collective beer drinking experiences to more individualised ones,” they write.

It’s a change that invites further investigation, not merely because of the move away from sucking beer out of a barrel through a straw, but also for geo-political reasons. The Khani Masi region sat at the edge of the Mesopotamian influence, next to the Upper Diyala River valley – an area as yet little understood in Bronze Age terms.

In this context it is possible that beer three-and-half-thousand years ago – as now, sometimes – also functioned as a kind of diplomatic ice-breaker.

“This points to the selective and no doubt socially strategic local adoption of Babylonian drinking paraphernalia and practices into an otherwise distinct west Iranian cultural sphere,” the researchers conclude.

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

Five of the scariest antibiotic-resistant bacteria in the past five years

Currently no alternatives to the common antibiotics

[Laura Christine McCaughey](#) *

Nearly one million people die every year from bacterial infections that [cannot be treated with common antibiotics](#). This is frightening because right now we don’t have any alternatives to these antibiotics. [Antibiotic resistance occurs](#) when bacteria change in a way that prevents the antibiotic from working. Changes in bacteria, known as resistance mechanisms, come in different forms and can be shared between different bacteria, spreading the problem.

Antibiotic resistance risks returning us to an age where even simple cuts and scrapes can become deadly. For a glimpse of what could be commonplace in our future, here are five of the scariest antibiotic resistant bacteria from the last five years.

1. Extensively drug-resistant *Salmonella typhi*

This highly contagious bacterium causes typhoid fever, a life-threatening infection that affects about 21 million people around the world every year. About [1% of those affected](#), or 223,000 people, will die.

In November 2016, a [strain of *Salmonella typhi*](#) emerged in Pakistan. It was resistant to five antibiotics, leaving only one oral antibiotic (azithromycin) able to treat it. Since then there have been 858 reported cases of this infection, resulting in four deaths in just one Pakistani province.

Worryingly, this strain of *Salmonella typhi* had changed from being multidrug-resistant (resistant to at least three classes of antibiotic) to extensively drug-resistant (resistant to all but two classes of antibiotic) in a single step. It achieved this by acquiring a piece of DNA, called a plasmid, which already contained all the new resistance genes it needed.

Even more concerning is that this strain is now only one step away from being untreatable with all available antibiotics by finding another plasmid with the resistance genes for the last two classes of antibiotic that can kill it.

2. Extensively drug-resistant *Mycobacterium tuberculosis*

Mycobacterium tuberculosis is the world's leading infectious killer, causing more than [1.7 million deaths](#) every year. One of the reasons this bacteria is so deadly is its ability to hide inside our cells. This means that to treat tuberculosis infection, people are required to take four different antibiotics continuously for six months.

It's estimated up to [13% of all new tuberculosis cases](#) are multidrug-resistant, with Europe, including Russia, seeing the highest number of these cases. This is alarming, as multidrug-resistant infections require treatment courses that are much longer (generally 18 to 24 months) and use antibiotics that are expensive and can be bad for the kidneys and other organs.

It's now been found that 6% of these cases are actually extensively drug-resistant (resistant to all but two classes of antibiotic). With a treatment success rate of only 30%, the global spread of extensively drug-resistant tuberculosis to more than [123 countries](#) is extremely concerning.

3. Pandrug-resistant *Klebsiella pneumoniae*

Klebsiella pneumoniae is a common bacterium found in the skin, intestines and soil. It causes a range of potentially deadly infections in people with compromised immune systems. As this bacterium is particularly prevalent in hospitals, it's one of the most [critical drug-resistant threats](#) to public health.

In 2013 there were 8,000 reports of multidrug-resistant *Klebsiella pneumoniae* in [the United States alone](#), with a death rate of [50% for people with bloodstream infections](#).

In 2016 a strain of [Klebsiella pneumoniae was identified](#) in the United States that was resistant to all 26 commonly available

antibiotics (known as pandrug-resistant). The patient infected by this bacteria died due to a lack of alternative treatments.

This is not an isolated case; other bacteria are also becoming pandrug-resistant.

4. Pandrug-resistant *Pseudomonas aeruginosa*

Like *Klebsiella pneumoniae*, *Pseudomonas aeruginosa* is a commonly found bacterium that causes infections in people with compromised immune systems. Like *Klebsiella pneumoniae*, it's particularly prevalent in hospitals.

In the United States, there are an estimated 51,000 health care-associated *Pseudomonas aeruginosa* infections each year, with around 400 causing death. In the past five years, [29 cases](#) of pandrug-resistant *Pseudomonas aeruginosa* infection have been reported in hospitals in England.

Pseudomonas aeruginosa infection is also the leading cause of death for people with cystic fibrosis. In 2013, more than 42% of cystic fibrosis patients with chronic *Pseudomonas aeruginosa* infection were [treated with colistin](#), the "last line of defence" antibiotic. This is because most of these infections were resistant to every other antibiotic available.

5. Extensively drug-resistant *Neisseria gonorrhoeae*

There are an estimated [78 million global cases](#) of *Neisseria gonorrhoeae*, which causes gonorrhoea, a sexually transmitted infection affecting men and women. Although usually not deadly, serious and permanent health problems including infertility can result if the disease goes untreated.

Around one-third of all *Neisseria gonorrhoeae* infections are resistant to at least one antibiotic. More worryingly, a new extensively drug-resistant "[super gonorrhoeae](#)", resistant to all but one antibiotic, has been discovered.

Two of the first reported cases of this superbug were in Australia. This is cause for concern, as extensively drug-resistant *Neisseria*

gonorrhoeae can spread quickly through a population if people have multiple partners. In rare cases, untreated gonorrhoea can enter the bloodstream, causing septic shock and death.

Could future outbreaks be worse?

Yes. Bacteria have the ability to pass antibiotic resistance genes to other bacteria and can develop the resistance themselves. So it's likely a bacteria resistant to all but one antibiotic will develop resistance to that final one over time.

The good news is we can reduce the likelihood of this happening if we use antibiotics appropriately and invest in the research and development of new antibiotics, vaccines and diagnostic tools.

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