

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

The Shocking Truth about Aftershocks

After an earthquake, some aftershocks go on for an astonishingly long time.

By [Dana Hunter](#) on April 30, 2017

We've discussed earthquakes before, and everybody's probably pretty aware of the fact that when you have an earthquake, you're probably going to have an aftershock. Or two. Or two dozen. Most of us think those aftershocks will last, at most, a few days.

But studies suggest that some aftershocks will go on – are you ready for this? – for [a few centuries](#):

Many researchers assume that small-scale seismic activity reveals where stress is building up in the Earth's crust — stress that can cause larger quakes in the future, says Mian Liu, a geophysicist at the University of Missouri in Columbia. However, Liu and Seth Stein of Northwestern University in Evanston, Ill., report in the Nov. 5 Nature, many moderate-sized temblors that occur far from the edges of tectonic plates could be merely the aftershocks of larger quakes that occurred along the same faults decades or even centuries ago.

Stein and Liu analyzed earthquake data gathered worldwide. For major quakes that occurred where the sides of a fault moved past each other at average rates of more than 10 millimeters per year — as the two sides of many tectonic boundaries do — aftershocks died off after a decade or so. But for faults where the sides scraped past each other at just a few millimeters per year, aftershocks lasted about 100 years, the researchers reported. The longest series of aftershocks, some which have lasted several centuries, were triggered by quakes that occurred in continental interiors along slow-moving faults.

Bet you folks in the Midwest didn't think [New Madrid](#) was sending you old news, did you? But it certainly seems so.

Let's step back a moment and [take a look at the mechanics here](#):

Large earthquakes are often followed by aftershocks, the result of changes in the surrounding crust brought about by the initial shock. Aftershocks are most common immediately after the main quake. As time passes and the fault recovers, they become increasingly rare. This pattern

of decay in seismic activity is described by Omori's Law but Stein and Liu found that the pace of the decay is a matter of location.

At the boundaries between tectonic plates, any changes wreaked by a big quake are completely overwhelmed by the movements of the plates themselves. At around a centimetre per year, they are regular geological Ferraris. They soon "reload" the fault, dampen the aftershocks, and return the status quo within 10 years. In the middle of continents, faults move at less than a millimetre every year. In this slow lane, things can take a century or more to return to normal after a big quake, and aftershocks stick around for that duration.

It's a tale of two faults! Let's have a look at New Madrid, shall we? Go ahead. [Search for photos of "New Madrid Fault."](#) I'll wait.

Lots of maps, not many photos, right? That's because not a lot's going on there. Most of it's concealed below the surface, and what's been exposed doesn't look much like a fault. Unless you're a professional, the photo of the fault at [this Missouri Department of Natural Resources article](#) doesn't exactly stand out.

Ed Yong [says](#),

Again, New Madrid proves the principle - a cluster of large earthquakes hit the area in the past thousand years, but the crust shows no sign of recent deformation according to two decades of GPS measurements. It seems that recent activity really is the legacy of centuries-old quakes, a threat that has since shut down.

In other words, there's not a lot going on that would show at the surface, unlike the San Andreas, which is [bleeding obvious](#). New Madrid is a slow, sleepy fault, despite the excitement it caused over the winter of 1811-1812. Compared to New Madrid, the San Andreas fault is a speed demon, and it shows. There are other differences, of course – one's a transform fault where two plates are scooting past each other, the other's more of a rift type thing where North America started splitting apart, then decided to stay together – but the main thing is speed. According to the study, San Andreas locks and loads within a decade or so, leaving the aftershocks in the dust and nervous Californians waiting for the Big One. New Madrid's still squirming

around trying to get comfortable after a fairly dramatic disruption. And every time it twitches noticeably, folks in the Midwest get twitchy themselves.

The river did, after all, run backwards the last time this thing went crack. Bound to worry folks a bit. But according to Stein and Liu, there's nothing much to worry about – at least, not where New Madrid's concerned. You're just in for hundreds of years of aftershocks, since the fault moves more than 100 times slower than the San Andreas. This is *good* news. And [the data are beautiful](#):

"A number of us had suspected this," Liu said, "because many of the earthquakes we see today in the Midwest have patterns that look like aftershocks. They happen on the faults we think caused the big earthquakes in 1811 and 1812, and they've been getting smaller with time."

To test this idea, Stein and Liu used results from lab experiments on how faults in rocks work to predict that aftershocks would extend much longer on slower moving faults. They then looked at data from faults around the world and found the expected pattern. For example, aftershocks continue today from the magnitude 7.2 Hebgen Lake earthquake that shook Montana, Idaho and Wyoming 50 years ago.

"This makes sense because the Hebgen Lake fault moves faster than the New Madrid faults but slower than the San Andreas," Stein noted. "The observations and theory came together the way we like but don't always get."

This might be of some comfort to residents near the epicenter of the [Hebgen Lake Quake](#). Then again, it might not. It's rather hard to feel comforted by the fact that the fault moves slower than the San Andreas, and therefore shall have aftershocks longer, when the last big quake took down a mountainside, ripped open roads, created a new lake, and left fault scarps all over the danged place, right?

And this study points to the fact that [the small isn't always a foreshadow of the big](#):

The new results will help investigators in both understanding earthquakes in continents and trying to assess earthquake hazards there. "Until now,"

Liu observed, "we've mostly tried to tell where large earthquakes will happen by looking at where small ones do." That's why many scientists were surprised by the disastrous May 2008 magnitude 7.9 earthquake in Sichuan, China -- a place where there hadn't been many earthquakes in the past few hundred years.

"Predicting big quakes based on small quakes is like the 'Whack-a-mole' game -- you wait for the mole to come up where it went down," Stein said. "But we now know the big earthquakes can pop up somewhere else. Instead of just focusing on where small earthquakes happen, we need to use methods like GPS satellites and computer modeling to look for places where the earth is storing up energy for a large future earthquake. We don't see that in the Midwest today, but we want to keep looking."

Sounds like a very good idea to me. Anything we can do to increase the chances of successful earthquake prediction could help save a lot of lives. And it allows us to rest easier when we find out that those little temblors are just past earthquakes saying "So long, and thanks for all the fish."

<http://bit.ly/2qdmVL2>

Immune war with donor cells after transplant may wipe out HIV

HAVE we had it all back to front?

By Clare Wilson

Ten years ago, a man known as the Berlin patient was cured of HIV. It was thought that a bone marrow transplant he received for cancer, from a person immune to HIV, had eradicated the virus from his body. But evidence from a new group of people suggests an immune reaction provoked by the transplant may actually have been responsible.

The cancer therapy is so harsh that it wouldn't be given to people who don't have that disease, but if confirmed, the finding gives us a new insight into how to fight HIV.

The Berlin patient – Timothy Brown – is still the only person who seems to have remained free from HIV for a long period. A few other people have been “functionally cured” – although they have some

dormant virus in their cells, they no longer need to take antiviral therapy.

HIV targets immune cells, leaving people defenceless against other infections if it goes untreated. The standard view was that Brown was cured by a bone marrow transplant he received to treat his leukaemia.

The bone marrow came from someone with a genetic mutation in the CCR5 gene that makes immune cells resistant to HIV. But some believe that a side effect of the transplant may actually have been at least partly responsible for wiping out the virus in his body.

Known as graft-versus-host disease, it is caused by immune cells from the donor attacking those of the recipient. Brown's bone marrow transplant triggered this, causing his own immune cells – and the HIV they contained – to be killed. "Some believe that a side effect of the bone marrow transplant killed off the virus in the body"

Six more people with HIV and cancer who have been treated in the same way as Brown now seem to have no trace of the virus in their system, says Javier Martínez-Picado from IrsiCaixa AIDS Research Institute in Barcelona, Spain. Only one of the six received bone marrow from a person with the CCR5 mutation – however, all six developed graft-versus-host disease.

We won't know if the six people have completely cleared their bodies of HIV until they stop taking their anti-HIV drugs. That may happen for the first person within the next year, says Martínez-Picado.

"If the theory is right, that would be tremendous," says Annemarie Wensing of the University Medical Center Utrecht in the Netherlands, who presented data on two of the six at the European Congress of Clinical Microbiology and Infectious Diseases in Vienna last week. All HIV tests on the six have been negative for more than two years.

A different approach for treating HIV has recently shown promise. Known as "kick and kill", this treatment wakes up dormant virus that has been hiding in a person's cells and then targets it. This has enabled five people to stop taking anti-HIV drugs, but the virus is still present in some of their immune cells.

That's not so for Brown or the six newer cases, who come from various countries.

