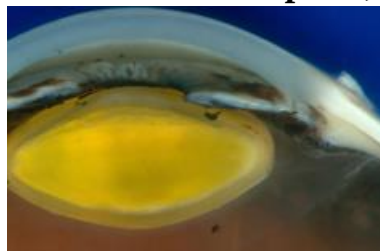


<https://go.nature.com/2jZ8tHV>

## Woman is first to receive cornea made from ‘reprogrammed’ stem cells

*The Japanese woman’s vision has improved since the transplant, say her doctors.*

[David Cyranoski](#)



A Japanese woman in her forties has become the first person in the world to have her cornea repaired using reprogrammed stem cells.

*The transparent cornea protects the eye from damage.* Ralph C. Eagle Jr/Science Photo Library

At a press conference on 29 August, ophthalmologist Kohji Nishida from Osaka University, Japan, said the woman has a disease in which the stem cells that repair the cornea, a transparent layer that covers and protects the eye, are lost. The condition makes vision blurry and can lead to blindness.

To treat the woman, Nishida says his team created sheets of corneal cells [from induced pluripotent stem \(iPS\) cells](#). These are made by reprogramming adult skin cells from a donor into an embryonic-like state from which they can transform into other cell types, such as corneal cells.

Nishida said that the woman’s cornea remained clear and her vision had improved since the transplant a month ago.

Currently people with damaged or diseased corneas are generally treated using tissue from donors who have died, but there is a long waiting list for such tissue in Japan.

Japan has been ahead of the curve in approving the clinical use of iPS cells, which were discovered by stem-cell biologist Shinya Yamanaka at Kyoto University, who won a Nobel prize for the work. Japanese physicians have also used iPS cells to treat [spinal cord injury](#), [Parkinson’s disease](#) and [another eye disease](#).

The Japanese health ministry gave Nishida permission to try the procedure on four people. He is planning the next operation for later this year and hopes to have the procedure in the clinic in five years.

doi: 10.1038/d41586-019-02597-2

<http://bit.ly/2lsZAH0>

## Humans haven’t just changed what dogs look like—we’ve altered the very structure of their brains

*New study of dogs’ brain scans suggests we’ve changed the very structure of their brains*

By [Eva Frederick](#)

In the thousands of years we’ve lived with dogs, we’ve transformed them from fearsome wolves to fluffy, tail-wagging Frisbee catchers that range in size from tiny pomeranians to towering great Danes. Now, a new study of dogs’ brain scans suggests our impact on our canine pals has been even more profound: We’ve changed the very structure of their brains.

“This is really exciting new work,” says Daniel Horschler, a comparative psychologist at the University of Arizona in Tucson who has studied the evolution of dog brains but who was not involved with the current work. “Dogs haven’t really been studied in this way before.”

To conduct the research, Erin Hecht, a Harvard University neuroscientist (and the caretaker of two incredibly hyper Australian shepherds), and her colleagues assembled a library of MRI brain scans from 62 purebred dogs from 33 different breeds. As soon as she saw the images lined up next to each other, “You could just see the results staring at you,” she says. The dogs, which included bichon frises, Labrador retrievers, and more, had a variety of head shapes and sizes. But neither of those things alone could explain the variation in the layout of the dogs’ brains.

Hecht and her team identified six networks of brain regions that tended to be bigger or smaller from dog to dog, and that varied in tandem with each other. The pattern led Hecht to think these regions were probably working together in different behaviors. She wondered whether the varying layouts might be due to behavioral differences between breeds. Beagles can sniff out cancerous tumors in humans and let doctors know, for example, and a border collie can herd hundreds of sheep (or even [turkeys](#)) into an enclosure with remarkable speed and agility.

Her team looked at how the six networks differed between dogs based on the traits they were bred for, as defined by the American Kennel Club.

[Each of the six brain networks correlated with at least one behavioral trait](#), the researchers report today in the *Journal of Neuroscience*. Boxers and dobermans—sometimes used as police dogs—showed significant differences from other breeds in the network that was linked to sight and smell, for example. Dogs bred for sport fighting showed changes in the network that represented fear, stress, and anxiety responses.

Hecht was particularly interested in the differences between dogs bred for sight hunting and those that hunt by scent. Dogs that specialized in scent hunting showed differences not in the early regions of the brain that detect smells, but instead in the more sophisticated areas that help the dogs understand and communicate that information, which made sense to Hecht. “I’ve heard trainers that are working with scent hounds say you don’t have to train a dog to be able to smell something,” she says. “You just have to train them to report it.”

One drawback to her study, Hecht says, is that all the dogs examined were pet dogs, not working dogs. “It’s kind of amazing that we can see these differences in their brains even though they’re not actively performing the behaviors.”

She also says her findings may have other implications. The fact that we’re altering the species around us so much that it affects their brain structure is “deeply profound,” Hecht says. “I think it is a call to be responsible about how we’re doing that and how we’re treating the animals that we’ve done it to.”

*doi:10.1126/science.aaz3324*

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

## Weight-Loss Surgery May Reduce Heart Risks in People With Type 2 Diabetes

*A review of patient records finds startling differences, but critics say a clinical trial must be done.*

By [Roni Caryn Rabin](#)

Every year, hundreds of thousands of obese Americans undergo weight-loss surgery in a last-ditch effort to shed pounds and control their Type 2 diabetes. Now a new study suggests that bariatric surgery may also have other significant health benefits, [cutting the overall risk of serious cardiovascular events and premature death by almost half](#).



*Weight-loss surgery should be the preferred treatment for Type 2 diabetes in certain patients with obesity, one expert suggested. Bruno Boissonnet/Science*

Source

The study, published in the medical journal JAMA on Monday, is not definitive. Though it compared the long-term outcomes of about 2,300 bariatric surgery patients with some 11,500 closely matched patients who had not undergone surgery, it was an observational study, not a randomized controlled trial of the kind considered the gold standard in medicine.

But the findings were so striking that an editorial accompanying the paper suggested that weight-loss surgery, rather than medications,

should be the preferred treatment for Type 2 diabetes in certain patients with obesity.

“The new information here is the ability of bariatric surgery to control macrovascular events like strokes, heart attacks, heart failure and kidney disease,” not just improve weight and diabetes control, said Dr. Edward H. Livingston, the editorial’s author. “That’s a big deal.”

A bariatric surgeon himself, Dr. Livingston said he had long been known as a “curmudgeon” who was reluctant to make claims about the long-term health benefits of weight-loss surgery. “This is the first time I’ve come out publicly saying, ‘You know what, this may be a better way to go,’” he said, adding that insurers should cover the procedure more liberally.

But other scientists were less certain, and even the study’s authors said the findings must be confirmed in clinical trials that randomly assign patients to have surgery or continue with regular care.

“This study needs to be taken with a giant grain of salt,” said Dr. David M. Nathan, director of the Diabetes Center and Clinical Research Center at Massachusetts General Hospital and a professor at Harvard Medical School, who was not involved in the study.

“It will be interpreted as, ‘You see, the surgery reduces heart disease,’” he said. But, he added, “it doesn’t show that.”

A similar observational [study last year that compared 5,301 obese patients with Type 2 diabetes who had bariatric surgery with 14,934 patients](#) who served as controls also found improved outcomes in patients who underwent the operation.

Both Dr. Nathan and Dr. Livingston said the comparisons between patients who had surgery and those who did not were flawed, because people who elect to undergo weight-loss surgery are in many ways different from those who do not. Surgical patients are highly motivated, for instance, and healthy enough that surgeons do not turn them away.

The results of the study of weight-loss surgery — known as bariatric surgery and sometimes as metabolic surgery — were presented on Monday at the European Society of Cardiology Congress in Paris. The study, carried out at the Cleveland Clinic, was partly funded by Medtronic, a company that makes medical equipment used in weight-loss surgery.

The researchers first combed through electronic medical records to identify 2,287 patients with obesity and Type 2 diabetes who had undergone one of four types of weight-loss surgery at the Cleveland Clinic. The majority of patients had undergone gastric bypass or sleeve gastrectomy, while a smaller number had adjustable gastric banding or a duodenal switch procedure.

The scientists then identified 11,435 control patients with obesity and diabetes for comparison — five times the number of surgery patients. Although the researchers made an effort to match the control patients closely to the surgery patients, there were differences between the groups.

The members of the control group were slightly older and had double the smoking rates of the surgery group; the surgery patients were slightly heavier to begin with, and had higher rates of high blood pressure and high cholesterol.

The main question the scientists sought to answer was whether those who had surgery were less likely to experience death or one of five major complications associated with obesity and diabetes: coronary artery events (like heart attacks), cerebrovascular events (like strokes), heart failure, atrial fibrillation or kidney disease.

The investigators found that over a period of eight years, 30.8 percent of patients who had weight-loss surgery either died or developed one of the conditions, compared with 47.7 percent of patients who did not have surgery, a 40 percent reduction.

Surgery patients were also 41 percent less likely to die of any cause during the study period: Ten percent died, compared with 17.8 percent of the patients who did not have surgery.

“The differences were simply astonishing,” said Dr. Steven Nissen, chief academic officer of the Heart & Vascular Institute at Cleveland Clinic and the study’s senior author.

“We struggle to make small incremental improvements in cardiovascular mortality, and here’s an eight-year trial where the magnitude and absolute reduction are very large,” he added.

Patients who had metabolic surgery also lost an average of 15 percent more weight than those who did not, and they had lower blood-sugar levels. They needed less medication to control diabetes and less insulin after the operation than the comparison group, and required fewer drugs to control blood pressure and cholesterol.

The sustained weight loss means “you’ve taken away the burden on the heart of pumping blood to a large body mass,” Dr. Nissen said.

Dr. Ali Aminian, a surgeon who was the study’s lead author, said the next project would be to carry out a randomized controlled clinical trial that randomly assigned similar patients either to weight-loss surgery or to regular care.

Over one-third of American adults have obesity, which is closely linked to Type 2 diabetes, heart disease and stroke. The vast majority of people with Type 2 diabetes die of heart disease.

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

### **Why are fossils more often male?**

#### ***Genetic sexing reveals some interesting anomalies.***

**Dyani Lewis reports.**

When you dig up an ancient bison leg, you’d be forgiven for thinking that the odds of it being a bull versus cow leg were roughly equal. But you’d be wrong. Around 75% of bison fossils are male, according to a new [study](#) in *Proceedings of the National Academies of Sciences*.

The bizarre finding grew out of an unexpected observation by ancient DNA researchers at the University of Adelaide, Australia. When ancient DNA is analysed, specimen sex is also determined as part of normal sample processing. When bison samples seemed to more often come back as male, Bastien Llamas and his colleagues began wondering why.

“It’s something usually we don’t really look at carefully,” he says. “And it seemed like the numbers were too high. I mean, like 75% males, it’s just not normal.” When another group published a [paper](#) that found 72% of mammoth remains were male, they figured should take a closer look.

They looked at the sex of remains from 186 Holarctic bison and 91 arctic brown bears by comparing the amount of X-chromosome sequences to sequences from a non-sex-chromosome. Females, with two X chromosomes, have a double-dose of X-chromosome sequences. In the case of the bison, it seems that – like the mammoths – the herd structure explains the anomaly.

Bison herds usually consist of one dominant male surrounded by a gaggle of females. Less dominant males leave the herd to find a herd of their own or form bachelor groups. “A lot of those males are going to be roaming around the landscape and they’re going to do silly stuff. They have on average more dangerous behaviours or they would be exposed to more predators,” says Llamas.

The upshot of these foolhardy males galumphing all over the place is that when palaeontologists come along millennia later looking for fossils, the chance of finding a male is greater. On the other hand, when you find a female, it’s likely to be clustered with other females. The research team identified just a handful of such sites.

To find out what happens with animals that don’t form female herds, the team looked at brown bears.

A male bias was also found in brown bears – around two thirds of specimens were male. Males generally travel further than females,

which could explain the higher male ratio. Males could also outcompete females for den sites, such as caves. But it depended where you looked. In the alps, where females have wider ranges, only a third of specimens were male. In non-alpine regions, the overall percentage of males jumped to 75%. The team also found widespread sex biases in mammal specimens of living and extinct species in museums. The biases often tilted towards males, but sometimes – as in the case of bats – the bias was for females.

The reasons for the biases are likely varied – and might be the result of behaviour differences in the species being studied – as is the case for bison and mammoths. But biases in specimen collection practices could also play a role. For example, collectors could target male deer with antlers, or avoid taking females with young.

Whatever the cause of the bias, it is something that scientists should take into account, says Llamas. “If you don't consider the fact that your sample is like 60, 70% males, then your conclusions are probably going to be wrong,” he says. Analyses that look at isotope levels to determine diet, for example, or differences in morphology between species, could incorrectly assume that the results apply to an entire population, rather than just one sex.

<http://bit.ly/2krzUu7>

## Teen's Junk Food Diet Caused Him to Go Blind,

### Doctors Say

*He was reportedly a "fussy eater."*

By [Rachael Rettner](#)

A teen who ate nothing but fries, chips and other junk food for years slowly went blind as a result of his poor diet, according to a new report of the case. The case highlights a perhaps little-known fact about poor diets: In addition to being tied to obesity, [heart disease](#) and cancer, they "can also permanently damage the nervous system, particularly vision," according to the report, published today (Sept. 2) in the journal *Annals of Internal Medicine*.

The teen's problems began at age 14, when he went to the doctor's office complaining of tiredness. The teen was reportedly a "fussy eater," and blood tests showed he had anemia and low levels of [vitamin B12](#), the report said. He was treated with injections of vitamin B12 along with advice on how to improve his diet.

However, by age 15, he developed hearing loss and vision problems, but doctors couldn't seem to find the cause — results from an MRI and eye exam were normal. Over the next two years, the teen's vision got progressively worse. When the boy was 17, an eye test showed that his vision was 20/200 in both eyes, the threshold for being "legally blind" in the United States.

Further tests showed the teen had developed damage to his [optic nerve](#), the bundle of nerve fibers that connects the back of the eye to the brain. In addition, the teen still had low levels of vitamin B12, along with low levels of [copper](#), selenium and vitamin D.

These deficiencies prompted doctors to ask the teen about the foods he ate. "The patient confessed that, since elementary school, he would not eat certain textures of food," the authors, from the University of Bristol in the United Kingdom, wrote in the report. He told doctors that the only things he ate were fries, chips — specifically, Pringles — white bread, processed ham slices and sausage.

After ruling out other possible causes for his vision loss, the teen was diagnosed with nutritional optic neuropathy, or damage to the optic nerve that results from nutritional deficiencies. The condition can be caused by drugs, malabsorption of food, poor diet or alcohol abuse. "Purely dietary causes are rare in developed countries," the authors said.

It's known that the B vitamins are essential for many cellular reactions, and [deficiencies in these vitamins](#) can lead to the buildup of toxic byproducts of metabolism, and eventually to the damage of nerve cells, according to the [University of Iowa](#).

Vision loss from nutritional optic neuropathy is potentially reversible if caught early. However, by the time the teen was diagnosed, his vision loss was permanent. What's more, wearing glasses would not help the teen's vision, because damage to the optic nerve cannot be corrected with lenses, said study lead author Dr. Denize Atan, a consultant senior lecturer in ophthalmology at Bristol Medical School and Bristol Eye Hospital.

The teen was prescribed nutritional supplements, which prevented his vision loss from getting any worse. The teen was also referred to mental health services for an eating disorder. The researchers note that the teen's diet was more than just "[picky eating](#)" because it was very restrictive and caused multiple nutritional deficiencies.

A relatively new diagnosis known as "avoidant-restrictive food intake disorder" (previously known as "[selective eating disorder](#)") involves a lack of interest in food or avoidance of foods with certain textures, colors, etc., without concern to body weight or shape. The condition usually starts in childhood, and patients often have a normal body mass index (BMI), as was the case for this patient, the authors said.

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

## Earth's Orbital Shifts May Have Triggered Ancient Global Warming

*A new study combining astronomical and geologic data hints at an extraterrestrial cause for extreme climate change 56 million years ago*

By [Jim Daley](#) on September 3, 2019

Some 56 million years ago, during the transition between the Paleocene and Eocene epochs, Earth caught a fever. In a span of scarcely 20,000 years—not even a rounding error in most measures of geologic time—massive amounts of carbon dioxide flowed into the atmosphere, and average temperatures rose by five to eight degrees Celsius. The planet was transformed. Crocodiles basked on

Arctic beaches lined with palm trees, and steamy swamps and jungles stretched across much of the midlatitudes. Such "hyperthermal" events periodically come and go throughout Earth's history, but this one was particularly intense for unclear reasons. For decades, researchers have puzzled over what triggered this Paleocene-Eocene Thermal Maximum (PETM), peering through the lens of the past to better understand our planet's present-day warming. A surge in [volcanic eruptions](#) likely played a role, perhaps aided by a [comet impact](#). But a new study suggests the PETM may have been instigated by subtle shifts in Earth's orbit around the sun.

Determining where Earth was tens of millions of years ago is a surprisingly thorny problem, because the sun and its planets form a chaotic system, in which minuscule orbital changes can, over time, magnify into enormous effects. Astronomers' best models of planetary motions cannot go further back in time than about 50 million years. Geologists can help by seeking clues about Earth's paleoclimate in ancient seafloor sediments and using those data to extrapolate information about the planet's past position, relative to the sun. In the new study, published in [Science](#), Richard Zeebe, a paleoceanographer at the University of Hawaii at Manoa, and Lucas Lourens, a geoscientist at Utrecht University in the Netherlands, combined astronomical and geologic data to push our detailed knowledge of Earth's position back another eight million years, linking the PETM's onset with a larger cycle of orbital change.

"Given an orbital trigger for the PETM and the strong evidence for orbital pacing of the subsequent hyperthermals, no other trigger is necessary," Zeebe says.

### A 405,000-Year Clock

Earth's orbit is eccentric, meaning it has changed repeatedly over time. Nudged by the gravitation of Jupiter, Mars, Venus and other planets, our world's axial tilt and precession are always slowly

shifting. And its orbit slips between circular and elliptical paths in complex cycles across millennia. One cycle in particular, with a duration of 405,000 years, helps geologists calibrate planetary dynamics using sediment records: like clockwork, when this cycle brought Earth closer to the sun, the climate warmed, leaving behind evidence laid down in rock.

In their study, Zeebe and Lourens examined geologic records to identify orbital eccentricity cycles, calculating a new astronomical solution for the positions and velocities of the planets in the past and checking it against the sediments from Atlantic Ocean seafloors. “We came up with a remarkable match,” Zeebe says. “The geologic record and our calculation seem to be very much in agreement until 58 million years ago.” Most significantly, Zeebe and Lourens’s calculations show the PETM also began around one of the 405,000-year cycles, which tracks with past hyperthermal events, suggesting planetary dynamics initiated it.

“We’ve been waiting for someone to do something like this for some time,” says Linda Hinnov, a paleoclimatologist at George Mason University, who was not involved in the study. She says that figuring out which of the many proposed astronomical solutions for planetary dynamics fit the geologic data is key to illuminating where Earth was more than 50 million years ago. The new study could provide an anchor to pushing that window even further back in time, she adds.

### **Hyperthermal Debate Heats Up**

Paul Olsen, a paleontologist at Columbia University, who was not part of the work, says the conclusion tying the PETM to orbital dynamics is well founded. “For a long time, it looked like the PETM was something super special and did not fall into the category of being paced by celestial mechanics, because it looked like it didn’t fall on one of these [405,000-year] peaks,” he says. But Olsen is not yet ready to close the book on what triggered the

PETM. He says its severity as compared with other hyperthermals that also occurred on 405,000-year cycles raises the question of why this one was so much more extreme. “What makes it different?” he says, noting the comet and volcano hypotheses are still relevant. Jessica Whiteside, a molecular paleontologist at the University of Southampton in England, who was also not involved in the study, says that a confluence of conditions on Earth at the Paleocene-Eocene boundary may have made conditions ripe for orbital dynamics to push the PETM’s warming to such extremes. “I think [what caused] the initial pulse of carbon dioxide is still debatable,” she says.

Whatever was responsible for the surge of carbon dioxide that preceded the PETM, the event—and the rise in global temperatures that followed—are the best analogue in the rock record for current human-caused global warming. That does not mean orbital forcing is playing a role in anthropogenic climate change, Zeebe says. In fact, humans are releasing carbon into the atmosphere far faster than it occurred at the time of the PETM, meaning its impacts could be more severe. “Obviously, orbital configurations today are very different than they were 56 million years ago,” he says. “And in terms of future climate change, there’s very little expectation that orbital forcing will reduce or mitigate [it].”

<http://bit.ly/2lCQpn9>

### **The seeds of Parkinson's disease: amyloid fibrils that move through the brain**

***Using X-ray imaging of post mortem brains, researchers from Osaka University find  $\alpha$ -synuclein aggregates that can move through the brain before developing into Lewy bodies, the hallmark of Parkinson's disease***

Osaka, Japan - Researchers in Japan have found that the structure of Parkinson's disease-associated protein aggregates can tell us, for the first time, about their movement through the brain. These new

findings indicate that Parkinson's disease is a kind of amyloidosis, which has implications for its diagnosis and treatment.

Lewy bodies, primarily composed of  $\alpha$ -synuclein proteins ( $\alpha$ -syn), are the neuropathological hallmark of Parkinson's disease. However, we don't yet fully understand how or why they appear in the brain. Using state-of-the-art imaging techniques, researchers at Osaka University have found that Lewy bodies in Parkinson's disease brains contain  $\alpha$ -syn protein aggregates (called amyloid fibrils) that can propagate through the brain. These findings, published this week in *PNAS*, support the new idea that Parkinson's disease is a kind of amyloidosis, which is a group of rare diseases caused by abnormal protein accumulation.

"Our work follows on from *in vitro* findings that aggregates of  $\alpha$ -synuclein that can propagate through the brain have a cross- $\beta$  structure," says lead author of the study Dr Hideki Mochizuki. "Our study is the first to find that aggregates in Parkinson's disease brains *also* have this cross- $\beta$  structure. This could mean that Parkinson's disease is a kind of amyloidosis that features the accumulation of amyloid fibrils of  $\alpha$ -synuclein."

While immunostaining can tell us about the localization of a protein of interest, it doesn't tell us about its conformation. Electron microscopy can tell us about morphological features, but not about protein structure. Similarly, Fourier-transform infrared spectroscopy can tell us about the secondary structure of proteins, but not about their fibrillary organization.

The researchers therefore teamed up with the large-scale synchrotron radiation facility, SPring-8, and used microbeam X-ray diffraction to visualize the ultrastructure of Lewy bodies in the post mortem brain slices of three patients with Parkinson's disease. Some of the  $\alpha$ -syn aggregates did indeed have a cross- $\beta$  structure, but there was quite a bit of variety in the state of amyloid proteins.

"One possibility is that this variability could indicate the different maturity stages of Lewy bodies," says Dr Katsuya Araki, first author of the paper. "This has obvious implications in the diagnosis of Parkinson's disease, and could also have therapeutic implications in the long run."

The researchers suggest that Parkinson's disease is a systemic (whole-body) amyloidosis rather than one that is localized to one part of the brain. This fits with the non-motor symptoms that patients experience before the onset of motor dysfunction and the multiple organ involvement of  $\alpha$ -syn pathology. The findings from this work are highly applicable to the development of new diagnostic and therapeutic tools for the treatment of Parkinson's disease.

*The article, "Parkinson's disease is a type of amyloidosis featuring accumulation of amyloid fibrils of  $\alpha$ -synuclein," was published in PNAS at DOI <https://doi.org/10.1073/pnas.1906124116>.*

<http://bit.ly/2ly6QBh>

**Parkinson's disease may originate in the intestines**  
***A theory that Parkinson's disease can arise in the intestinal system and from there migrate to the brain has now gained support from research on rats conducted at Aarhus University and Aarhus University Hospital.***

In 2003, a German neuropathologist proposed that Parkinson's disease, which attacks the brain, actually might originate from the gut of the patients. Researchers from Aarhus have now delivered decisive supportive evidence after seeing the disease migrate from the gut to the brain and heart of laboratory rats. The scientific journal *Acta Neuropathologica* has just published the results, which have grabbed the attention of neuroscientific researchers and doctors internationally.

**Harmful proteins on the move**



Parkinson's disease is characterised by slowly destroying the brain due to the accumulation of the protein alpha-synuclein and the subsequent damage to nerve cells. The disease leads to shaking, muscle stiffness, and characteristic slow movements of sufferers. In the new research project, the researchers used genetically modified laboratory rats which overexpress large amounts of the alpha-synuclein protein. These rats have an increased propensity to accumulate harmful varieties of alpha-synuclein protein and to develop symptoms similar to those seen in Parkinson's patients. The researchers initiated the process by injecting alpha-synuclein into the small intestines of the rats. According to professor Per Borghammer and postdoc Nathalie Van Den Berge, the experiment was intended to demonstrate that the protein would subsequently spread in a predictable fashion to the brain.

"After two months, we saw that the alpha-synuclein had travelled to the brain via the peripheral nerves with involvement of precisely those structures known to be affected in connection with Parkinson's disease in humans. After four months, the magnitude of the pathology was even greater. It was actually pretty striking to see how quickly it happened," says Per Borghammer, who is professor at the Department of Clinical Medicine at Aarhus University.

#### **Symptoms in the intestine twenty years before the diagnosis**

Per Borghammer explains that patients with Parkinson's disease often already have significant damage to their nervous system at the time of diagnosis, but that it is actually possible to detect pathological alpha-synuclein in the gut up to twenty years before diagnosis.

"With this new study, we've uncovered exactly how the disease is likely to spread from the intestines of people. We probably cannot develop effective medical treatments that halts the disease without knowing where it starts and how it spreads - so this is an important step in our research," says Per Borghammer, adding:

"Parkinson's is a complex disease that we're still trying to understand. However, with this study and a similar study in the USA that has recently arrived at the same result using mice, the suspicion that the disease begins in the gut of some patients has gained considerable support."

The research project at Aarhus University also showed that the harmful alpha-synuclein not only travel from the intestines to the brain, but also to the heart.

"For many years, we have known that Parkinson patients have extensive damage to the nervous system of the heart, and that the damage occurs early on. We've just never been able to understand why. The present study shows that the heart is damaged very fast, even though the pathology started in the intestine, and we can continue to build on this knowledge in our coming research," says Per Borghammer.