If graft-versus-host disease does turn out to wipe out HIV, doctors would be reluctant to deliberately provoke this potentially fatal condition in people. An international consortium of researchers, including Wensing and Martínez-Picado, has been following 23 people with HIV who received bone marrow transplants to treat cancer. So far, about half have died – either from the transplant, or their cancer.

Current anti-HIV drugs mean that people in rich countries can largely keep HIV under control, so inciting graft-versus-host disease wouldn't be a desirable option.

But the consortium is studying the transplant recipients to learn more about where HIV hides. This should help develop a cure without the need for a bone marrow transplant, says Martínez-Picado.

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

From pill to needle: Prescription opioid epidemic may be increasing drug injection

Drug users born in the 1980s and 1990s are turning to injection drug more quickly than previous generations, a USC-led study suggests

The prescription opioid epidemic is shrinking the time it used to take drug users to progress to drug injection, a new Keck School of Medicine of USC-led study suggests.

The study may predict the next national public health threat related to prescription painkiller abuse, said Ricky Bluthenthal, lead author of the study and a professor of preventive medicine at the Keck School of Medicine.

"The prescription opioid epidemic is creating a heroin epidemic, which will create an injection drug use epidemic," Bluthenthal said.

"We've seen the first two. Now we're waiting to see the last emerge on the national level. I predict we'll see an uptick in injection-related diseases over the next couple of years."

The study, published in April in the journal *Drug and Alcohol Dependence*, is based on 776 drug users in Los Angeles and San Francisco. Participants born in the 1980s or 1990s, on average, took six years to escalate from first illicit drug use to first drug injection. The average for participants born in the 1970s was nine years.

"The more rapid transition to injection is an impact of the prescription opioid-to-heroin use phenomenon," Bluthenthal said. "Heroin is most efficiently used via injection as compared to other formerly popular drugs such as crack cocaine or even cocaine."

Injection-related diseases can include HIV, which affects more than 1.2 million Americans, and hepatitis C, which affected an estimated 3.9 million Americans in 2014, according to the Centers for Disease Control and Prevention. People who inject drugs also are at elevated risk for sexually transmitted infections, abscesses and soft-tissue infections, mental health disorders, drug overdose and dying young, the study stated. Researchers found that the first drug injected changed in tandem with national drug use trends. In general, however, heroin and prescription opiate pills were the most common first drug injected. Drug users born

in the 1980s and 1990s moved quicker from initial illicit drug use to syringe use than those born in the '70s.

In California, 2,014 deaths were attributed to opioid-related poisoning or overdose, according to the state's Department of Public Health.

Nationwide, the rate of overdose deaths involving opioids -- more than 165,000 deaths -- has nearly quadrupled since 1999, according to the U.S. Department of Health and Human Services. On an average day in America, some 3,900 people begin nonmedical use of prescription opioids, creating more than \$55 billion in health and social costs each year.

Younger generations may experience uptick in hepatitis C, HIV and drug overdose

Prescription opioids are the current drug of choice and has been for nearly two decades, Bluthenthal said. Heroin was popular in the 1970s, crack cocaine in the 1980s and marijuana in the 1990s.

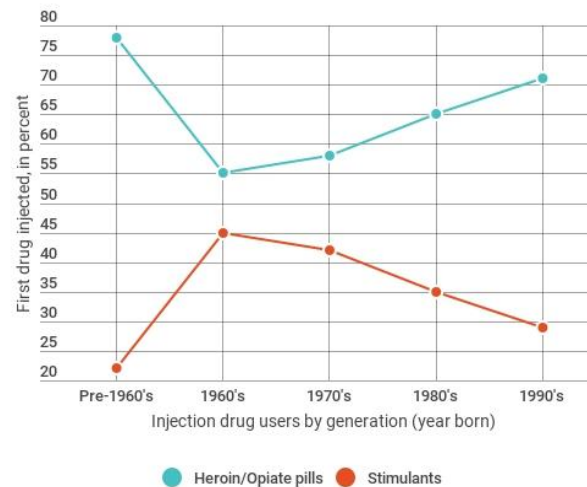
For the past 20 years, people who inject drugs were considered an aging population. Long-acting opioid-based medications became available in the 1990s, Bluthenthal said. Once use of prescription opioid pain relievers and heroin skyrocketed, however, the downward trend changed, he noted.

In the study, researchers divided the 776 individuals into birth cohorts: those born before the 1960s, in the 1960s, 1970s and 1980s or later. All participants had injected in the last month. About 33 percent were white, 30 percent were African-American and 25 percent were Latino. The adult participants completed a survey that asked if they had ever used a list of drugs, including crack cocaine, methamphetamine, speed, heroin, tranquilizers, nonmedical use of prescription opioids and buprenorphine. They reported when they first used that drug, the first time they injected and what drug they injected.

More than half had injected heroin, powder cocaine and methamphetamine. More than 30 percent reported they had injected crack cocaine and opioid painkillers.

Changing trends in injection drug use

USC researchers found that injection drug users from younger generations are more likely than older users to have tried heroin or opiates as their first drug. People who abuse opioids are believed to slide more quickly into injection drug abuse than other drug users, so researchers believe today's opioid epidemic will lead to growing injection drug abuse among the young.



Stimulants include methamphetamines, cocaine, and stimulant prescription medications. SOURCE: "Drug use generations and patterns of injection drug use: Birth cohort differences among people who inject drugs in Los Angeles and San Francisco, California," *Drug and Alcohol Dependence*

Longer time until first injection was associated with drug treatment prior to first injection. This fact suggests that drug interventions may help keep drug users away from the needle.

"We need to get ahead of a possible drug injection epidemic," Bluthenthal said. "What works for Latinos in East Los Angeles might not work for people in West Virginia. We need to come up with prevention activities responsive to specific cultures, generations and locales to combat the move to drug injection."

USC researchers from multiple disciplines, including the USC Schaeffer Center for Health Policy and Economics, are trying to solve the intractable problem of unnecessary drug prescriptions.

Previous USC-led research found that a "nudge" reduces doctors' unnecessary antibiotic prescriptions. Researchers ranked and shared a list of physicians most likely to give an unnecessary prescription and used pop-up boxes that required physicians to justify their pharmacy order. Interventions such as these potentially can prevent unnecessary opioid prescriptions and the negative effects that result from painkiller addiction.

Bluthenthal is collecting more data from younger people using opioids to better understand the drug behaviors associated with younger generations.

The research was supported by the National Institute on Drug Abuse and the National Cancer Institute via nearly \$1.7 million in awards.

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

Underlying molecular mechanism of bipolar disorder revealed

Findings inform development of potential diagnostic test and improved therapies

La Jolla, Calif. - An international collaborative study led by researchers at Sanford Burnham Prebys Medical Discovery Institute (SBP), with major participation from Yokohama School of Medicine, Harvard Medical School, and UC San Diego, has identified the molecular

mechanism behind lithium's effectiveness in treating bipolar disorder patients.

The study, published in Proceedings of the National Academy of Sciences (PNAS), utilized human induced pluripotent stem cells (hiPS cells) to map lithium's response pathway, enabling the larger pathogenesis of bipolar disorder to be identified. These results are the first to explain the molecular basis of the disease, and may support the development of a diagnostic test for the disorder as well as predict the likelihood of patient response to lithium treatment. It may also provide the basis to discover new drugs that are safer and more effective than lithium.

Bipolar disorder is a mental health condition causing extreme mood swings that include emotional highs (mania or hypomania) and lows (depression) and affects approximately 5.7 million adults in the U.S. Lithium is the first treatment explored after bipolar symptoms, but it has significant limitations. Only approximately one-third of patients respond to lithium treatment, and its effect is only found through a trial-and-error process that takes months--and sometimes years--of prescribing the drug and monitoring for response. Side effects of lithium treatment can be significant, including nausea, muscle tremors, emotional numbing, irregular heartbeat, weight gain, and birth defects, and many patients choose to stop taking the medicine as a result.

"Lithium has been used to treat bipolar disorder for generations, but up until now our lack of knowledge about why the therapy does or does not work for a particular patient led to unnecessary dosing and delayed finding an effective treatment. Further, its side effects are intolerable for many patients, limiting its use and creating an urgent need for more targeted drugs with minimal risks," said Evan Snyder, M.D., Ph.D., professor and director of the Center for Stem Cells and Regenerative Medicine at SBP, and senior author of the study. "Importantly, our findings open a clear path to finding safe and effective new drugs. Equally as important, it helped give us insight

[Video](#)

into what type of mechanisms cause psychiatric problems such as these."