<http://bit.ly/2lx8PWF>

### **Surgical masks as good as respirators for flu and respiratory virus protection**

#### ***"No significant difference in the effectiveness" of medical masks vs. respirators***

DALLAS - Researchers may finally have an answer in the long-running controversy over whether the common surgical mask is as effective as more expensive respirator-type masks in protecting health care workers from flu and other respiratory viruses.

A study published today in [JAMA](#) compared the ubiquitous surgical (or medical) mask, which costs about a dime, to a less commonly used respirator called an N95, which costs around \$1. The study reported "no significant difference in the effectiveness" of medical masks vs. N95 respirators for prevention of influenza or other viral respiratory illness.

"This study showed there is no difference in incidence of viral respiratory transmission among health care workers wearing the

two types of protection," said Dr. Trish Perl, Chief of UT Southwestern's Division of Infectious Diseases and Geographic Medicine and the report's senior author. "This finding is important from a public policy standpoint because it informs about what should be recommended and what kind of protective apparel should be kept available for outbreaks."

Medical personnel - in particular nurses, doctors, and others with direct patient contact - are at risk when treating patients with contagious diseases such as influenza (flu). A large study conducted in a New York hospital system after the 2009 outbreak of H1N1, or swine flu, found almost 30 percent of health care workers in emergency departments contracted the disease themselves, Dr. Perl said.

During that pandemic, the U.S. Centers for Disease Control and Prevention (CDC) recommended using the tighter-fitting N95 respirators, designed to fit closely over the nose and mouth and filter at least 95 percent of airborne particles, rather than the looser-fitting surgical masks routinely worn by health care workers, Dr. Perl said. But some facilities had trouble replenishing N95s as supplies were used.

In addition, there are concerns health care workers might be less vigilant about wearing the N95 respirators since many perceive them to be less comfortable than medical masks, such as making it harder to breathe and being warmer on the wearer's face.

Earlier clinical studies comparing the masks and respirators yielded mixed results, said Dr. Perl, also a Professor of Internal Medicine who holds the Jay P. Sanford Professorship in Infectious Diseases.

The new study was performed at multiple medical settings in seven cities around the country, including Houston, Denver, Washington, and New York, by researchers at the University of Texas, the CDC, Johns Hopkins University, the University of Colorado, Children's Hospital Colorado, the University of Massachusetts, the University

of Florida, and several Department of Veterans Affairs hospitals. Researchers collected data during four flu seasons between 2011 and 2015, examining the incidence of flu and acute respiratory illnesses in the almost 2,400 health care workers who completed the study.

The project was funded by the CDC, the Veterans Health Administration, and the Biomedical Advanced Research and Development Authority (BARDA), which is part of the U.S. Health and Human Services Department and was founded in the years after Sept. 11, 2001, to help secure the nation against biological and other threats.

"It was a huge and important study - the largest ever done on this issue in North America," Dr. Perl said.

In the end, 207 laboratory-confirmed influenza infections occurred in the N95 groups versus 193 among medical mask wearers, according to the report.

In addition, there were 2,734 cases of influenza-like symptoms, laboratory-confirmed respiratory illnesses, and acute or laboratory-detected respiratory infections (where the worker may not have felt ill) in the N95 groups, compared with 3,039 such events among medical mask wearers.

"The takeaway is that this study shows one type of protective equipment is not superior to the other," she said. "Facilities have several options to provide protection to their staff - which include surgical masks - and can feel that staff are protected from seasonal influenza. Our study supports that in the outpatient setting there was no difference between the tested protections."

Dr. Perl said she expects more studies to arise from the data collected in this report; she now plans to investigate the dynamics of virus transmission to better understand how respiratory viruses are spread.

<http://bit.ly/2k1D7Ao>

## Human perception of colors does not rely entirely on language, a case study

### *Patient loses ability to name colors after suffering a stroke*

After patient RDS (identified only by his initials for privacy) suffered a stroke, he experienced a rare and unusual side effect: when he saw something red, blue, green, or any other chromatic hue, he could not name the object's color.

Using RDS as a subject, a study publishing on September 3 in the journal *Cell Reports* looks at how language shapes human thinking. Neuroscientists and philosophers have long wrestled with the interaction between language and thought: do names shape the way we categorize what we perceive, or do they correspond to categories that arise from perception?

To name the color red, for instance, we think of a red item as one of many in a vaguely defined spectrum that encompasses the concept "red." In this sense, we perform an act of categorization each time we call something by its name--we group colors into discrete categories to identify mustard as a shade of yellow, for instance, or place teal in the blue family.

Senior author Paolo Bartolomeo, a neurologist at the Brain and Spine Institute in Salpêtrière Hospital in Paris, says, "We perceive colors as continuous. There is no sharp boundary between, say, red and blue. And yet conceptually we group colors into categories associated with color names.

"In our study, we had the unique opportunity to address the role of language in color categorization by testing a patient who couldn't effectively name colors after a stroke," he says.

Many scientists believe categorizing colors depends on top-down input from the language system to the visual cortex. Color names are believed to be stored in the brain's left hemisphere and to depend on language-related activity in the left side of the brain.

Conversely, these latest findings support recent neuroimaging studies suggesting that color categorization is distributed bilaterally in the human brain.

Viewing discs containing two colors from the same color category (e.g., two blue shades) or from different categories (e.g., brown and red), RDS was asked to identify same-category colors. He was also asked to name 34 color patches presented on a computer screen; eight of these patches were achromatic (white, black and grey), and 26 were chromatic.

Before his stroke, RDS perceived and named colors normally. After the stroke, an MRI revealed a lesion in the left region of his brain. This lesion apparently severed RDS's memory of color names from his visual perception of colors and his language system. Yet RDS could still group most colors--even colors he couldn't name--into categories such as dark or light or as being a mixture of other colors. "We were surprised by his ability to consistently name so-called achromatic colors such as black, white, and gray, as opposed to his impaired naming of chromatic ones such as red, blue, and green," says the first author of the study, PhD student Katarzyna Siuda-Krzywicka. This suggested that our language system may process black, white, and gray differently from chromatic colors. Such striking dissociations raise important questions about how different color-related signals are segregated and integrated in the brain, she says.

To ensure that RDS's behavior did not reflect abnormal brain organization, the researchers compared the functioning of his unaffected brain areas to that of the same brain areas in healthy subjects and developed a non-verbal color-categorization test. "Our result--that his color categories were independent from language--could be generalized to healthy adults," Bartolomeo says.

Where do color categories come from, if not from language? Siuda-Krzywicka suggests that future studies could explore the

implementation of color categorization in non-human primates as well as in the human brain and how language acquisition interacts with color categorization at stages of childhood development.

*This study was supported in France by the Ecole de Neurosciences de Paris (ENP) and the Agence Nationale de la Recherche (ANR).*

*Cell Reports, Siuda-Krzywicka et al. "Color categorization independent of color naming" [https://www.cell.com/cell-reports/fulltext/S2211-1247\(19\)31026-5](https://www.cell.com/cell-reports/fulltext/S2211-1247(19)31026-5)*

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

## Woman Pecked to Death by Her Rooster

Attacks by roosters are very rare, the authors said.

By [Rachael Rettner - Senior Writer](#) 2 days ago [Health](#)

A woman in Australia who was attacked by a rooster died after the bird's pecking caused her leg to hemorrhage profusely, according to a new report of the case.

The 76-year-old woman was collecting chicken eggs on her rural property when an aggressive rooster began pecking at her lower-left leg, according to the report, published Aug. 20 in the journal [Forensic Science, Medicine, and Pathology](#). The pecking led to a "significant hemorrhage," which caused the woman to collapse, the report said.

An autopsy revealed two small lacerations on her leg, one of which was over a large [varicose vein](#). Doctors concluded that the woman died from "exsanguination" due to bleeding from a varicose vein following the rooster attack, the report said.

Varicose veins are swollen, twisted veins just under the skin, according to the [National Institutes of Health](#). The condition is very common and can occur when valves inside the veins become weak or damaged.

Varicose veins are usually not harmful. But in rare cases, they can cause complications, including bleeding that is difficult to stop, according to the [U.K.'s National Health Service](#). In a 2012 report published in the journal [BMC Research Notes](#), researchers from Greece described the case of a 66-year-old woman who died from

bleeding due to a ruptured varicose vein. Underlying conditions, such as [heart disease](#), may increase the risk of death from varicose vein bleeding, the 2012 report said.

In the current case, the Australian woman had several underlying health conditions, including high blood pressure and [type 2 diabetes](#). Attacks by roosters are "very rare," Dr. Roger Byard, a professor of pathology at the University of Adelaide and co-author of the new report, told the [Australian Broadcasting Corporation \(ABC\)](#).

"This case demonstrates that even relatively small domestic animals may be able to inflict lethal injuries in individuals if there are specific vascular vulnerabilities present," the authors wrote in their report.

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

## When more pain means more gain

*Self-inflicted pain can result in an individual feeling much better*

by [Elaina Hancock](#)

It seems unimaginable that intense, self-inflicted pain can result in an individual feeling much better, but that was the case with a longstanding ritual studied by researchers at the University of Connecticut.



[Dimitris Xygalatas](#)

Their study, published in *Current Anthropology*, reports significant positive psychological outcomes and increased perceived well-being in participants who performed an extreme annual ritual as part of a national celebration.

Dimitris Xygalatas, assistant professor of anthropology, studies all kinds of rituals and tends to see them everywhere in daily life. However, the bloody physical rigor endured by Tamil Hindus in Mauritius is very different from the holidays and sports rituals familiar to those in the United States.

"Ritual is something that has no clear function, we just do it because we do it," says Xygalatas, whose findings may provide insight into other extreme behaviors, such as ultramarathons or fire walking. "The reason they have survived is because they have specific benefits."

The researchers designed a real-life experiment to measure the psycho-physiological responses of those who participate in kavadi attam, not only during the ritual, but for weeks before and after the event. They did this by enlisting some 37 participants to wear a non-intrusive sensor, much like a Fitbit, as an armband.

The festival honors the Hindu God of war, Murugan. As the story goes, Murugan was caught in an epic battle with a demon where he used a spear to ensure his victory, says Xygalatas.

In deference to him, Tamil Hindus across the world pierce and puncture their skin with skewers and needles. Then they begin a pilgrimage over many miles uphill to a temple, all the while pulling altars connected to their bodies.

Even for the week prior to the festival, the participants undergo deprivation in the form of fasting, sleeping on the floor, and abstaining from sex and other pleasures, to ensure that they are sufficiently ready for the ordeal ahead.



Dimitris Xygalatas

Designing the experiment was very challenging, Xygalatas says. "It was crucial to use unobtrusive methods and not cause any disruption to the ritual or major alteration to the participants' behavior.

We used an armband that is no heavier than a wristwatch, is invisible to observers, and can be worn for a week on one charge. People get used to it and quickly forget they even have it on. In fact,

at the end of each period we often had to remind them to remove it."

With the armbands, the team measured physiological signals including stress, skin temperature, heat flux, heart rate, and sleep efficiency. Researchers also measured the weight of the altars and the number of piercings or skewers each participant had inserted.

They found a significant increase in the participants' assessment of their health after the ritual.

In fact, the more pain they had endured during the ritual—the more needles they put through their body and the more energy they expended—the greater those benefits were.

This might help explain why those with chronic illness had higher odds of being in the group exposing themselves to the most pain. In addition, participants of lower socio-[economic status](#) and those with more severe health conditions seemed to engage in more painful rituals than those higher on the social ladder or in [better health](#).

Researchers also found the ritual leads to a cohesive feeling within the community and a commitment to community on the part of the participants.

Xygalatas plans to continue studying the kavadi attam [ritual](#) and how it increases participants' quality of life.

"Traditional cultural practices that may strike outsiders as strange may actually have tangible benefits, by helping their practitioners cope with adversity," he says.

"Although, of course, these practices should not be treated as a substitute for biomedical interventions, we should not dismiss their complementary utility for health management, especially in contexts where psychiatric or other medical interventions are either not widely available or are associated with stigma."

**More information:** Dimitris Xygalatas et al. *Effects of Extreme Ritual Practices on Psychophysiological Well-Being*, *Current Anthropology* (2019). [DOI: 10.1086/705665](https://doi.org/10.1086/705665)

<https://go.nature.com/2m1QVeS>

## Ancient worm fossil rolls back origins of animal life

### Half-a-billion-year-old creature challenges theory that animals burst onto the scene in an abrupt event known as the Cambrian explosion.

[Colin Barras](#)

More than half a billion years ago, a strange, worm-like creature died as it crawled across the muddy sea floor. Both the organism and the trail it left lay undisturbed for so long that they fossilized. Now, they are helping to revise our understanding of when and how animals evolved.



*A fossil of Yilingia spiciformis and the track it left as it moved.* Z. Chen et al./Nature

The fossil, which formed some time between 551 million and 539 million years ago, in the Ediacaran period, joins a growing body of evidence that challenges the idea that animal life on Earth burst onto the scene in an [event known as the Cambrian explosion](#), which began about 539 million years ago.

“It is just pushing things further and further back into the Ediacaran,” says Rachel Wood, a geoscientist at the University of Edinburgh, UK. The Cambrian explosion no longer appears to be such an abrupt event in the history of life on Earth, she says. An analysis of the fossil, along with a few dozen similar specimens found in the same rock sequence in southern China, is published in *Nature*<sup>1</sup>.

“What’s extraordinary about this paper is it’s three home runs in the same five-page manuscript,” says Simon Darroch, a palaeontologist at Vanderbilt University in Nashville, Tennessee. First, it’s exceptionally rare to find a dead animal preserved at the end of a

trail it made when alive, he says. Second, the fossil dates to a crucial moment in the evolution of animal life.

And third: “It’s such a bizarre-looking organism,” says Darroch. The creature, which has been named *Yilingia spiciformis* and was up to 27 centimetres long, seems to be a biologically complex animal with a distinct front and rear end. “We don’t really have many of those from the Ediacaran,” he says.

### Ancient organisms

The rock record has already revealed that the Ediacaran seas were rich in life, but many Ediacaran fossils have strange anatomical features that are unlike those seen in modern animals. Because of this, palaeontologists have struggled to relate the Ediacaran organisms to the creatures of the Cambrian period. This bolstered the idea that the Cambrian explosion represented the dramatic first appearance of familiar animals.

But opinions have begun to shift in the past few years. Some Ediacaran organisms have been recognized as animals despite their peculiar anatomy, which suggests that animal life began millions of years before the Cambrian explosion.

*Yilingia spiciformis* fits into that picture and pushes the idea further.

With a segmented body that is symmetrical down its length, it has an anatomy that is more obviously similar to that of Cambrian animals, says Shuhai Xiao, a palaeontologist at Virginia Tech in Blacksburg and a co-author of the study.



*Like modern animals, Y. spiciformis had a distinct front and back end: the fossil tapers towards the rear.* Z. Chen et al./Nature

What’s more, the trail demonstrates that *Y. spiciformis* could crawl over the sea floor like a modern animal. Palaeontologists have found only few pieces of evidence that the strange organisms of the

Ediacaran were similarly mobile. Collectively, Xiao's team's findings mean that *Y. spiciformis* looked and behaved like a Cambrian animal — despite living up to 12 million years before what is usually considered the start of the Cambrian explosion.

“In the past, palaeontologists emphasized the differences between the Ediacaran and Cambrian,” says Xiao. “But when you think about it, life had to continue through the boundary. Some lineages had to survive.”

### Seeking descendants

Exactly which animal lineage *Y. spiciformis* belonged to is unclear. The researchers suggest it might be a relative of insects and crustaceans such as shrimp and lobsters, because it seems to have leg-like structures. If further analysis shows that those structures are actually an artefact of the fossilization process, the animal might instead be some sort of primitive segmented worm.

“There's a third possibility,” says Xiao: it could be an ancestor to both groups. The idea that segmented worms and shrimp-like creatures all evolved from a single group of segmented animals dates back to the nineteenth century, but it's controversial because most researchers now think that shrimp-like animals are more closely related to [nematode worms](#) and other creatures that grow by shedding an exoskeleton.

Xiao thinks the evolution of segments could have been a key event in the history of animal life. Segmented animals might be able to evolve more or fewer segments without fatally disrupting their biology. So, he reasons, once a single group of segmented animals evolved, it might have had great potential to diversify into a whole range of lineages adapted to new niches, explaining why animal life flourished a few million years after *Y. spiciformis* appeared.

But Doug Erwin, a palaeobiologist at the Smithsonian National Museum of Natural History in Washington DC, isn't convinced by the idea: he thinks segmentation probably arose several times in

animal evolution. Partly as a consequence, he thinks *Y. spiciformis* could even belong to a completely different branch of the animal evolutionary tree, which has since gone extinct.

*Nature* 573, 15 (2019) doi: 10.1038/d41586-019-02556-x

### References

<sup>1</sup>. Chen, Z., Zhou, C., Yuan, X. & Xiao, S. *Nature* <https://doi.org/10.1038/s41586-019-1522-7> (2019).

<http://bit.ly/2m1IWOT>

## Denisovan fossil finger points to the timing of Neanderthal evolution

**Anthropologists put a finger on differences between Neanderthals and Denisovans.**

[Kiona N. Smith](#)

*The two fragments of Denisova 3's fingertip, reunited in digital form. Bennett et al. 2019*



A group of anthropologists finally put back together a Denisovan finger bone unearthed in 2009, and it pointed to something surprising. Denisovan fingers looked more like ours than like Neanderthals', even though DNA shows that Denisovans are more closely related to Neanderthals. That suggests Neanderthals evolved subtle differences in the shape of their finger bones (phalanges) sometime after they branched off from Denisovans around 410,000 years ago. DNA can tell us a lot about how species are related to each other, but we still need to look at the bones themselves to understand how and when particular traits changed. The combination of DNA and skeletal evidence can help us understand the details that differentiated modern humans from our nearest hominin relatives—and the environmental and other forces that shaped those differences.

### The fickle fate of a finger

Back in 2010, DNA from one fragment of this finger bone (the proximal end, or the one closest to the body) revealed the existence

of another hominin species that we'd been missing all this time. The Denisovans were named for Denisova Cave in Siberia, where anthropologists unearthed the bone. It's the tip of the right pinky finger of a 13-year-old Denisovan girl who died 50,000 years ago. Her DNA sequence has become the source of most of what we now know about her enigmatic people, as fossil finds have been surprisingly rare for such a wide-ranging, long-lived species.

Shortly after exhuming the finger bone, the anthropologists who made the find cut it in half and sent the proximal end to the Max Planck Institute in Germany and the distal end (the very tip of the finger) to the University of California, Berkeley. Sometime in the decade since then, someone lost the only photos of the whole bone, leaving researchers with no idea what the entire finger looked like.

Molecular biologist E. Andrew Bennett of the Institut Jacques Monod in France and his colleagues have now used photos of the distal piece and digital scans of the proximal one to reunite the two fragments.

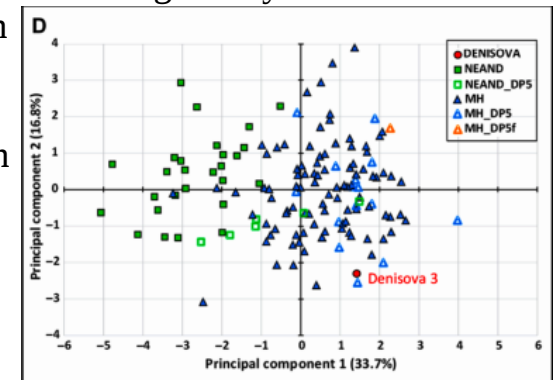
With a digital (get it? *digit*-al?) reconstruction of the finger bone, Bennett and his colleagues had enough evidence to say that the bone had come from the right hand, and to conclude that the girl now called Denisova 3 was between 13 and 14 years old when she died. The plate of bone at the end of the finger bone, called the epiphysis, had been in the process of fusing with the bone of the shaft when she died. In most modern human girls (and the Neanderthals we have finger bones and age estimates from), that happens between the ages of about 13 and 14 years.

### A matter of proportion

The authors carefully measured the proportions of the finger bone, the size of important features, and the distance between key landmarks on the surface of the bone. They used those measurements to compare the shape and proportions (not the absolute size) of the bone to finger bones from a sample of

Neanderthal and *Homo sapiens* remains. The Neanderthals and the *Homo sapiens* sorted into two distinct groups, and Denisova 3 clearly fit in with the *Homo sapiens*, not her closer Neanderthal cousins.

Neanderthal finger bones are pretty easy to tell apart from *Homo sapiens* finger bones—for paleoanthropologists, anyway. Most Neanderthals had proportionally longer finger bones, with wider ends (called tufts). Bennett and his colleagues say that “seems to be related to functional rather than cold climate adaptations,” unlike several of the other anatomical differences between us and Neanderthals. Denisova 3's finger bone looked no different from that of a *Homo sapiens*—but quite different from that of a Neanderthal.



***Although there's a little overlap, the Neanderthal and Homo sapiens finger bones sort themselves into two clear groups on the chart, and Denisova 3 fits in with the Homo sapiens.*** Bennett et al 2019

Those differences in Neanderthal fingers must have evolved sometime after Neanderthals and Denisovans had branched off from their last common ancestor 410,000 years ago. Bennett and his colleagues suggest that it must have happened relatively late in the Neanderthals' story. One pinky finger tip from a Neanderthal who lived at the Moula-Guercy site in France ([therein hangs a tale](#)) around 100,000 years ago, looked more like *Homo sapiens* than later Neanderthals—but it was the only one in the sample that did. So sometime either around or after that, something about the demands of Neanderthal life must have caused them to evolve longer finger bones with wider ends.



A [160,000-year-old Denisovan jawbone from the Xiahe site in China](#) tells a different piece of that evolutionary story, but one that lines up well with what Denisova 3's little finger tells us. Some of the Denisovan jaw's features are very similar to those of Neanderthals, which suggests that both species inherited those features from their last common ancestor. But some features of Neanderthal jaws don't show up on the Denisovan version, which suggests that those features—like the differences in finger shape—probably emerged later on in response to different evolutionary pressures.

These look like subtle differences, but they're clues about the kinds of evolutionary pressures that shaped Neanderthals, Denisovans, and our ancestors in small but ultimately important ways during the few tens of thousands of years when all three shared the planet. Someday, they may even reveal why we're still here while the Neanderthals and Denisovans aren't.

Science Advances, 2019. DOI: [10.1126/sciadv.aaw3950](https://doi.org/10.1126/sciadv.aaw3950) ([About DOIs](#)).

<http://bit.ly/2kv6dbq>

### **Human speech may have a universal transmission rate: 39 bits per second**

***No matter how fast or slowly languages are spoken, they tend to transmit information at about the same rate: 39 bits per second***

By [Catherine Maticic](#)

Italians are some of the fastest speakers on the planet, chattering at up to nine syllables per second. Many Germans, on the other hand, are slow enunciators, delivering five to six syllables in the same amount of time. Yet in any given minute, Italians and Germans convey roughly the same amount of information, according to a new study. Indeed, no matter how fast or slowly languages are spoken, they tend to transmit information at about the same rate: 39 bits per second, about twice the speed of Morse code.

“This is pretty solid stuff,” says Bart de Boer, an evolutionary linguist who studies speech production at the Free University of Brussels, but was not involved in the work.

Language lovers have long suspected that information-heavy languages—those that pack more information about tense, gender, and speaker into smaller units, for example—move slowly to make up for their density of information, he says, whereas information-light languages such as Italian can gallop along at a much faster pace. But until now, no one had the data to prove it.

Scientists started with written texts from 17 languages, including English, Italian, Japanese, and Vietnamese. They calculated the information density of each language in bits—the same unit that describes how quickly your cellphone, laptop, or computer modem transmits information. They found that Japanese, which has only 643 syllables, had an information density of about 5 bits per syllable, whereas English, with its 6949 syllables, had a density of just over 7 bits per syllable. Vietnamese, with its complex system of six tones (each of which can further differentiate a syllable), topped the charts at 8 bits per syllable.

Next, the researchers spent 3 years recruiting and recording 10 speakers—five men and five women—from 14 of their 17 languages. (They used previous recordings for the other three languages.) Each participant read aloud 15 identical passages that had been translated into their mother tongue. After noting how long the speakers took to get through their readings, the researchers calculated an average speech rate per language, measured in syllables/second.

Some languages were clearly faster than others: no surprise there. But when the researchers took their final step—multiplying this rate by the bit rate to find out how much information moved per second—they were shocked by the consistency of their results.

No matter how fast or slow, how simple or complex, [each language gravitated toward an average rate of 39.15 bits per second](#), they report today in *Science Advances*. In comparison, the world's first computer modem (which came out in 1959) had a transfer rate of 110 bits per second, and the average home internet connection today has a transfer rate of 100 megabits per second (or 100 million bits).

"Sometimes interesting facts or rules are hidden in plain sight," says study co-author François Pellegrino, an evolutionary linguist at the CNRS-sponsored Dynamique Du Langage Laboratory at the University of Lyon in France.

Because language science has focused so long on things like grammatical complexity, he says, this information transfer rate has been overlooked. The "crystal clear conclusion," he adds, is that although languages differ widely in their encoding strategies, no one language is more efficient than another at delivering information.

But the "why" is another question entirely. Pellegrino and his colleagues suspect that the answer has everything to do with the limits imposed by our fragile biology—how much information our brains can take in—or produce—at any one time. Research in neuroscience supports that idea, with one recent paper suggesting an upper bound to auditory processing of [9 syllables per second in U.S. English](#).

De Boer agrees that our brains are the bottleneck. But, he says, instead of being limited by how quickly we can process information by listening, we're likely limited by how quickly we can gather our thoughts. That's because, he says, the average person can listen to audio recordings sped up to about 120%—and still have no problems with comprehension. "It really seems that the bottleneck is in putting the ideas together."

Posted in: [Brain & Behavior](#) doi:10.1126/science.aaz3886

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

**Employees who are treated rudely get their revenge with the silent treatment, research shows**  
***Employees who are treated rudely at work get their revenge by withholding important information from colleagues and managers, new research shows.***

by Tony Trueman, British Academy of Management

The British Academy of Management's annual conference in Birmingham heard today [Thursday 5 September] that employees who experience [workplace incivility](#) are more likely to engage in "deviant behaviors" directed toward both colleagues and the organization.

Researchers asked almost 300 employees in US firms to rate how rude colleagues had been to them, and how much they kept silent in order to get even or to harm their employers.