"We realized that studying the lithium response could be used as a 'molecular can-opener' to unravel the molecular pathway of this complex disorder, that turns out not to be caused by a defect in a gene, but rather by the posttranslational regulation (phosphorylation) of the product of a gene--in this case, CRMP2, an intracellular protein that regulates neural networks," added Snyder.

In hiPS cells created from lithium-responsive and non-responsive patients, researchers observed a physiological difference in the regulation of CRMP2, which rendered the protein to be in a much more inactive state in responsive patients. However, the research showed that when lithium was administered to these cells, their regulatory mechanisms were corrected, restoring normal activity of CRMP2 and correcting the underlying cause of their disorder. Thus, the study demonstrated that bipolar disorder can be rooted in physiological--not necessarily genetic--mechanisms. The insights derived from the hiPS cells were validated in actual brain specimens from patients with bipolar disorder (on and off lithium), in animal models, and in the actions of living neurons.

"This 'molecular can-opener' approach--using a drug known to have a useful action without exactly knowing why--allowed us to examine and understand an underlying pathogenesis of bipolar disorder," said Snyder. "The approach may be extended to additional complex disorders and diseases for which we don't understand the underlying biology but do have drugs that may have some beneficial actions, such as depression, anxiety, schizophrenia and others in need of more effective therapies. One cannot improve a therapy until one knows what molecularly really needs to be fixed."

This study was performed in collaboration with Veterans Administration Medical Center in La Jolla, University of California San Diego, Yokohama City University, Massachusetts General Hospital, Harvard Medical School, Mailman Research Center at McLean Hospital, University of Connecticut School of Medicine, University of Pittsburgh Medical Center, National Institute of Mental Health, Vala Sciences, Inc., Broad Institute of MIT and Harvard

University, Dalhousie University, Beth-Israel Deaconess Medical Center, Örebro University, Janssen Research & Development Labs, Waseda University, and RIKEN .

Funding was provided by the National Institutes of Health (grants RC2MH090011, R21MH093958, R33MH087896 and R01MH095088 and the Library of Integrated Network-based Cellular Signatures Program), the Viterbi Foundation Neuroscience Initiative, the Stanley Medical Research Institute, the Tau Consortium, the California Institute of Regenerative Medicine, the California Bipolar Foundation and the International Bipolar Foundation.

<http://bit.ly/2pIZDM1>

Cannabis reverses aging processes in the brain

Researchers at the University of Bonn restore the memory performance of Methuselah mice to a juvenile stage

Memory performance decreases with increasing age. Cannabis can reverse these ageing processes in the brain. This was shown in mice by scientists at the University of Bonn with their colleagues at The Hebrew University of Jerusalem (Israel). Old animals were able to regress to the state of two-month-old mice with a prolonged low-dose treatment with a cannabis active ingredient. This opens up new options, for instance, when it comes to treating dementia. The results are now presented in the journal Nature Medicine.

Like any other organ, our brain ages. As a result, cognitive ability also decreases with increasing age. This can be noticed, for instance, in that it becomes more difficult to learn new things or devote attention to several things at the same time. This process is normal, but can also promote dementia. Researchers have long been looking for ways to slow down or even reverse this process.

Scientists at the University of Bonn and The Hebrew University of Jerusalem (Israel) have now achieved this in mice. These animals have a relatively short life expectancy in nature and display pronounced cognitive deficits even at twelve months of age. The researchers administered a small quantity of THC, the active ingredient in the hemp plant (cannabis), to mice aged two, twelve and 18 months over a period of four weeks.

Afterwards, they tested learning capacity and memory performance in the animals - including, for instance, orientation skills and the

recognition of other mice. Mice who were only given a placebo displayed natural age-dependent learning and memory losses. In contrast, the cognitive functions of the animals treated with cannabis were just as good as the two-month-old control animals. "The treatment completely reversed the loss of performance in the old animals," reported Prof. Andreas Zimmer from the Institute of Molecular Psychiatry at the University of Bonn and member of the Cluster of Excellence ImmunoSensation.

Years of meticulous research

This treatment success is the result of years of meticulous research. First of all, the scientists discovered that the brain ages much faster when mice do not possess any functional receptors for THC. These cannabinoid 1 (CB1) receptors are proteins to which the substances dock and thus trigger a signal chain. CB1 is also the reason for the intoxicating effect of THC in cannabis products, such as hashish or marijuana, which accumulate at the receptor. THC imitates the effect of cannabinoids produced naturally in the body, which fulfil important functions in the brain. "With increasing age, the quantity of the cannabinoids naturally formed in the brain reduces," says Prof. Zimmer. "When the activity of the cannabinoid system declines, we find rapid ageing in the brain."

To discover precisely what effect the THC treatment has in old mice, the researchers examined the brain tissue and gene activity of the treated mice. The findings were surprising: the molecular signature no longer corresponded to that of old animals, but was instead very similar to that of young animals. The number of links between the nerve cells in the brain also increased again, which is an important prerequisite for learning ability. "It looked as though the THC treatment turned back the molecular clock," says Zimmer.

Next step: clinical trial on humans

A low dose of the administered THC was chosen so that there was no intoxicating effect in the mice. Cannabis products are already permitted as medications, for instance as pain relief. As a next step,

the researchers want to conduct a clinical trial to investigate whether THC also reverses ageing processes in the brain in humans and can increase cognitive ability.

The North Rhine-Westphalia science minister Svenja Schulze appeared thrilled by the study: "The promotion of knowledge-led research is indispensable, as it is the breeding ground for all matters relating to application. Although there is a long path from mice to humans, I feel extremely positive about the prospect that THC could be used to treat dementia, for instance."

Publication: A chronic low dose of delta9-tetrahydrocannabinol (THC) restores cognitive function in old mice, Nature Medicine, DOI: 10.1038/nm.4311

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

'Humanlike' ways of thinking evolved 1.8 million years ago, suggests new study

Observing modern humans crafting ancient tools reveals human-like ways of thinking may have emerged 1.8 million years ago

By using highly advanced brain imaging technology to observe modern humans crafting ancient tools, an Indiana University neuroarchaeologist has found evidence that human-like ways of thinking may have emerged as early as 1.8 million years ago.

The results, reported May 8 in the journal *Nature Human Behavior*, place the appearance of human-like cognition at the emergence of *Homo erectus*, an early apelike species of human first found in Africa whose evolution predates Neanderthals by nearly 600,000 years.

"This is a significant result because it's commonly thought our most modern forms of cognition only appeared very recently in terms of human evolutionary history," said Shelby S. Putt, a postdoctoral researcher with The Stone Age Institute at Indiana University, who is first author on the study. "But these results suggest the transition from apelike to humanlike ways of thinking and behaving arose surprisingly early."

The study's conclusions are based upon brain activity in modern individuals taught to create two types of ancient tools: simple

Oldowan-era "flake tools" -- little more than broken rocks with a jagged edge -- and more complicated Acheulian-era hand axes, which resemble a large arrowhead. Both are formed by smashing rocks together using a process known as "flintknapping."

Oldowan tools, which first appeared about 2.6 million years ago, are among the earliest used by humanity's ancestors. Acheulian-era tool use dates from 1.8 million to 100,000 years ago.

Putt said that neuroarchaeologists look to modern humans to understand how pre-human species evolved cognition since the act of thinking -- unlike fossilized bones or ancient artifacts -- leave no physical trace in the archaeological record.

The methods used to conduct studies on modern humans crafting ancient tools was limited until recently by brain imaging technology. Previous studies depended on placing people within the confines of a functional magnetic resonance imaging machine -- essentially a narrow mental tube -- to observe their brain activity while watching videos of people crafting tools.

Putt's study, by contrast, employed more advanced functional near-infrared spectroscopy -- a device that resembles a lightweight cap with numerous wires used to shine highly sensitive lasers onto the scalp -- to observe brain activity in people as they learned to craft both types of tools with their hands.

In the study, 15 volunteers were taught to craft both types of tools through verbal instruction via videotape. An additional 16 volunteers were shown the same videos without sound to learn toolmaking through nonverbal observation. These experiments were conducted in the lab of John P. Spencer at the University of Iowa, where Putt earned her Ph.D. before joining IU. Spencer is now a faculty member at the University of East Anglia.

The resulting brain scans revealed that visual attention and motor control were required to create the simpler Oldowan tools. A much larger portion of the brain was engaged in the creation of the more complex Acheulian tools, including regions of the brain associated

with the integration of visual, auditory and sensorimotor information; the guidance of visual working memory; and higher-order action planning.

"The fact that these more advanced forms of cognition were required to create Acheulean hand axes -- but not simpler Oldowan tools -- means the date for this more humanlike type of cognition can be pushed back to at least 1.8 million years ago, the earliest these tools are found in the archaeological record," Putt said. "Strikingly, these parts of the brain are the same areas engaged in modern activities like playing the piano."