Three academics at the Universite de Pau et des Pays de l'Adour in France conducted online surveys with 297 employees working in various industries in the United States, a representative sample of the workforce.

Professor Jean Pierre Neveu, Dr. Ghulam Murtaza and Rahman Khan asked the employees to rate on a scale of 1 (never) to 5 (every day) how often a colleague or boss had been rude to them during the previous two months. They also asked them to rate from 1 to 5 how much they had remained silent about an important matter when they should have spoken up, in order to get even with a colleague or hurt their employer.

The researchers found that the average score for the rudeness experienced was 2.12, and that for every 1 unit increase, the likelihood that workers would remain silent increased by about a third. An [employee](#) who experience rudeness every day would be around twice as likely to remain silent as the average.

Employee silence, an increasingly recognized phenomenon, can be costly for organizations. Examples include staff failing to speak up when workplace plans and procedures are riddled with inaccuracies or faulty thinking.

"Experiencing incivility at work leads to deviant silence in which an individual withholds useful information to harm someone," Mr Khan told the conference. Staying silent was "a response to experiencing incivility because the individual thinks that it's fair to retaliate against the perpetrator," he said.

"Employees intentionally remain silent about important issues because they perceive their work environment is not conducive for it, which can posit serious harm to the organizations.

"Experiencing workplace [incivility](#) may not only be harmful to a victim's mental health but can also motivate him or her to make unethical choices. In turn, such deviant behaviors can hurt an organization's culture as well as its financial condition."

Mr Khan said that staying silent could backfire and created a vicious cycle. "Deviant behavior like hiding valuable information can lead colleagues or superiors to make wrong decisions and may cause [negative emotions](#) in them thus further leading to subsequent mistreatment targeted towards the perpetrator as they want to pay him back."

<https://bbc.in/2IF19BO>

**Left-handed DNA found - and it changes brain structure**  
***Scientists have found the first genetic instructions hardwired into human DNA that are linked to being left-handed.***

By James Gallagher Health and science correspondent, BBC News

The instructions also seem to be heavily involved in the structure and function of the brain - particularly the parts involved in language. The team at the University of Oxford say left-handed people may have better verbal skills as a result. But many mysteries

remain regarding the connection between brain development and the dominant hand.

**What does this tell us?**

About one in 10 people is left handed. Studies on twins have already revealed genetics - the DNA inherited from parents - has some role to play. However, the specifics are only now being revealed. The research team turned to the UK Biobank - a study of about 400,000 people who had the full sequence of their genetic code, their DNA, recorded. Just over 38,000 were left-handed.

And the scientists played a giant game of spot-the-difference to find the regions of their DNA that influenced left-handedness.

The study, published in the journal *Brain*, found four hotspots.

"It tells us for the first time that handedness has a genetic component," Prof Gwenaëlle Douaud, one of the researchers, told BBC News.

**But how does it work?**

The mutations were in instructions for the intricate "scaffolding" that organises the inside of the body's cells, called the cytoskeleton. Similar mutations that change the cytoskeleton in snails have been shown to lead to the molluscs having an anticlockwise or "lefty" shell.

(Remember the quest to find Jeremy the garden snail [a mate](#) because, in the snail world, righties and lefties can't have sex as their genitals are in the wrong place as far as the other is concerned?)

Image copyright University of Nottingham Image caption Jeremy the "lefty" snail and one of his right-spiralling-shell offspring

Scans of participants in the UK Biobank project showed the cytoskeleton was changing the structure of the white matter in the brain. "For the first time in humans, we have been able to establish that these handedness-associated cytoskeletal differences are

actually visible in the brain," Prof Douaud, who is herself left handed, said.

In the left-handed participants, the two halves of the brain - the left and right hemispheres - were better connected and more coordinated in regions involved in language.

The researchers speculate left-handed people may have better verbal skills, although they do not have the data from this study to prove it. The study also showed slightly higher risks of schizophrenia, and slightly lower risks of Parkinson's disease, in left-handed people.

### **Does this change what it means to be left-handed?**

Being left-handed has often led to a raw deal.

"In many cultures being left handed is seen as being unlucky or malicious and that is reflected in language," said Prof Dominic Furniss, a hand surgeon and author on the report.

In French, "gauche" can mean "left" or "clumsy". In English, "right" also means "to be right".

"What this study shows is that being left-handed is just a consequence of the developmental biology of the brain, it has nothing to do with luck or maliciousness," Prof Furniss said. "And it is driven at least in part by genetic variants we've discovered.

"This adds to the understanding of what makes us human."

### **Is this the end of the story?**

Far from it.

The best guess is handedness is 25% genetic and 75% down to the environment (anything that's not in the genes). Yet this study has found only the first 1% of that genetic component and only in a British population. So, much more work is needed to understand the genetic component of handedness in people across the globe, never mind what the huge environmental effects are, and then piece together how those elements result in people being either left or right handed.

<http://bit.ly/2jYf70S>

## **Study links hearing aids to lower risk of dementia, depression and falls**

*Study of Medicare HMO participants, whose insurance covers part of hearing aid cost, reveals disparities in use and difference in incidence of major conditions after 3 years*

Older adults who get a hearing aid for a newly diagnosed hearing loss have a lower risk of being diagnosed with dementia, depression or anxiety for the first time over the next three years, and a lower risk of suffering fall-related injuries, than those who leave their hearing loss uncorrected, a new study finds.

Yet only 12% of those who have a formal diagnosis of hearing loss actually get the devices - even when they have insurance coverage for at least part of the cost, the study shows. It also reveals gaps in hearing aid use among people of different racial and ethnic backgrounds, geographic locations and genders.

The findings, made by a University of Michigan team using data from nearly 115,000 people over age 66 with hearing loss and insurance coverage through a Medicare HMO between 2008 and 2016, are published in the [Journal of the American Geriatrics Society](#). Unlike traditional Medicare, Medicare HMOs typically cover some hearing aid costs for members diagnosed with hearing loss by an audiologist.

[Elham Mahmoudi, MBA, Ph.D.](#), the U-M Department of Family Medicine health economist who led the study, says the study confirms what other studies have shown among patients studied at a single point in time - but the new findings show differences emerging as time goes on.

"We already know that people with hearing loss have more adverse health events, and more co-existing conditions, but this study allows us to see the effects of an intervention and look for associations between hearing aids and health outcomes," she says.

"Though hearing aids can't be said to prevent these conditions, a delay in the onset of dementia, depression and anxiety, and the risk of serious falls, could be significant both for the patient and for the costs to the Medicare system."

### Long-term tracking

Mahmoudi and her colleagues at the [U-M Institute for Healthcare Policy and Innovation](#) looked at anonymous insurance data to perform the study, and looked at the data for each person with hearing loss one year before their diagnosis, and three years after, so they could see only newly diagnosed dementia, depression, anxiety and fall injuries. They intend to keep studying further data from this population, to see if the differences in health outcomes continue beyond three years.

The study shows that men with hearing loss were more likely to receive a hearing aid - 13.3% compared with 11.3% of women. Only 6.5% of people of Latino heritage received a hearing aid for their hearing loss, compared with 9.8% of African-Americans and 13.6% of whites. Nearly 37% of people with hearing loss who lived in the north-central part of the country, as designated by the Census Bureau, used a hearing aid, compared with just 5.9% of people in the mountain states.

### Differences in diagnosis

When the researchers looked at the path that patients who received hearing aids took over three years, compared with those who didn't get the devices, significant differences emerged.

In all, the relative risk of being diagnosed with dementia, including Alzheimer's disease, within three years of a hearing loss diagnosis was 18% lower for hearing aid users. The risk of being diagnosed with depression or anxiety by the end of three years was 11% lower for hearing aid users, and the risk of being treated for fall-related injuries was 13% lower. The study also confirms previous studies'

findings that people with hearing loss had much higher rates of dementia, depression and fall injuries than the general population.

The reasons for this are complicated, and can include loss of social interaction, loss of independence, loss of balance and less stimulation to the brain. Some researchers also believe that the loss of nerve impulses from the ear to the brain, and loss of cognitive ability leading to dementia, could be part of the same aging process.

### What's to come

The study only included individuals who billed their insurance company for part of the cost of their hearing aid, Mahmoudi notes. The coming of FDA-approved over-the-counter hearing aids in 2020 for people with mild to moderate hearing loss could make the devices much more accessible for many people.

But those new devices could also complicate researchers' ability to study the effects of hearing aids on other health outcomes, if people do not use insurance coverage and researchers can't tell if they have one.

"Correcting hearing loss is an intervention that has evidence behind it, and we hope our research will help clinicians and people with hearing loss understand the potential association between getting a hearing aid and other aspects of their health," says Mahmoudi.

She notes that Medicaid in the state of Michigan is now covering hearing aid testing, fitting and purchase, since a policy change in 2018, and that it will be important to study impacts in this population as well.

*In addition to Mahmoudi, the new study's authors are IHPI statisticians Tanima Basu, M.S. and Neil Kamdar, M.A., and IHPI members Kenneth Langa, M.D., Ph.D., Michael M. McKee, M.D., M.P.H., Phillip Zazove, M.D. and Neil Alexander, M.D. Langa and Alexander are professors in the U-M Department of Internal Medicine; McKee and Zazove are assistant professor and chair, respectively, of the U-M Department of Family Medicine. Langa also holds faculty positions in the U-M Institute for Social Research and the VA Ann Arbor Center for Clinical Management Research.*

*Reference: Journal of the American Geriatrics Society, DOI:10.1111/jgs.16109, <https://onlinelibrary.wiley.com/doi/10.1111/jgs.16109>*

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

## **Eating mushrooms may help lower prostate cancer risk**

### ***Inverse relationship between mushroom consumption and the development of prostate cancer***

A new study published in the [International Journal of Cancer](#) found an inverse relationship between mushroom consumption and the development of prostate cancer among middle-aged and elderly Japanese men, suggesting that regular mushroom intake might help to prevent prostate cancer.

A total of 36,499 men, aged 40 to 79 years who participated in the Miyagi Cohort Study in 1990 and in the Ohsaki Cohort Study in 1994 were followed for a median of 13.2 years. During follow-up, 3.3% of participants developed prostate cancer. Compared with mushroom consumption of less than once per week, consumption once or twice a week was associated with an 8% lower risk of prostate cancer and consumption three or more times per week was associated with a 17% lower risk.

"Since information on mushroom species was not collected, it is difficult to know which specific mushroom(s) contributed to our findings. Also, the mechanism of the beneficial effects of mushrooms on prostate cancer remains uncertain," said lead author Shu Zhang, PhD, of the Tohoku University School of Public Health, in Japan.

<http://bit.ly/2IAwmG6>

## **Coffee may protect against gallstones**

### ***Drinking more coffee may help reduce the risk of developing gallstones***

Drinking more coffee may help reduce the risk of developing gallstones, according to a new study published in the [Journal of Internal Medicine](#).

Among 104,493 individuals, those who drank more than six cups of coffee per day had a 23% lower risk of developing symptomatic

gallstones compared with individuals who did not drink coffee. Drinking one extra cup of coffee per day was associated with 3% lower risk. Also, individuals with certain genetic variants that have been linked to increased coffee consumption had a lower risk of gallstones.

Although the study only uncovered correlations, the authors highlighted several mechanisms by which coffee consumption might help prevent gallstones from forming.

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

## **Stop Prescribing Antipsychotics for Delirium**

### ***Antipsychotics do not show a clear benefit over placebo for preventing or treating delirium in hospitalized adults***

Diana Swift

Neither first- nor second-generation antipsychotics show a clear benefit over placebo for preventing or treating [delirium](#) in hospitalized adults, and their routine use should be discontinued, researchers from Johns Hopkins University in Baltimore, Maryland, report.

Second-generation antipsychotics, however, may have some benefit in the postoperative setting, according to two systematic reviews of 26 randomized controlled trials (RCTs) published online September 2 in the *Annals of Internal Medicine*.

As many as 50% of older inpatients hospitalized for acute illness or surgery experience delirium, which can impair awareness, attention, and cognition and may lead to potentially dangerous disorientation and confusion.

### **Data Do Not Support Routine Use for Prevention**

In [the first](#) of two reviews, Esther S. Oh, MD, PhD, associate director of the Johns Hopkins Memory and Alzheimer's Treatment Center, and colleagues analyzed 14 RCTs involving 4281 patients that were published from 1999 to 2018. They compared the preventive benefits and harms of [haloperidol](#) vs placebo and

atypical second-generation antipsychotics such as [risperidone](#) and [quetiapine](#).

Little or no data emerged from the review to determine the effect of haloperidol on cognitive function, delirium severity, inappropriate continuation of medication, and sedation. Evidence suggested that second-generation antipsychotics may offer minimal benefit in the postsurgical setting.

Overall, the researchers conclude, "...evidence was insufficient to support the routine use of antipsychotics for preventing delirium in adult patients. Second-generation antipsychotics may lower delirium incidence in postoperative patients, but more research is needed to confirm this finding."

That conclusion is based on three RCTs that compared second-generation antipsychotics with placebo in postoperative settings. A statistically significantly lower pooled relative risk (RR) for incident delirium was found. In these studies, the pooled RR for delirium incidence with second-generation agents was 0.36 (95% confidence interval [CI], 0.26 – 0.50); for haloperidol, the RR was 0.94 (95% CI, 0.77 – 1.16).

In terms of safety, no statistically significant differences between haloperidol and placebo emerged regarding cardiac side effects such as arrhythmia and prolongation of the corrected QT interval (QTc). For six studies, the pooled RR of arrhythmias with haloperidol vs placebo was 1.27 (95% CI, 0.72 – 2.21). For seven studies, the RR of QTc was 1.11 (95% CI, 0.80 – 1.55).

Overall findings for cardiac events were similar for second-generation antipsychotics compared with placebo, but some trials found such events to be more frequent in antipsychotic recipients.

### Treatment

A second [review](#), by Roozbeh Nikooie, MD, a postdoctoral research fellow at Johns Hopkins University School of Medicine, and colleagues, assessed 16 RCTs and 10 observational studies

involving 5607 inpatients that were published from 2004 to 2018. This review weighed the benefits and harms of haloperidol and second-generation antipsychotics for treating delirium in hospitalized populations.

As with its prevention counterpart, the treatment review found no differences for haloperidol and second-generation antipsychotics compared with placebo regarding hospital length of stay, sedation status, delirium duration, or mortality. Evidence for their effects on cognitive functioning and delirium severity was insufficient or lacking.

Again, there were reports of more frequent cardiac side effects with antipsychotics, particularly prolongation of the QT interval, with second-generation antipsychotics compared with placebo or haloperidol. There was little evidence of antipsychotic-related neurologic harms.

Nikooie and associates note that for some clinically important outcomes and for subgroups such as older patients and palliative care patients, evidence was insufficient or absent, underscoring the need for continued research in this area.

The researchers write that future trials with standardized outcome measures are needed to clarify the impact of antipsychotics on multiple outcomes. These endpoints include agitation and distress, subsequent memories of delirium, caregiver burden and distress, inappropriate continuation of antipsychotic therapy, and long-term cognitive function.

In an [accompanying editorial](#) that focuses on treatment, Edward R. Marcantonio, MD, section chief for research in the Division of General Medicine and Primary Care at Beth Israel Deaconess Hospital in Boston, Massachusetts, notes that delirium is a strong predictor of adverse outcomes. These include in-hospital complications such as falls, functional and cognitive decline, and death. Delirium also leads to extensions of hospital stay and post-

discharge institutional care, adding billions of dollars in annual costs to the US healthcare system.

Marcantonio agrees with the study authors that the routine practice of giving antipsychotics for delirium is not supported by evidence. "With regard to use of antipsychotics for broad treatment of delirium, I believe the findings presented are sufficient to stop this clinical practice," he writes.

Managing delirium for better short- and long-term outcomes should be an investigational priority. "Future research should focus on defining patient subgroups and settings (if any) in which the benefits of antipsychotics outweigh harms, such as short-term use for behavioral control of a patient who is a danger to themselves or others, and for whom behavioral strategies are insufficient," Marcantonio writes.

He supports a patient-centered, bundled approach to delirium that includes early diagnosis and that addresses underlying causes, prevention of complications, and promotion of functional recovery. "Identifying which practices belong in this bundle, and how to deliver it in a standardized, high-quality, and sustainable way, should be a major focus of the next generation of delirium treatment research," Marcantonio concludes.

*Both studies and several authors were financially supported by the Agency for Healthcare Research and Quality. Coauthor Karin J. Neufeld, MD, MPH, reports financial relationships with Merck and Hitachi outside the submitted work. Marcantonio has disclosed no relevant financial relationships.*

*Ann Intern Med.* Published online September 2, 2019. Review 1, [Full text](#); Review 2, [Full text](#); [Editorial](#)

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

## Loch Ness Monster may be a giant eel, say scientists

*The creatures behind repeated sightings of the fabled Loch Ness Monster may be giant eels, according to scientists.*

Researchers from New Zealand have tried to catalogue all living species in the loch by extracting DNA from water samples.

Following analysis, the scientists have ruled out the presence of large animals said to be behind reports of a monster. No evidence of a prehistoric marine reptile called a plesiosaur or a large fish such as a sturgeon were found. Catfish and suggestions that a wandering Greenland shark were behind the sightings were also discounted.



*The modern myth of the monster gathered pace in the 1930s but this famous 1934 photo was later revealed to be a fake The "Surgeon's Photo" turned out to be a toy submarine - but these "witnesses" recorded in 1938 were taking the monster seriously Getty Images*

The aim of the research was not to find Nessie, but to improve knowledge of what plants and animals live in Loch Ness.

[European eels are among the creatures in the loch](#), and whose DNA was picked up by the new research. Juvenile eels, known as elvers, arrive in Scottish rivers and lochs after migrating more than 3,100 miles (5,000 km) from the Sargasso Sea near the Bahamas, where the animals spawn and lay eggs.

Prof Neil Gemmill, a geneticist from New Zealand's University of Otago. said: "People love a mystery, we've used science to add another chapter to Loch Ness' mystique. "We can't find any evidence of a creature that's remotely related to that in our environmental-DNA sequence data. So, sorry, I don't think the plesiosaur idea holds up based on the data that we have obtained."

He added: "So there's no shark DNA in Loch Ness based on our sampling. There is also no catfish DNA in Loch Ness based on our sampling. We can't find any evidence of sturgeon either,

"There is a very significant amount of eel DNA. Eels are very plentiful in Loch Ness, with eel DNA found at pretty much every location sampled - there are a lot of them. So - are they giant eels?"



"Well, our data doesn't reveal their size, but the sheer quantity of the material says that we can't discount the possibility that there may be giant eels in Loch Ness. Therefore we can't discount the possibility that what people see and believe is the Loch Ness Monster might be a giant eel."

DNA from humans, dogs, sheep, cattle, deer, badgers, rabbits, voles and birds were also identified by the researchers.

### **How Nessie came to grip the public imagination**

The Loch Ness Monster is one of Scotland's oldest and most enduring myths. It inspires books, TV shows and films, and sustains a major tourism industry around its home.

The story of the monster can be traced back 1,500 years when Irish missionary St Columba is said to have encountered a beast in the River Ness in 565AD. Later, in the 1930s, The Inverness Courier reported the first modern sighting of Nessie.

In 1933, the newspaper's Fort Augustus correspondent, Alec Campbell, reported a sighting by Aldie Mackay of what she believed to be Nessie. Mr Campbell's report described a whale-like creature and the loch's water "cascading and churning".

The editor at the time, Evan Barron, suggested the beast be described as a "monster", kick starting the modern myth of the Loch Ness Monster. In 1934, highly respected British surgeon, Colonel Robert Wilson, claimed he took a photograph of the monster while driving along the northern shore of Loch Ness.

Known as the "Surgeon's Photograph", 60 years later it was confirmed as a hoax hatched in revenge after a newspaper ridiculed journalist Marmaduke Wetherell for finding "Nessie footprints" on the shore.

The "monster" caught on camera was apparently a toy submarine bought from Woolworths, with a head fashioned from wood putty.

The hoaxers then gave the photo to Wilson, a friend who enjoyed a good practical joke.

Explanations for the monster offered in the past include it being [swimming circus elephants](#).

In his research of Nessie, Glasgow-based palaeontologist Neil Clark found fairs and circuses were a common occurrence in the Inverness area, particularly from the early 1930s.

He said elephants may have been allowed to swim in the loch while the travelling carnivals stopped to give the animals a rest.

Another theory is that large [fallen branches](#) floating in the loch are the cause of monster sightings.

Steve Feltham, who is recognised by the Guinness Book of Records for the longest continuous monster hunting vigil of Loch Ness, is not convinced the scientists have yet identified the creature behind the sightings.

Mr Feltham, who made childhood visits to the Highlands and moved from Dorset almost 30 years ago to look for Nessie, said the research had not ruled out other animals such as seals being mistaken for the monster.

The presence of eels in the the loch was no big surprise, he added. He added: "A 12-year-old boy could tell you there are eels in Loch Ness. I caught eels in the loch when I was a 12-year-old boy."

Gary Campbell, keeper of a register of Nessie sightings, receives on average 10 reports a year of something unexplained being spotted in the loch's waters.

He welcomed the latest research and hoped more scientists will examine what lives in Loch Ness.

Mr Campbell said tourism that has developed around the story of the monster would be unaffected by the new study. He said: "The Loch Ness Monster has evolved into a world-wide icon."

Chris Taylor, of VisitScotland, said he expected the myth of the monster would continue to bring tourists to the loch.

He said: "This scientific investigation, led by Professor Gemmell, into the inhabitants of one of Scotland's largest lochs has once again shone a spotlight on the Highlands.

"Its findings will provide further insight into what lies beneath but questions still remain, and visitors will, no doubt, continue to be drawn to the loch to seek the answers for themselves."

Loch Ness expert Adrian Shine said the new study had provided researchers with a new list of species to compare against records going back 40 years.

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

### **It's not aurora, it's STEVE**

***Aurora-watchers gazing at spectacular displays over the Labor Day weekend may have been seeing more than the northern lights.***

***They may have been dazzled by STEVE as well.***

STEVE is short for the Strong Thermal Emissions Velocity Enhancement, a celestial phenomenon auroral researchers, citizen-scientists and photography enthusiasts first introduced to the world in 2016.

STEVE's narrow ribbon of light, to the naked eye, looks strikingly similar to aurora. However, there are distinct differences. First, its pinkish mauve color is not aurora-like. In addition, the phenomenon is often associated with "picket fence" emissions, which look like green columns of light passing through the ribbons at lower altitudes. Lastly, STEVE appears in areas farther south than auroral lights typically do.

Scientists thought something didn't add up.

This summer, researchers confirmed that STEVE is not aurora, but is instead a unique phenomenon. Their findings were [published in the journal Geophysical Research Letters](#).

"The big thing is, we can clearly say now it's not regular aurora," said University of Alaska Fairbanks researcher Don Hampton, a co-author on the paper. "It's a new phenomenon, that's pretty exciting."

The project, led by University of Calgary researcher D.M. Gillies, used a spectrograph to examine the light from the phenomenon and identify what kind of emissions it gives and in what patterns and wavelengths. Hampton and his colleagues designed and built the spectrograph at the UAF Geophysical Institute.

*The Strong Thermal Emission Velocity Enhancement, visible as a pink band rising from the lower left to upper right of this photograph, appears with the Milky Way over Childs Lake, Manitoba, Canada. Scientists have recently confirmed STEVE is a unique phenomenon and not a kind of aurora, as previously thought. The picture is a composite of 11 images stitched together.*

Image courtesy of Krista Trinder and NASA



"We need to understand what the spectrum looks like and therefore understand the physics behind it," Hampton said. A spectrum acts as a definitive identification, like a DNA test or chemical formula for light.

When the scientists looked at STEVE's spectrum they saw something unique. Aurora has individual wavelengths and acts like a neon sign. In aurora, electrons from our magnetosphere fly down, bumping into atoms and molecules in our atmosphere, which excites them.

Once the excited particles relax they emit photons, which can be seen as specific wavelengths of light. Depending on which colors you see, you know certain lights came from a nitrogen molecule and others came from oxygen.

"When we looked at the spectrum of STEVE, it had none of those distinct wavelengths," Hampton said. "Instead, it's a very broad band of light. So all wavelengths are basically equally as strong."

This means that the light is not coming from atoms and molecules colliding in the atmosphere but from something very warm -- maybe thousands of degrees warm.

"When you turn your electric stove on, those coils get red hot, right? If you look at it with a spectrograph, you would see broadband emissions," Hampton said. "So this is like very, very warm atmosphere emissions of some sort."

The research also concluded that the picket fence emissions are similar to a typical aurora structure. These are caused by the same kinds of particle precipitation usually seen with aurora.

Like auroras, STEVE's appearances vary greatly, showing up anywhere from weeks to months apart.

Scientists have studied the hot particles associated with STEVE since the 1970s. However, they did not realize until recently that they produced a visible feature.

Confirming the existence of a celestial phenomenon is exciting, Hampton said. The next, and more difficult step, is finding out what causes it and how it affects us.

Any disturbance to our upper atmosphere, like aurora, can affect radio communications between Earth and spacecraft. STEVE is especially interesting because it is a large local energy input, but clearly not normal aurora.

"As a new phenomenon we want to understand not just why and how it is created, but also how does it affect our infrastructure," Hampton said. "We don't expect that if we understand how STEVE is created that we will cure cancer, or produce warp drive (though one never knows), but we do want to understand how one bit of the ionosphere works, and that may help overall knowledge as well as provide some practical understanding to reduce the impact on other aspects of our daily life."

ON THE WEB: For additional explanation of the phenomenon, watch this video from NASA: <https://www.youtube.com/watch?v=wRHwGD-is9U>

<http://bit.ly/2k4X21d>

## A new duck-billed dinosaur, *Kamuysaurus japonicus*, identified

*Nearly complete skeleton belongs to a new genus and species of a herbivorous hadrosaurid*

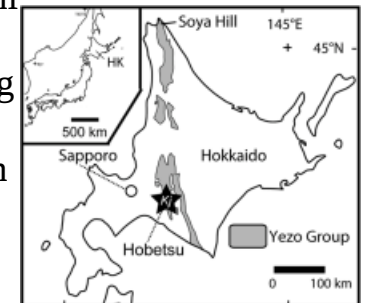
The dinosaur, whose nearly complete skeleton was unearthed from 72 million year old marine deposits in Mukawa Town in northern Japan, belongs to a new genus and species of a herbivorous hadrosaurid dinosaur, according to the study published in *Scientific Reports*. The scientists named the dinosaur *Kamuysaurus japonicus*.