In addition to Spencer, other authors on the study were Sobanawartiny Wijekumar of the University of East Anglia and Robert Franciscus of the University of Iowa. The research was supported in part by the Wenner-Gren Foundation; the Leakey Foundation; Sigma Xi, the Scientific Research Society; the American Association of University Women; and the University of Iowa.

Putt also said the study was inspired in part by a similar experiment previously performed at IU by Nicholas Toth and Kathy Schick, both professors in the IU College of Arts and Sciences' Cognitive Science Program and co-directors of The Stone Age Institute, and Dietrich Stout, a Ph.D. student in their lab who is now a faculty member at Emory University in Georgia. Putt joined IU in part to pursue additional research on human cognition at The Stone Age Institute under support from the institute's \$3.2 million grant from the Temple Foundation in 2016.

<http://nyti.ms/2pIMQZ6>

Why Everything We Know About Salt May Be Wrong *The salt equation taught to doctors for more than 200 years is not hard to understand.*

By [GINA KOLATA](#) MAY 8, 2017

The body relies on this essential mineral for a variety of functions, including [blood pressure](#) and the transmission of nerve impulses. Sodium levels in the blood must be carefully maintained.

If you eat a lot of salt — sodium chloride — you will become thirsty and drink water, diluting your blood enough to maintain the proper concentration of sodium. Ultimately you will excrete much of the excess salt and water in urine.

The theory is intuitive and simple. And it may be completely wrong.

New studies of Russian cosmonauts, held in isolation to simulate space travel, show that eating more salt made them *less* thirsty but somehow hungrier. Subsequent experiments found that mice burned more calories when they got more salt, eating 25 percent more just to maintain their weight.

The [research](#), published recently in two dense [papers](#) in The Journal of Clinical Investigation, contradicts much of the conventional wisdom about how the body handles salt and suggests that high levels may play a role in weight loss.

The findings have stunned kidney specialists.

“This is just very novel and fascinating,” said Dr. Melanie Hoenig, an assistant professor of medicine at Harvard Medical School. “The work was meticulously done.”

Dr. James R. Johnston, a professor at the University of Pittsburgh, marked each unexpected finding in the margins of the two papers. The studies were covered with scribbles by the time he was done.

“Really cool,” he said, although he added that the findings need to be replicated.

The new studies are the culmination of a decades-long quest by a determined scientist, Dr. Jens Titze, now a kidney specialist at [Vanderbilt University](#) Medical Center and the Interdisciplinary Center for Clinical Research in Erlangen, Germany.

In 1991, as a medical student in Berlin, he took a class on human physiology in extreme environments. The professor who taught the course worked with the European space program and presented data from a simulated 28-day mission in which a crew lived in a small capsule.

The main goal was to learn how the crew members would get along. But the scientists also had collected the astronauts’ urine and other physiological markers.

Dr. Titze noticed something puzzling in the crew members’ data: Their urine volumes went up and down in a seven-day cycle. That

contradicted all he’d been taught in medical school: There should be no such temporal cycle.

In 1994, the Russian space program decided to do a 135-day simulation of life on the Mir space station. Dr. Titze arranged to go to Russia to study urine patterns among the crew members and how these were affected by salt in the diet.

A striking finding emerged: a 28-day rhythm in the amount of sodium the cosmonauts’ bodies retained that was not linked to the amount of urine they produced. And the sodium rhythms were much more pronounced than the urine patterns.

The sodium levels should have been rising and falling with the volume of urine. Although the study wasn’t perfect — the crew members’ sodium intake was not precisely calibrated — Dr. Titze was convinced something other than fluid intake was influencing sodium stores in the crew’s bodies.

The conclusion, he realized, “was heresy.”

In 2006, the Russian space program announced two more simulation studies, one lasting 105 days and the other 520 days. Dr. Titze saw a chance to figure out whether his anomalous findings were real.

In the shorter simulation, the cosmonauts ate a diet containing 12 grams of salt daily, followed by nine grams daily, and then a low-salt diet of six grams daily, each for a 28-day period. In the longer mission, the cosmonauts also ate an additional cycle of 12 grams of salt daily.

Like most of us, the cosmonauts liked their salt. Oliver Knickel, 33, a German citizen participating in the program who is now an automotive engineer in Stuttgart, recalled that even the food that supplied 12 grams a day was not salty enough for him.

When the salt level got down to six grams, he said, “It didn’t taste good.”

The real shocker came when Dr. Titze measured the amount of sodium excreted in the crew’s urine, the volume of their urine, and the amount of sodium in their blood.

The mysterious patterns in [urine volume](#) persisted, but everything seemed to proceed according to the textbooks. When the crew ate more salt, they excreted more salt; the amount of sodium in their blood remained constant, and their urine volume increased.

“But then we had a look at fluid intake, and were more than surprised,” he said.

Instead of drinking more, the crew were drinking less in the long run when getting more salt. So where was the excreted water coming from?

“There was only one way to explain this phenomenon,” Dr. Titze said.

“The body most likely had generated or produced water when salt intake was high.”

Another puzzle: The crew complained that they were always hungry on the high-salt diet. Dr. Titze assured them that they were getting exactly enough food to maintain their weights, and were eating the same amount on the lower-salt diets, when hunger did not seem to be problem.

But urine tests suggested another explanation. The crew members were increasing production of glucocorticoid hormones, which influence both metabolism and immune function.

To get further insight, Dr. Titze began a study of mice in the laboratory. Sure enough, the more salt he added to the animals’ diet, the less water they drank. And he saw why.

The animals were getting water — but not by drinking it. The increased levels of glucocorticoid hormones broke down fat and muscle in their own bodies. This freed up water for the body to use.

But that process requires energy, Dr. Titze also found, which is why the mice ate 25 percent more food on a high-salt diet. The hormones also may be a cause of the strange long-term fluctuations in urine volume.

Scientists knew that a starving body will burn its own fat and muscle for sustenance. But the realization that something similar happens on a salty diet has come as a revelation.

People do what camels do, noted Dr. Mark Zeidel, a nephrologist at Harvard Medical School who wrote an [editorial](#) accompanying Dr. Titze’s studies. A camel traveling through the desert that has no water to drink gets water instead by breaking down the fat in its hump.

One of the many implications of this finding is that salt may be involved in weight loss. Generally, scientists have assumed that a high-salt diet encourages a greater intake of fluids, which increases weight.

But if balancing a higher salt intake requires the body to break down tissue, it may also increase energy expenditure.

Still, Dr. Titze said he would not advise eating a lot of salt to lose weight. If his results are correct, more salt will make you hungrier in the long run, so you would have to be sure you did not eat more food to make up for the extra calories burned.

And, Dr. Titze said, high glucocorticoid levels are linked to such conditions as [osteoporosis](#), muscle loss, [Type 2 diabetes](#) and other metabolic problems.

But what about liquids? Everyone knows that salty foods make you thirsty. How could it be that a high-salt diet made the cosmonauts less thirsty?

In reality, said Dr. Zeidel, people and animals get thirsty because salt-detecting neurons in the mouth stimulate an urge to drink. This kind of “thirst” may have nothing to do with the body’s actual need for water.

These findings have opened up an array of puzzling questions, experts said. “The work suggests that we really do not understand the effect of sodium chloride on the body,” said Dr. Hoenig.

“These effects may be far more complex and far-reaching than the relatively simple laws that dictate movement of fluid, based on pressures and particles.”

She and others have not abandoned their conviction that high-salt diets can raise blood pressure in some people.

But now, Dr. Hoenig said, “I suspect that when it comes to the adverse effects of high sodium intake, we are right for all the wrong reasons.”

<http://bit.ly/2rcD5V6>

The vicious circle of inequality

An international investigation into the association between societal inequality and instability and psychological motives for group dominance

How to distribute resources between different individuals and groups is one of the basic dilemmas of social life. All known surplus-producing societies are organised as social hierarchies where some groups of people have more resources and better opportunities and life conditions than other groups. Some societies, such as the Indian caste-system, are strongly hierarchical, others like the Nordic welfare states less so. Yet, even in Scandinavia some groups - like ethnic Danes or Norwegians - hold higher status than other groups such as immigrants and refugees.

The question is how societal hierarchies stabilise and arise.

The greater societal inequality, the larger motives for dominance

Researchers from Norway (University of Oslo), Denmark (Aarhus University), New Zealand (Victoria Wellington University) and the US (Harvard University) have conducted an investigation into the association between societal inequality and instability and psychological motives for group dominance with about 45,000 persons across 27 nations and 30 American states.