*Reconstruction of Kamuysaurus japonicus (Kobayashi Y., et al, Scientific Reports, September 5, 2019)*

A partial tail of the dinosaur was first discovered in the outer shelf deposits of the Upper Cretaceous Hakobuchi

Formation in the Hobetsu district of Mukawa Town, Hokkaido, in 2013. Ensuing excavations found a nearly complete skeleton that is the largest dinosaur skeleton ever found in Japan. It's been known as "Mukawaryu," nicknamed after the excavation site.



*Map of Hokkaido showing the location of Hobetsu district where Kamuysaurus (black star labeled "Kj") was excavated. (Kobayashi Y., et al, Scientific Reports, September 5, 2019)*

In the current study, a group of researchers led by Professor Yoshitsugu Kobayashi of the Hokkaido University Museum conducted comparative and phylogenetic analyses on 350 bones and 70 taxa of hadrosaurids, which led to the discovery that the

dinosaur belongs to the Edmontosaurini clade, and is closely related to *Kerberosaurus* unearthed in Russia and *Laiyangosaurus* found in China. The research team also found that *Kamuysaurus japonicus*, or the deity of Japanese dinosaurs, has three unique characteristics that are not shared by other dinosaurs in the Edmontosaurini clade: the low position of the cranial bone notch, the short ascending process of the jaw bone, and the anterior inclination of the neural spines of the sixth to twelfth dorsal vertebrae.



*A fossilized skeleton of Kamuysaurus japonicus was first discovered in the Hobetsu district of Mukawa Town, Hokkaido, in 2013. Ensuing excavations found a nearly complete skeleton (above), currently the largest dinosaur skeleton ever found in Japan.*

According to the team's histological study, the dinosaur was an adult aged 9 or older, measured 8 meters long and weighed 4 tons or 5.3 tons (depending on whether it was walking on two or four legs respectively) when it was alive. The frontal bone, a part of its skull, has a big articular facet connecting to the nasal bone, suggesting the dinosaur may have had a crest. The crest, if it existed, is believed to resemble the thin, flat crest of *Brachylophosaurus* subadults, whose fossils have been unearthed in North America.

The study also shed light on the origin of the Edmontosaurini clade and how it might have migrated. Its latest common ancestors spread widely across Asia and North America, which were connected by what is now Alaska, allowing them to travel between the two continents. Among them, the clade of *Kamuysaurus*, *Kerberosaurus* and *Laiyangosaurus* inhabited the Far East during the Campanian, the fifth of six ages of the Late Cretaceous epoch, before evolving independently.

The research team's analyses pointed to the possibility that ancestors of hadrosaurids and its subfamilies, Hadrosaurinae and

Lambeosaurinae, preferred to inhabit areas near the ocean, suggesting the coastline environment was an important factor in the diversification of the hadrosaurids in its early evolution, especially in North America.

**Original article:**

Kobayashi Y., et al, [A new hadrosaurine \(Dinosauria: Hadrosauridae\) from the marine deposits of the late Cretaceous Habouchi Formation, Yezo Group, Japan](#), Scientific Reports, September 5, 2019.

DOI: 10.1038/s41598-019-48607-1

<http://bit.ly/2k62zEO>

## Research warns of the far-reaching consequences of measles epidemic and failure to vaccinate

***Risks of failing to vaccinate children may extend far beyond one specific vaccine***

The European Society of Clinical Microbiology and Infectious Diseases (ESCMID) 5th Vaccine Conference will hear that the risks of failing to vaccinate children may extend far beyond one specific vaccine, although currently the most urgent problem to address is the resurgence of measles.

Measles, a highly contagious infectious disease, is serious, causing fever, rash and other symptoms in most children and complications including pneumonia and brain inflammation. In 2018, across the globe measles killed approximately 1 in every 75 children infected with the virus, leading to over 100,000 deaths.

Furthermore, research by Assistant Professor Michael Mina, MD of Center for Communicable Disease Dynamics at the Harvard T.H. Chan School of Public Health and Harvard Medical School, Boston, MA, USA and colleagues from his own and other groups suggests that infection with measles in unvaccinated children increases their risk of other, subsequent severe, non-measles infectious diseases in the 2-3 years following infection. Thus, after surviving measles,

children may fall ill or die from other infections which they previously developed immunity to, but this immunity was erased by the measles virus.

This observation, backed by numerous studies (with the mechanism still being investigated) shows that when measles virus infects a person, it primarily infects a large proportion of the memory cells of the immune system. ***This results in so called immune-amnesia, whereby the immune system cannot remember some of the diseases it has fought in the past, thus exposing children to re-infection with these other diseases.***

These findings would help explain the mysterious large drops in mortality of up to 50% following the introduction of measles vaccinations, even though prior to vaccines measles was usually associated with much less than 50% of childhood deaths. This has gone unnoticed in previous years because clinicians would not, for example, link a death from another infectious disease back to a measles infection that that child may have had two years earlier and that wiped away the child's immune memory for the other infecting pathogen.

"Prior to vaccination, measles infected nearly everyone. Because we now think that measles infections may erase pre-existing immune memory, by preventing measles infection through vaccination, we prevent future infection with other infectious diseases allowed back into the body by the damage done by measles," explains Dr. Mina. "The epidemiological data from the UK, USA and Denmark shows that ***measles causes children to be at a heightened risk of infectious disease mortality from other non-measles infections for approximately 2-3 years.***"

He continues: "Prior to vaccination, the incidence of measles from year to year could explain almost all of the variation in non-measles infectious disease deaths that occurred over multiple decades. Altogether, this suggests that measles may have been associated

with as much as half of all childhood deaths due to infectious diseases prior to vaccination, and thus explaining the mysterious large drops in mortality seen following introduction of the vaccine."

He adds: "It may be that the only way for a child to recover from this immune-amnesia is if their memory cells 'relearn' how to recognise and defend against diseases they had known before, and they can do this through re-exposure to the pathogen or by re-vaccination against that particular infection."

However, it is this re-exposure to the other pathogens that pose the long-term risks following a measles infection. A recent epidemiological study led by Dr Mina's colleague, Dr Rik de Swart of the Department of Virosciences at Erasmus Medical Center in Rotterdam, Netherlands looked at the clinical outcomes of over 2,000 children infected with measles in the UK (see link below). In that study, they found that children were significantly more likely to require physician visits and had higher rates of antibiotic prescriptions for 2-5 years following measles. To mitigate these long-term effects, Dr Mina suggests ***"It might be reasonable to consider re-vaccination with other childhood vaccines following measles infection."*** However, he adds that "because many children who are infected with measles generally have not been vaccinated, whether because of [parental] refusal or are in settings that do not have access to vaccinations in the first place, this may not always be a viable option."

Thus - probably the most important conclusion of these fascinating studies is that prevention of measles by vaccination is crucial and high vaccination coverage is a fundamental step nowadays. However, in this symposium, Helen Johnson, Expert in Mathematical Modelling at the European Centre for Disease Prevention and Control (ECDC) Solna, Sweden and Dr Takis Panagiotopoulos of the National School of Public Health, Athens, Greece, will highlight that even when contemporary vaccination

coverage is high, risk of infection may be concentrated in certain groups. Analysing data from Greece, they say that this heightened risk can be associated with age (low vaccine coverage from previous years) or social aspects (for example, barriers to access for the Roma population, and vaccine hesitancy for healthcare workers or other opinion groups).

The dangers of healthcare workers not being vaccinated are clearly highlighted by these data. "The risk of being infected, and of onwards transmission, is associated with the way people come into contact," explains Johnson. "Although only approximately 4% of cases were in healthcare workers, an individual case in this group was far more likely than any other to cause five or more secondary cases. In contrast, approximately 30% of cases were in Roma children aged 4 years and under, but each of these children caused, on average, only around one secondary infection."

Even if vaccination rates nationwide approach 95%, pockets of susceptible unvaccinated people, such as the Roma population or healthcare workers, may make outbreaks not only more likely but also considerably larger than would be expected from assessments of vaccination coverage alone. "The results highlight the imperative of maintaining high vaccination coverage at all subnational levels and in all population groups," explains Johnson.

Data from ECDC show that a large epidemic of measles has affected the EU/EEA in the past three years, with 47,690 cases reported between 1 January 2016 and 30 June 2019. Only eight countries -- Romania (14,712 cases), Italy (10,439), France (5,812), Greece (3,288 c), United Kingdom (2,412), Germany (2,240), Poland (1,874) and Bulgaria (1,295) -- were responsible for 88% of the cases in this period, but multiple cases occurred in each of the 30 countries that report data to ECDC.

The burden of measles in the EU/EEA is particularly high among infants and adults, the groups at the greatest risk of complications

following infection. Notification rates are much higher in infants and children under 5 years than older age groups, however, a large proportion (39%) of cases during this period occurred in adults aged 20 years and above, reflecting immunity gaps due to historic failures to vaccinate in many countries. "Low uptake of vaccine in certain groups means that, even in countries with very high rates of vaccination coverage, re-establishment of measles is a concerning reality. It is tragic and unacceptable that children and adults continue to die from complications of measles, when safe and effective vaccines are readily available," concludes Johnson.

This ESCMID 5th Vaccines Congress, which will cover multiple vaccine-preventable diseases is taking place just one week after WHO announced that four European countries: the UK, Albania, Czech Republic and Greece: had all lost their previous 'measles-free' status due to confirmed endemic transmission in all four.

"Incidence of measles in the European Region increased in 2018 compared to previous years, and continues to escalate in 2019," says Dr Patrick O'Connor, Team Lead, Accelerated Disease Control Vaccine Preventable Diseases and Immunization for the WHO-EURO region, who is also speaking at this symposium.

He concludes: "Elimination of both measles and rubella is a priority goal that all countries of the WHO European Region have firmly committed to achieve. WHO urges health authorities to use every opportunity to reach children with routine vaccination, as well as to identify and close immunity gaps in adolescent and adult populations."

Professor Ron Dagan, Ben-Gurion University of the Negev, Beer-Sheva, Israel, the Chair of the Organising and Scientific Committee of the ESCMID 5th Vaccines Congress adds: "Measles is definitively an imminent danger worldwide that can be solved by aggressive vaccination policies."

<https://wb.md/2k63cON>

## Vitamin E Oil Potentially Linked to Vaping-Related Lung Illness

*New York state health officials investigating cases of severe lung injury associated with vaping have identified a potential culprit: [vitamin E](#) acetate, an oil derived from vitamin E.*

Megan Brooks

The New York State Department of Health has received 34 reports of severe pulmonary illness among patients ranging in age from 15 to 46 who were using at least one cannabis-containing vape product before they became ill.

In [a statement](#) issued today, the health department said laboratory test results showed "very high levels of vitamin E acetate in nearly all cannabis-containing samples analyzed by the Wadsworth Center as part of this investigation. At least one vitamin E acetate-containing vape product has been linked to each patient who submitted a product for testing." New York health officials said vitamin E acetate is now a "key focus" of their investigation of potential causes of vaping-associated pulmonary illnesses.

Vitamin E acetate is a commonly available nutritional supplement that is not known to cause harm when ingested as a vitamin supplement or applied to the skin. However, New York health officials are continuing to investigate its health effects when inhaled because its oil-like properties could be associated with the observed symptoms, they said.

### FDA Still Investigating

The *Washington Post* [reported](#) today that state and federal health officials have identified vitamin E acetate in cannabis products used by people from different parts of the country who developed severe lung disease after vaping and who used different brands of products. But the US Food and Drug Administration (FDA) has cautioned against jumping to any conclusions.

"The FDA is analyzing samples submitted by the states for the presence of a broad range of chemicals, including nicotine, THC, and other cannabinoids along with cutting agents/diluents and other additives, pesticides, opioids, poisons, and toxins," FDA spokeswoman Stephanie Caccamo told *Medscape Medical News*.

"No one substance, including vitamin E acetate, has been identified in all of the samples tested," she said. "Importantly, identifying any compounds that are present in the samples will be one piece of the puzzle but will not necessarily answer questions about causality. The results from the FDA's laboratory analysis will be shared with the respective states to aid in their investigations and will help further inform the federal response." As of early last week, 215 possible cases of severe lung injury related to vaping had been reported from 25 states, as [reported](#) by *Medscape Medical News*.

Many patients said their symptoms had started gradually. Those symptoms included difficulty breathing, shortness of breath, and/or chest pain prior to hospitalization. Some patients also experienced mild-to-moderate gastrointestinal symptoms including vomiting and [diarrhea](#), and some reported fever and fatigue. Some became critically ill and required [mechanical ventilation](#).

Two people are believed to have died from severe respiratory illness after vaping. Illinois officials reported the first likely vaping death August 23, [as reported](#) by *Medscape Medical News*, and Oregon health officials [reported](#) the second likely case this week.

<http://bit.ly/2IDBx8e>

## Gel that makes teeth repair themselves could spell the end of fillings

*A new way to treat tooth decay is on the way*

By [Alice Klein](#)

Tooth enamel can now be made to repair itself by applying a special gel. The product could save people from developing cavities that require dental fillings. Enamel is the hard, protective layer on

the outside of teeth. It can be worn down by mouth acid and repeated chewing, leading to cavities that have to be plugged with fillings to prevent further decay. Because fillings are made from foreign materials like metal, porcelain and resin, they don't bind seamlessly to the tooth surface and often become loose.

To overcome this problem, Ruikang Tang at Zhejiang University in China and his colleagues made a gel containing calcium and phosphate – the building blocks of real enamel – to try to encourage teeth to self-repair. They tested the gel by applying it to human teeth that had been removed from patients and damaged with acid. They then left the teeth in containers of fluid designed to mimic the mouth environment for 48 hours.

### **New crystals**

During this time, the gel stimulated the growth of new enamel, with microscopy revealing that it had the same highly ordered arrangement of calcium and phosphate crystals as regular enamel.

This is probably because in normal tooth development, the emerging enamel is coated in a disordered layer of calcium and phosphate particles – like in the gel – that encourages its growth, says Tang.

The new enamel coating was only 3 micrometres thick, which is about 400 times thinner than undamaged enamel. But Tang says the gel could be repeatedly applied to build up this repair layer.

Several other groups have tried to repair tooth enamel with calcium and phosphate mixtures, but they contained larger particle clusters that didn't cling well to the tooth surface, says Tang. This made it difficult for the enamel crystals to re-build, he says.

The team is now testing the gel in mice and hopes to later test it in people. They will need to make sure the chemicals in the gel are safe and that new enamel can form in the real-life mouth environment, even when people eat and drink, Tang says.

Journal reference: *Science Advances*, [DOI: 10.1126/sciadv.aaw9569](https://doi.org/10.1126/sciadv.aaw9569)

<http://bit.ly/2m62H81>

## **New compound promotes healing of myelin in nervous system disorders**

### ***OHSU-led research could lead to clinical trials in people with multiple sclerosis or other neurodegenerative conditions***

Scientists have developed a compound that successfully promotes rebuilding of the protective sheath around nerve cells that is damaged in conditions such as multiple sclerosis.

In a study published today in the journal *Glia*, scientists described successfully testing the compound in mice. Researchers at Oregon Health & Science University have already started to apply the compound on a rare population of macaque monkeys at the Oregon National Primate Research Center at OHSU who develop a disease that is similar to MS in humans.

"I think we'll know in about a year if this is the exact right drug to try in human clinical trials," said senior author Larry Sherman, Ph.D., an OHSU professor in the Division of Neuroscience at the primate center. "If it's not, we know from the mouse studies that this approach can work. The question is, can this drug be adapted to bigger human brains?"

The discovery culminates more than a decade of research following a 2005 breakthrough by Sherman's lab.

In that study, scientists discovered that a molecule called hyaluronic acid, or HA, accumulates in the brains of patients with MS. Further, the scientists linked this accumulation of HA to the failure of cells called oligodendrocytes to mature. Oligodendrocytes generate myelin.

Myelin, in turn, forms a protective sheath covering each nerve cell's axon - the threadlike portion of a cell that transmits electrical signals between cells.

Damage to myelin is associated with MS, stroke, brain injuries, and certain forms of dementia such as Alzheimer's disease. In addition,



delay in myelination can affect infants born prematurely, leading to brain damage or cerebral palsy.

Subsequent studies led by the Sherman lab showed that HA is broken down into small fragments in multiple sclerosis lesions by enzymes called hyaluronidases. In collaboration with Stephen Back, M.D., Ph.D., a professor of pediatrics in the OHSU School of Medicine, Sherman discovered that the fragments of HA generated by hyaluronidases send a signal to immature oligodendrocytes not to turn on their myelin genes.

That led researchers to explore how they might block hyaluronidase activity and promote remyelination.

For the past decade, an international team of researchers led by OHSU has been working to develop a compound that neutralizes the hyaluronidase in the brains of patients with MS and other neurodegenerative diseases, thereby reviving the ability of progenitor cells to mature into myelin-producing oligodendrocytes.

The study published today describes a modified flavonoid - a class of chemicals found in fruits and vegetables - that does just that.

The compound, called S3, reverses the effect of HA in constraining the growth of oligodendrocytes and promotes functional remyelination in mice. Lead author Weiping Su, Ph.D., senior scientist in the Sherman lab, dedicated years of intensive research to make the discovery.

"It's not only showing that the myelin is coming back, but it's causing the axons to fire at a much higher speed," Sherman said. "That's exactly what you want functionally."

The next phase of research involves testing, and potentially refining, the compound in macaque monkeys who carry a naturally occurring version of MS called Japanese macaque encephalomyelitis. The condition, which causes clinical symptoms similar to multiple sclerosis in people, is the only spontaneously occurring MS-like disease in nonhuman primates in the world.

*The work was supported by the National Institutes of Health grant No. P51OD011092 for the operation of the Oregon National Primate Research Center; Congressionally Directed Medical Research Program grant No. MS160144; the National Multiple Sclerosis Society grant No. RG4843A5/1; the NIH's National Institute of Neurological Disorders and Stroke award Nos. NS054044 and NS045737; and American Heart Grant in Aid award No. 17GRNT33370058.*

<https://wb.md/2IG0waX>

## **No, Medical Errors Are Not the Third Leading Cause of Death**

***The supposed fact that medical errors are the third leading cause of death in the United States has become a meme***

**Benjamin Mazer, MD, MBA; Chadi Nabhan, MD, MBA**

The supposed fact that medical errors are the third leading cause of death in the United States has become a meme, spreading virally through society from the scientific literature to the evening news. As they're repeated within the scholarly community and popular media, estimates in the range of 200,000-400,000 deaths per year look like settled science.

But the methodology applied to arrive at these estimates published in multiple scientific journals falls short of the rigor needed for such an important topic. We are concerned that these estimates are inaccurate, implausible, and encourage unwarranted distrust in the healthcare system. Yet they have spread widely while critiques have not. Lowering our standards of scientific evidence, even for a good cause, sets a dangerous precedent.

Popular estimates of medical harm have faced criticism since the National Academy of Medicine's seminal 1999 "To Err Is Human" [report](#), which estimated the number of preventable medical error deaths at around 44,000-98,000 per year. Two [powerful critiques](#) of this report were [published in JAMA](#) shortly afterward, but these counterpoints in a top medical journal have only racked up a few hundred citations compared with the tens of thousands that the original report has achieved, according to Google Scholar. Even a

[critique of the report](#) by an author of the studies it was based on, published in the *New England Journal of Medicine*, has been cited an order of magnitude less than the report itself.

Two newer publications have arrived at even larger estimates. A [2013 paper](#) in the *Journal of Patient Safety* suggested that 440,000 people per year die from preventable medical error, and a [2016 paper](#) in the *BMJ* proposed that 251,454 people die from medical errors yearly. The latter's title declared medical error "the third leading cause of death in the US" — and a meme was born.

That was despite the fact that these papers also faced immediate criticism from experts. In fact, the editors-in-chief of *BMJ Quality and Safety* [carefully debunked](#) both of these estimates shortly after their publication. In a polite tone, authors Kaveh Shojania and Mary Dixon-Woods made clear that enormous error estimates distort the underlying studies beyond credibility. This fair counteranalysis has received little attention.

The rebukes point out many fatal flaws: Medical error death rates extrapolate from small samples, generalize local data to national contexts, ignore the limited life expectancy of many patients, and gloss over the myriad uncertainties in defining error, preventability, and causality. Yet the idea that "medical errors are the third leading cause of death" has become a powerful cultural meme immune to correction. This claim shows up in [newspaper articles](#) and [TV shows](#). It's been repeated on the floor of the [Senate](#). Nursing unions have [used](#) the "third leading cause of death" mantra to advocate for new legislation. A sensational [patient safety documentary](#) relies on it. It's even been spotted in a college [sociology textbook](#).

### ***The Medical Error Meme***

In [an analysis](#) we recently published in the *Journal of General Internal Medicine*, we propose a few reasons for why these debatable estimates of medical error have become so well accepted. First, the "third leading cause of death" phrase has proved an easy

rallying cry for a growing patient safety effort. Patient safety is emerging as both an academic discipline and an activist movement, two developments we strongly support. But all new disciplines and political movements need justification, and a hidden epidemic of medical error deaths is a powerful one. We also suggest that ever-increasing estimates of medical error deaths play into the compelling narrative of a worsening crisis, even though these estimates were not designed to analyze change over time.

Poor understanding of the number of overall deaths and hospital-based deaths probably leads people to underrate how outlandish these estimates truly are. If we take the 440,000 medical error deaths estimate at face value, it suggests that the majority (about 62%) of hospital deaths are caused by preventable medical errors. This estimate also implies that preventable medical errors [kill about as many people](#) as tobacco. Put like that, this estimate is hard to swallow.

We agree that medical errors occur all too often, remain underreported, and that systemic changes can improve patient outcomes. But we also recognize that there are no useful fictions in medicine. A misleading statistic shared for righteous reasons is still dangerous.

Memes don't stay in the hands of their creators. The concept of "preventable adverse events" is conflated with the altogether different idea of "medical malpractice." The National Rifle Association recently downplayed the gun violence epidemic by [suggesting](#) in a video viewed by over 100,000 people that "medical malpractice deaths stand at over 500 times higher than accidental gun-related fatalities with as many as 400,000 deaths per year." Did the authors of these studies want their estimates politicized in this way? Or how about when law firms drum up business by [claiming](#) "medical malpractice is the third leading cause of death"? As we argue in our analysis, "those who have a financial or philosophical

agenda to discredit physicians can bolster their arguments if they seem to originate from within the medical community."

Inaccurate memes also pose a risk because they anchor us to higher estimates, producing unwarranted skepticism over more realistic calculations. When our article came out, we received immediate criticism from patient safety activists. One person even seemed to [ask us](#) to prove a negative — that medical errors were *not* the third leading cause of death. Because medical errors are underreported, it's easy to cling to inflated estimates rather than accept gaps in our knowledge. Shojania and Dixon-Woods call this "the bottomless well of medical error" in their *BMJ Quality and Safety* critique.

### ***Fewer Memes, More Context***

The memeification of medical errors has rallied more resources and attention to an important problem, but it masks some key questions: What makes something an "error" beyond simply a negative outcome? When was an error truly "preventable," and can we accurately assess these things in retrospect? These questions can be approached with more rigorous science, but we need better communication to achieve public understanding.

We are encouraging less memeification and more contextualization. The experiences we have as doctors are confusing, compelling, frustrating, and moving all at once. We witness and make mistakes, but we also know there are cultural and administrative barriers to preventing them. No single number will ever capture that varied experience or suggest a solution to medicine's most entrenched problems. We encourage all medical professionals, as well as patients, to speak up about their experiences with adverse events. In this way, a nuanced understanding of modern medical practice can come out and we can work on solutions. Putting patient safety first is no reason to oversimplify the truth and spread misleading statistics.

<http://bit.ly/2k67bLf>

**Doctors aghast at Groupon deals for medical care**  
*The deals are actually pretty good, even if they show how broken the system is.*

**Beth Mole**

Doctors online expressed shock and dismay after realizing that patients are using Groupon deals to access medical services, such as chest CT scans and mammograms, at discount rates, [according to a report by Kaiser Health News](#).



*Coupons from the advertising section of a Sunday newspaper* [Getty | Karen Bleier](#)

Such deals illustrate how broken the US healthcare system is, according to Paul Ketchel, CEO and founder of MDsave, a site that offers discount-priced vouchers on bundled medical treatments and services.

That said, after their initial astonishment over the deals wore off, some doctors noted that the discounts were actually pretty good. "Whether or not a person may philosophically agree that medicine is a business, it is a market," Steven Howard, who runs Saint Louis University's health administration program, told KHN.

***Saw 3 pts in clinic for abnormal chest CTs BOUGHT ON Groupon.***

***Evolution of my thoughts:***

***-What the \$@&#? (\*Google it\*)***

***-hm actually priced pretty reasonably 🙄***

***-jeez if I ever need testing I'm going w/ Groupon, prob cheaper than insurance 🤔***

***US healthcare is bonkers***

***— Nicole Herbst (@NicoleHerbst2) [August 25, 2019](#)***

The deals—which have actually been around for years—cover things like elective medical services, dental work, eye care, and preventative scans, such as mammograms. They’re often used by people who do not have health insurance or have limited coverage. Still, some insured patients turn to them for cost-saving deals, more pricing transparency, and control over their healthcare bills. Without the coupons, the same services provided by some hospitals and providers can have wildly varied pricing, which can be nearly impossible to estimate in advance.

One imaging center in Atlanta has a running Groupon deal for a \$26 heart CT scan with an included consultation—that’s a 96% discount. Groupon has sold more than 5,000 coupons for the center. Still, there are risks to using the deals, such as getting medically unnecessary scans, which expose patients to radiation needlessly and can lead to unnecessary follow-up tests or procedures.

“If you’re going to have any type of medical testing done, I would make sure you discuss it with your primary care provider or practitioner,” Dr. Andrew Bierhals cautioned to KHN. Dr. Bierhals is a radiology safety expert at Washington University in St. Louis’ Mallinckrodt Institute of Radiology.

On the flip side, if a discount medical scan does find something, there’s a chance that a treating hospital or care provider may want to re-do the scans anyway, undoing the good deal.