The result is clear: The greater the societal inequality and instability, the more the groups on top of society tend to support a hierarchy between groups, protecting their own privileged status.

"What we see is a self-fulfilling process where greater societal inequality motivates the group at the top to use even violent means to maintain such inequality. This, in turn, may lead to even more inequality and even extremist violence. This results in a vicious circle," says the senior author of the study, Lotte Thomsen, associate professor in psychology, University of Oslo, Norway and in political science at Aarhus BSS, Aarhus University, Denmark.

Even though you are at considerable disadvantage when positioned at the bottom of the hierarchy and denied access to important resources of territory, food, and mates, as a single individual you may nevertheless be better off by staying out of costly dominance conflicts you are bound to lose anyway. As a consequence, more or less stable dominance hierarchies will arise where some have more and some have less than others.

Clear association across 27 countries

The researchers compared the participants' answers to questions about their support for hierarchy versus equality between groups with macro-indicators from the UN, the World Bank and Reporters Without Borders, among others.

"We see a clear association across 27 countries" says first-author Jonas Kunst, who is a postdoctoral fellow in psychology, University of Oslo and in political science, Aarhus University.

The greater the societal inequality is, the greater is the average social dominance orientation (SDO) among members of the dominant group in the country. The social dominance orientation of the population is systematically higher in countries that score worse on macro-indicators for the risk of violent conflicts, absence of good governance (such as corruption and lack of the rule of law), lack of social progress in terms of meeting the basic needs of the population and providing access to health care and education, lack of democracy, lack of a free press, and lack of gender equality.

Violent persecution of immigrants, racism and sexism are among the consequences

In the second part of the study, the researchers again asked more than 4,000 white American citizens across 30 US states whether they support hierarchy or equality between different groups of people. They also asked questions about racism, sexism, and whether respondents would be willing to participate in the ethnic persecution of immigrants.

"This is a pretty extreme and almost right-wing extremist measure. We simply asked people to imagine that the government decides to outlaw immigrant organizations in the future and then asked each participant if they would inform the police of any members of immigrant organizations that they knew of, whether they would participate in hunting down immigrants and in attacks on immigrant headquarters, and whether they would support the use of physical force and execution of immigrant leaders", says Lotte Thomsen.

Again, the researchers found a systematic association with large-scale societal structure. Using the gini-coefficient to measure the degree of economic inequality and the US Peace index to indicate presence of violence in each state, they found that both predicted the dominance motives among individual participants. That is, white Americans somehow seemed to tune their psychological dominance motives to the degree of economic inequality and violence in the specific US state where they lived.

"This is quite serious, because we know that psychological group dominance motives are related to greater racism, sexism, and willingness to participate in violence against other groups. Our study also demonstrated these associations", says Jonas Kunst.

"The end result may be a vicious circle of inequality and violence. Because economic inequality is increasing in many parts of the world, this is an important cause for concern," says Lotte Thomsen.

Facts:

The research will be published in the week commencing 8 May in the research article "Preferences for group dominance track and mediate the effects of macro-level social inequality and violence across societies" in *Proceedings of the National Academy of Sciences*, one of the world's top three scientific journals.

The authors behind the research are J. R. Kunst (Oslo University and Aarhus University), R. Fischer (Victoria University of Wellington, New Zealand), J. Sidanius (Harvard University) and Lotte Thomsen (University of Oslo and Aarhus University).

The research was funded by young researcher awards to Lotte Thomsen from the Danish and Norwegian research councils.

Charitable giving: How do power and beliefs about equality impact donations?

More information: Jonas R. Kunst et al., "Preferences for group dominance track and mediate the effects of macro-level social inequality and violence across societies," *PNAS* (2017). www.pnas.org/cgi/doi/10.1073/pnas.1616572114

<http://bit.ly/2qiWe7M>

Ancient minerals fill in lost chapter of Earth's history

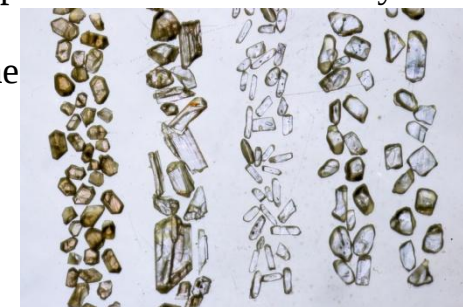
A study of the oldest minerals ever found has shed new light on Earth in the Hadean eon, 4.4 billion years ago. Andrew Stapleton reports.

Scientists from the Australian National University in Canberra studying ancient minerals have filled in some gaps in our picture of Earth in the Hadean eon, 4.4 billion years ago.

The Jack Hills, in mid-west Western Australia, are home to the world's oldest known mineral samples, called detrital zircon grains. These small zircon grains are the only known geological record of the Earth's crust from the Hadean eon. No other rocks remain from that period to provide us with clues about how Earth's first crust was formed.

Scientists from the Australian National University in Canberra studied the elements present in younger zircons, of known origin, to create a geological 'Rosetta Stone' to determine how the Jack Hills' zircons formed. They reported their findings in [Nature Geoscience](#).

The team discovered that the elements present in the 4.4 billion-year-old zircon minerals suggested that the Earth's earliest crust was made from the melting of igneous rock. The results clarify some ambiguity surrounding Earth's earliest history and help to understand how Earth's crust has changed over time.



Zircon crystals as old as 4.4 billion years were found in sandstone at Jack Hills of Western Australia. Stuart Hay / ANI

Based on the elemental analysis, the scientists think that the surface of Earth in the Hadean eon was barren, mountainless and almost entirely under water except for a few small islands.

Lead researcher and Earth scientist, Dr Antony Burnham said, "We've improved the focus on the image of the world at that time but there are still plenty of questions unanswered."

In today's world, the research may also have some industrial benefit. "Zircons may be useful for finding ore bodies and understanding the processes behind economic mineralisation," Burnham added.

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

Doctors should be paid by salary, not fee-for-service, argue behavioral economists

Fee-for-service payments have adverse consequences that dwarf those of the payments from pharmaceutical companies

While most conflict of interest research and debate in medicine focuses on physicians interacting with pharmaceutical and device companies, one important source of conflicts is largely ignored in the medical literature on conflicts of interest: how doctors are paid.

In a [Journal of the American Medical Association Viewpoint article](#), Carnegie Mellon University's [George Loewenstein](#) and the University of California, Los Angeles' [Ian Larkin](#) outline the problems associated with the fee-for-service arrangements that most doctors currently operate under. Such compensation schemes, they argue, create incentives for physicians to order more, and different, services than are best for patients.

"Fee-for-service payments have adverse consequences that dwarf those of the payments from pharmaceutical companies and device manufacturers that have received the lion's share of attention in the conflict of interest literature," said Loewenstein, the Herbert A. Simon University Professor of Economics and Psychology at CMU and a leading expert on conflicts of interest.

"Paying doctors to do more leads to over-provision of tests and procedures, which cause harms that go beyond the monetary and time costs of getting them. Many if not most tests and procedures cause pain and discomfort, especially when they go wrong."

One commonly proposed solution to the problem involves requiring physicians to disclose their financial interest for a given procedure. However, disclosure of conflicts has been found to have limited, or even negative, effects on patients.

Loewenstein and Larkin argue that the simplest and most effective way to deal with conflicts caused by fee-for-service arrangements is to pay physicians on a straight salary basis.

Several health systems well-known for high-quality of care, such as the Mayo Clinic, the Cleveland Clinic and the Kaiser group in California, pay physicians salaries without incentives for volume of services performed.

Moving more physicians to straight salary-based compensation might have benefits not only for patients, but also for physicians themselves.

"The high levels of job dissatisfaction reported by many physicians may result, in part, from the need to navigate the complexities of the fee-for-service arrangements," said Larkin, an assistant professor of strategy at UCLA's Anderson School of Management.

"Instead of focusing on providing patients with the best possible medical care, physicians are forced to consider the ramifications of their decisions for their own paychecks."

Arthur L. Caplan, professor of bioethics at New York University's Langone Medical Center, told Medscape that he found Loewenstein and Larkin's piece to be "the most novel" in the May 2 *JAMA* issue dedicated to medical conflicts of interest.

In how they suggest using salaried compensation as a remedy for conflicts of interest that arise from fee-for-service incentives, Caplan said, "There's been a lot of talk about this, but not much had been written."

Loewenstein and Larkin also led a research study in the same issue of *JAMA* on how [restricting pharmaceutical sales representatives' marketing tactics changes physician prescribing behavior](#).

<http://bit.ly/2r65RJE>

Believing a cocktail contains an energy drink makes you feel more drunk

New research suggests that simply telling a young man that an energy drink has been added to his alcoholic beverage can make him feel more intoxicated, daring and sexually self-confident.

The study, led by the UBC Sauder School of Business, is the first to examine the effect of marketing on consumer beliefs related to alcohol mixed with energy drinks.

"Red Bull has long used the slogan 'Red Bull gives you wings,' but our study shows that this type of advertising can make people think it has intoxicating qualities when it doesn't," said Yann Cornil, the study's lead author and assistant professor at UBC Sauder. "When alcohol is mixed with an energy drink and people are aware of it, they feel like they're more intoxicated simply because the marketing says they should feel that way."

While earlier studies suggested that mixing energy drinks and alcohol could be dangerous, recent experiments in which people were not told what they were drinking found that adding energy drinks to alcohol had no effect on actual or perceived intoxication and was unlikely to increase alcohol's effect on behaviour. Despite this, those who knowingly mix energy drinks with alcohol have twice the risk of experiencing or committing sexual assault or being involved in a car crash, compared to people who drink alcohol straight.

To test their theory that the marketing of energy drinks could result in a placebo effect, the researchers recruited 154 young men who were each given a cocktail containing vodka, Red Bull and fruit juice. The labelling of the cocktail either emphasized the presence of the energy drink, describing it as a "vodka-Red Bull cocktail," or not, describing it as a "vodka cocktail" or "exotic cocktail." Participants were then asked to complete a series of tasks on a computer to measure their perceived drunkenness and their attitudes and behaviors.

The researchers found that emphasizing the presence of an energy drink significantly increased perceived intoxication, risk-taking and sexual self-confidence, especially among participants who already had a strong belief that mixing energy drinks with alcohol would have this effect.

The researchers also measured how likely participants were to drive, and found that emphasizing the energy drink decreased participants' intentions to drive under the influence.

"The silver lining was that emphasizing the energy drink in the cocktail made the participants less likely to drive," said study co-author Aradhna Krishna, marketing professor at the University of Michigan's Ross School of Business. "It seems that drunk-driving education is working enough to make people think hard about driving when they are feeling drunk."

"Given the study's findings about the psychological effects of energy-drink marketing, energy drink marketers should be banned from touting the disinhibiting effects of their ingredients," said co-author Pierre Chandon, marketing professor at INSEAD business school. "Regulations and codes of conduct should consider the psychological - and not just the physiological - effects of products."

The study, "Does Red Bull Give Wings to Vodka? Placebo Effects of Marketing Labels on Perceived Intoxication and Risky Attitudes and Behaviours," was recently published in the Journal of Consumer Psychology.

<http://bit.ly/2rft1KP>

Experts advise against surgery for almost all patients with degenerative knee damage

Knee arthroscopy should not be performed in almost all patients with degenerative knee disease

Knee arthroscopy (keyhole surgery to relieve pain and improve movement) should not be performed in almost all patients with degenerative knee disease, say a panel of international experts in The BMJ today.

Their strong recommendation against surgery is based on new evidence that it does not, on average, result in a lasting improvement in pain or function - and they say further research is unlikely to alter this advice.

Their advice is part of The BMJ's 'Rapid Recommendations' initiative - to produce rapid and trustworthy guidance based on new evidence to help doctors make better decisions with their patients.

Degenerative knee disease (commonly known as arthritis) is a chronic condition in which symptoms fluctuate. Knee arthroscopy is one of the most common surgical procedures. Every year, an estimated two million people worldwide undergo knee arthroscopy at a cost of \$3bn per year in the US alone. Yet current evidence suggests that arthroscopic knee surgery offers little benefit for most patients and is not cost effective.

For example, a trial published in The BMJ in 2016 showed that among patients with meniscus tear (damage to the rubbery discs that cushion the knee joint), surgery was no better than exercise therapy.

Yet, despite there being no evidence that arthroscopy is beneficial in any patient group, most guidelines continue to support the use of arthroscopy in key subgroups, including those with meniscus tear, sudden onset of symptoms (such as pain or swelling), or mild-moderate difficulties with knee movement. Most people with degenerative knee disease fit into at least one of these subgroups.

So an international panel - made up of bone surgeons, physiotherapists, clinicians and patients with experience of degenerative knee disease (including those who had undergone and those who had not undergone arthroscopy) decided to carry out a detailed analysis of the latest evidence.

Their rapid recommendation package includes a systematic review (published in BMJ Open) which adds the 2016 trial to the existing body of evidence, and a review of patients' preferences on knee disease (also published in BMJ Open). These data were used as the basis for the recommendation.

Using the GRADE approach (a system used to assess the quality of evidence), they found that arthroscopic knee surgery does not, on average, result in an improvement in long term pain or function to all or almost all patients with degenerative knee disease.

In addition to the burden of undergoing knee arthroscopy, they say there are rare but important harms, although exactly how common these are is uncertain (low quality of evidence).

As such, they strongly recommend against arthroscopy for almost all patients with degenerative knee disease - and suggest that non-use of knee arthroscopy can be used as a performance measure or tied to health funding.

It is unlikely that new trials will alter the evidence, they add.

Casey Quinlan, a patient panel member said: "Knee arthroscopy has been oversold as a cure-all for knee pain. Participating in the working group that developed this guideline allowed for actual patient experience to be considered - mine was nowhere near what I had been told it would be, function and pain level were only marginally improved? - giving real outcomes as a basis for the recommendations. The goal was to make it possible for people exploring this knee arthroscopy with their doctors to have a clearer view of when it might be helpful to them, or unnecessary surgery."

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

Hospitals must be prepared for ransomware attacks *Hospitals need to be prepared for ransomware attacks, warns a doctor in The BMJ today.*

Dr Krishna Chinthapalli, a neurology registrar at the National Hospital for Neurology and Neurosurgery in London, describes how a virus - or "ransomware" - infected and locked computers at the Hollywood Presbyterian Medical Center in Los Angeles hospital in February 2016. Rumours surfaced that the hospital was being held to ransom for \$3.4m (£2.6m; €3.1m), though the hospital denied this. After 10 days the hospital paid a smaller ransom of about \$17,000 to regain use of its computers.

Hollywood Presbyterian was the first hospital to admit paying a ransom, writes Chinthapalli, but other US hospitals, in California, Indiana, Kentucky, Maryland, and Texas, were targeted in 2016.

He points out that the number of ransomware attacks rose fourfold from 2015 to 2016, and so did the amount of money paid to hackers, to \$1bn, according to the FBI. In the UK, a third of NHS trusts have reported a ransomware attack, he adds.

Chinthapalli argues that hospitals are ideal targets for ransomware companies. For instance, many use proprietary software that runs on ancient operating systems - and hold confidential patient information that can be sold to other criminals. As such, hospitals are probably more willing than other organisations to pay for quick recovery of their data. So what can hospitals and their workers do, he asks?

Digital hygiene - that is, keeping hardware and software as secure as possible - is essential, while frequent backups are also important. And when attacks do occur, the IT department must be informed quickly to isolate infected computers, he says.

"We should be prepared: more hospitals will almost certainly be shut down by ransomware this year," he concludes.

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

Experts argue that obesity is a chronic, relapsing, progressive disease

Obesity fits the epidemiological model of a disease process

In a new article, World Obesity Federation experts consider the argument for obesity as a chronic relapsing disease process. They note that obesity fits the epidemiological model of a disease process except that the toxic or pathological agent is food rather than a microbe.

The question of whether obesity should be called a 'disease' has sparked controversy for most of the last century. In their Obesity Reviews position statement, Dr. George Bray and his colleagues examine how an abundance of food, low physical activity, and several other environmental factors interact with genetic susceptibility. They draw parallels to chronic diseases, noting that the magnitude of

obesity and its adverse effects in individuals may relate to the virulence or toxicity of the environment and its interaction with the host.

"Accepting the concept that obesity is a chronic disease process is important for several reasons," said Dr. Bray. "First, it removes the feeling that patients alone are responsible for their excess weight. It also focuses attention on the ways in which this disease process can be tackled. And finally, it shows that if we can successfully treat obesity, many of its associated diseases will be eliminated."

In an accompanying letter to the editor, experts agree that declaring obesity to be a disease could benefit those people who are suffering with obesity and wish to have access to medical advice and support, "whilst also strengthening the call for dealing with the social determinants, obesogenic environments and systemic causes of individual weight gain." They also note that recognizing obesity as a disease may reduce individuals' internalized stigma, change the public discourse about blame for the condition, and have benefits in countries where health service costs are funded from insurance schemes that limit payments for non-disease conditions or risk factors.

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

Snowball Earth melting led to freshwater ocean 2 kilometres deep

A little more than 600 million years ago, you could have drunk from the ocean.

By Brian Owens

After an extreme ice age known as snowball Earth, in which glaciers extended to the tropics and ice up to a kilometre thick covered the oceans, the melt formed a thick freshwater layer that floated on the super-salty oceans.

Those freshwater surface seas lasted far longer than thought, according to research by Dorian Abbot, a geologist at the University of Chicago, and his colleagues. Their mathematical models showed that it took around 50,000 years for the two layers to fully merge.

“This is interesting because the modern ocean mixes on a timescale of only about 1000 years,” says Abbot.

The much slower mixing was due to the huge density and temperature differences between the layers. During the snowball phase, half the oceans’ water ended up as snow and ice. The remaining seas were twice as salty as today, and near their freezing point. Once the ice melted, driven by a runaway greenhouse effect caused by volcanic eruptions, it formed a freshwater layer up to 2 kilometres thick.

Too hot for swimming

The extreme carbon dioxide concentrations in the atmosphere caused the layer’s surface temperature to rise as high as 50°C. The winds and tides needed a long time to mix this light, hot, freshwater layer with the dense, cold, salty layer because of their extreme differences.

The mixing didn’t just return the oceans to their previous saltiness, though. Warm water takes up more space than cold water, so once the hot surface water mixed with the cold depths, the overall temperature of the oceans rose and the waters expanded – causing an additional 50 metres of sea-level rise thousands of years after the last glaciers had melted.

Abbot says that learning about ancient climate change can help researchers better understand how the planet will respond to increasing carbon dioxide levels in the atmosphere today.

“Our predictions about climate change depend on physical theories, and we can test these theories by applying them to past climates,” he says. “If we can explain observations of past climates, then we are more confident in the theories, and therefore in our predictions of climate change.”

Paul Hoffman, a geologist at Harvard University who has studied the snowball Earth period, says this work won’t be the last word on how the planet responds to dramatic climate change.

“That such a basic issue should not have been simulated in a model until now, even in a preliminary way, illustrates how much is still to be learned about the snowball Earth phenomena,” he says.

Journal reference: *Geology*, DOI: 10.1130/G38920.1

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

About a third of FDA-approved drugs go on to have major safety issues

Amid calls for faster reviews, researchers look for ways to catch dangerous drugs.

[Beth Mole](#) - 5/11/2017, 4:20 AM

About a third of the drugs that the Food and Drug Administration deems safe and effective go on to have major safety issues years after their approval, researchers report in *JAMA*.

The finding lands amid pressure from lawmakers and the Trump administration to hasten the already fast pace of the agency’s drug reviews.

Among 222 novel therapeutics approved by the agency between 2001 and 2010, [71 \(or 32 percent\) had safety events](#) arise a median of 4.2 years later. Safety events assessed in the study were marked by any of three FDA actions: withdrawing a drug entirely from the market; adding a boxed warning to a drug’s label, which is often added for life-threatening health risks; or issuing a [safety communication](#), which is for serious, but non-life-threatening, health risks.

In all, the agency withdrew three drugs*, added boxed warnings to 61, and issued safety communications for 59.

The authors of the study, led by Joseph Ross, a Yale professor of general medicine and public health policy, hope the analysis helps regulators identify features of drugs that may have hidden health risks at the time of their review. This could allow regulators to beef up reviews, increase post-market monitoring, or boost data sharing for certain drugs.

“The majority of pivotal trials that form the basis for FDA approval [enroll fewer than 1,000 patients with follow-up of six months or less](#), which may make it challenging to identify uncommon or long-term serious safety risks,” Ross and his colleagues note. “The high frequency of post-market safety events highlights the need for

continuous monitoring of the safety of novel therapeutics throughout their life cycle.”

But the study also may offer a glimpse of what could come from policies designed to quicken the FDA’s already swift reviews.

In his first speech to Congress, President Donald Trump called the FDA’s review process “slow and burdensome.” He vowed to “slash the restraints” at the agency. However, the FDA is moving [more quickly than it has in its recent history](#). Since Congress passed the Prescription Drug User Fee Act in 1992, which allows the FDA to collect review fees from drug makers, the time for reviews has dropped steadily. In 2016, median standard review time fell to around 10 months, down from about 27 months in 1993.

Last month, Ross and colleagues (Nicholas Downing, of Brigham and Women’s Hospital, and Audrey Zhang, of New York University School of Medicine) reported in *The New England Journal of Medicine*, that the FDA was, on average, [two months faster](#) at approving drugs than its European counterpart, the European Medicines Agency.

Unsafe reviews

In their new study, the researchers looked to see how the speed of approval—along with other factors—might affect post-market safety. First, “[biologics](#)” (that is, medicines composed of sugars, proteins, living viruses, cells, tissue, or complex combinations of things) were more likely to lead to post-market safety problems than “pharmaceuticals” (medicines made of small molecules). Also, among the different treatment classes, drugs for psychiatric diseases were the most likely to have post-market safety events, as compared with the others, such as those that treat cancers and blood diseases.

When it came to approval time, the results were a bit complicated. The drugs that gained FDA approval right before the deadline for their review were more likely to have post-market safety issues. On the flip-side, drugs with the quickest approvals (under 200 days) were less likely to have safety issues later. The authors interpreted this as

suggesting that if drugs have strong pre-market safety data and can sail through their reviews, it may be a good indicator of their overall safety. Whereas, when drugs get hung up in their reviews, possibly because regulators are trying to parse weak or questionable pre-market safety data, it may be a red flag that there are post-market safety problems to come.

Perhaps most useful for future policy discussions, the researchers found that drugs approved through “accelerated” review processes were more likely to have safety issues later. Accelerated reviews can be granted for drugs that address a serious unmet medical need, and they allow the FDA to use “[surrogate endpoints](#)” for safety and effectiveness. That means instead of testing if a drug achieves a direct endpoint, such as preventing a patient from having a heart attack, drug makers can monitor if it reaches a surrogate endpoint, such as lowering “bad” LDL cholesterol. New policies, included in [the 21st Century Cures Act](#), push for more use of surrogates in drug-approval processes.

The authors noted limitations in their study. For one, they only had safety data until 2015 for drugs approved between 2001 and 2010. Safety events could still pop up later. And the researchers didn’t track other potential safety issues, like label or dosage changes.

Still, the data strongly point to a need for a way to monitor safety once drugs hit the market. Current methods rely on voluntary reporting of safety issues. And, of course, “further research is needed to better understand the dynamics between more rapid and near-regulatory deadline approval and drug safety,” the authors conclude.

****The three withdrawn drugs include valdecoxib, an anti-inflammatory, and tegaserod, a drug used for the treatment of irritable bowel syndrome. Both were withdrawn over concerns of cardiovascular events. The third is efalizumab, a drug used to treat psoriasis, which was withdrawn over the risk of progressive multifocal leukoencephalopathy, a disease that damages the brain.***

JAMA, 2017. DOI: [10.1001/jama.2017.5150](https://doi.org/10.1001/jama.2017.5150) ([About DOIs](#)).

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

Beauty requires thought, neuroscientists find

Experiencing beauty requires thought, a team of neuroscientists finds, in a new study that confirms an 18th-century claim by the philosopher Immanuel Kant.

"The experience of beauty is a form of pleasure," explains New York University's Denis Pelli, a professor of psychology and neural science and the study's senior author. "To get it, we must think."

"From Homer's Iliad to today's nearly-\$500-billion cosmetics industry, beauty always matters," adds Aenne Brielmann, a doctoral candidate in NYU's Department of Psychology and the study's lead author. "Our study reveals what makes beauty special."

The research, which appears in the journal *Current Biology*, tested twin claims by Kant. In his 1764 work *Observations on the Feeling of the Beautiful and Sublime*, and later in *Critique of Pure Judgment*, he posited that experiencing beauty requires thought, but that sensuous pleasure can be enjoyed without thought and cannot be beautiful.

The scientists examined whether experiencing beauty requires thought and sensuous pleasure does not.

They conducted a series of experiments in which the study's participants selected images from the Internet that they found "movingly beautiful." Participants were shown the images they selected as well as images that were independently evaluated as "beautiful" or "plain" (e.g., a beautiful beach scene or a plain piece of cloth). To measure how we process sensuous pleasures, participants tasted fruit-flavored candy or touched teddy bears with various wool textures.

For each object, participants reported how much pleasure and beauty they felt. In one half of the experiment, the same participants had to simultaneously complete a task: They listened to a sequence of letters and pressed a button every time the letter was the same as the one two letters back. This distracted the participants from thinking about the image, candy, or teddy bear while experiencing them.

Adding the distraction reduced the feelings of pleasure and beauty in viewing the beautiful images, but hardly affected that from non-beautiful things. These results support Kant's claim that beauty requires thought.

The researchers were surprised, however, to discover that strong pleasure is always beautiful. A third of participants got very strong pleasure from the candy and teddy bear, and called these sensuous pleasures "beautiful." This additional finding disproves Kant's claim that sensuous pleasures cannot be beautiful.

So, if you seek maximum pleasure, these results recommend undistracted beauty wherever you find it, even in candy.

DOI: 10.1016/j.cub.2017.04.018

<http://bit.ly/2pKZB6r>

Antibiotic-resistant microbes date back to 450 million years ago, well before the age of dinosaurs

Survival of mass extinctions helps to explain near indestructible properties of hospital superbugs

BOSTON - Leading hospital "superbugs," known as the enterococci, arose from an ancestor that dates back 450 million years -- about the time when animals were first crawling onto land (and well before the age of dinosaurs), according to a new study led by researchers from Massachusetts Eye and Ear, the Harvard-wide Program on Antibiotic Resistance and the Broad Institute of MIT and Harvard. [Published online today](#) in *Cell*, the study authors shed light on the evolutionary history of these pathogens, which evolved nearly indestructible properties and have become leading causes of modern antibiotic-resistant infections in hospitals.

Antibiotic resistance is now a leading public health concern worldwide. Some microbes, often referred to as "superbugs," are resistant to virtually all antibiotics. This is of special concern in hospitals, where about 5 percent of hospitalized patients will fight infections that arise during their stay. As researchers around the world

are urgently seeking solutions for this problem, insight into the origin and evolution of antibiotic resistance will help inform their search.

"By analyzing the genomes and behaviors of today's enterococci, we were able to rewind the clock back to their earliest existence and piece together a picture of how these organisms were shaped into what they are today" said co-corresponding author [Ashlee M. Earl, Ph.D.](#), group leader for the Bacterial Genomics Group at the Broad Institute of MIT and Harvard.



Early life as it is believed to have looked 335 million years ago, well before the age of the dinosaurs. Ancestors of hospital pathogens are now believed to have lived in the guts of these ancient land animals. Mark Witton

"Understanding how the environment in which microbes live leads to new properties could help us to predict how microbes will adapt to the use of antibiotics, antimicrobial hand soaps, disinfectants and other products intended to control their spread."

The picture the researchers pieced together begins with the dawn of life. Bacteria arose nearly 4 billion years ago, and the planet has teemed with them ever since, including the sea. Animals first arose in the sea during the time known as the Cambrian Explosion, 542 million years ago. As animals emerged in a sea of bacteria, bacteria learned to live in and on them. Some bacteria protect and serve the animals, as the healthy microbes in our intestines do today; others live in the environment, and still others cause disease. As animals crawled onto land about 100 million years later, they took their microbes with them. The authors of the *Cell* study found that all species of enterococci, including those that have never been found in hospitals, were naturally resistant to dryness, starvation, disinfectants and many antibiotics. Because enterococci normally live in the intestines of most (if not all)

land animals, it seemed likely that they were also in the intestines of land animals that are now extinct, including dinosaurs and the first millipede-like organisms to crawl onto land. Comparison of the genomes of these bacteria provided evidence that this was indeed the case. In fact, the research team found that new species of enterococci appeared whenever new types of animals appeared. This includes when new types of animals arose right after they first crawled onto land, and when new types of animals arose right after mass extinctions, especially the greatest mass extinction, the End Permian Extinction (251 million years ago).

From sea animals, like fish, intestinal microbes are excreted into the ocean, which usually contains about 5,000 mostly harmless bacteria per drop of water. They sink to the seafloor into microbe-rich sediments, and are consumed by worms, shellfish and other sea scavengers. Those are then eaten by fish, and the microbes continue to circulate throughout the food chain. However, on land, intestinal microbes are excreted as feces, where they often dry out and most die over time.

Not the enterococci, however. These microbes are unusually hardy and can withstand drying out and starvation, which serves them well on land and in hospitals where disinfectants make it difficult for a microbe.

"We now know what genes were gained by enterococci hundreds of millions of years ago, when they became resistant to drying out, and to disinfectants and antibiotics that attack their cell walls," said study leader [Michael S. Gilmore, Ph.D.](#), senior scientist at Mass. Eye and Ear and Director of the Harvard Infectious Disease Institute.

"These are now targets for our research to design new types of antibiotics and disinfectants that specifically eliminate enterococci, to remove them as threats to hospitalized patients," added Francois Lebreton, Ph.D., first author of the study and project leader for the Gilmore team.

In addition to Drs. Earl, Gilmore and Lebreton, authors on the Cell paper include Abigail L. Manson, Ph.D., and Timothy J. Straub, of the Broad Institute of MIT and Harvard, and Jose T. Saavedra, of Massachusetts Institute of Technology.

This research study was supported by Department of Health and Human Services/National Institutes of Health/National Institute of Allergy and Infectious Diseases grants AI072360, AI083214, HHSN272200900018C and U19AI110818.

<http://nyti.ms/2r6qv3f>

Humans Have a Poor Sense of Smell? It's Just a Myth

By shoving her nose against a fire hydrant, your terrier may be able to decipher which pit bull in the neighborhood marked it before her.

But that doesn't necessarily mean she's a superior sniffer.

By JOANNA KLEIN MAY 11, 2017

Still, it's conventional wisdom that humans' sense of smell is worse than that of other animals — dogs, mice, moles and even sharks.

This belief isn't based on empirical evidence, but on a 19th-century hypothesis about free will that has more in common with phrenology than with our modern understanding of how brains work. In a [review](#) published Thursday in Science, [John P. McGann](#), a neuroscientist who studies olfaction at Rutgers University, reveals how we ended up with this myth. The truth is, humans are actually [pretty good](#) at smelling our world.

“We're discovering, to our delight, that the human smell system is much better than we were led to believe,” he said. It may be different than other mammals' “but actually in ways that suggest that it could be more powerful than mice and rats and dogs.”

This is how the human nose works. All day long special cells inside the nose capture chemicals from the sensory environment around us, sending signals to a squished blob of brain called the olfactory bulb. The bulb then sends information about what odor is in the nose to other parts of the brain that work together to make sense of it all, associating these smells with other stimuli in our environments or with memories or emotions we have experienced before.

The myth that trivializes this complex process began with [Paul Broca](#), a 19th-century French physician who studied the human brain to understand what made us different from other animals. He compared

its large frontal lobe and, below it, the squished region for smelling with the plump olfactory bulbs situated in front of the brains of other mammals. Then he categorized animals into what were basically called the smellers (most mammals) and the non-smellers (including humans).

Dr. Broca argued that big olfactory bulbs compelled animals to succumb to earthly desires, while humans had free will nestled within big frontal lobes, which helped them overcome the urges caused by sensing odors. Other scientists simplified his findings without testing any animal's actual abilities. Sigmund Freud even suggested that mental illness arose from the weakened or unused human sense of smell. By 1924, [a major textbook](#) described human olfactory bulbs almost as if evolution of higher thought had shrunk them to near useless, atrophied blobs.

Today many of us learn that our pancake of an olfactory bulb isn't of much value because other animals have relatively bigger systems to process odors. We may think that our ability to see the world [trumps](#) our need to smell it. And introductory [psychology](#) and [biology](#) textbooks still say we can discern only about 10,000 odors. But smell influences our behavior, memories and emotions. There's little or nothing to prove it any less important than vision, and we can actually sift through [billions](#), possibly [trillions](#) of odors.

So it's true that your dog is so good at sniffing partly because she has [an extrasensory organ](#), around 50 times more receptors, and 40 times more space in her brain, relatively speaking, to process scents. But it's also true that you can smell a banana just as well as she can.

“Different animals in different ecological niches have different problems they need to solve,” Dr. McGann said.

What matters may not be the size or the space in the brain devoted to smelling, but other things like the ways our smell or brain systems are wired or used. Mice and humans' olfactory bulbs, for example, differ in relative size, but the number of neurons inside them are pretty similar.

“We’re all trying to understand the same sensory world, so if you’re a really big animal you might need to have more neurons devoted to touch because there are a lot of spaces you can touch on,” Dr. McGann said. “But you don’t necessarily need to smell more smells because you’re bigger.”

And there’s a lot we can do with our noses. Like our dog, we can [follow a scent trail](#) if we try. We can detect the sour ping of vomit and decide to move from an otherwise empty subway car to the packed one next door. We can tell by a person’s odor if he works in a coffee shop. And though the evidence isn’t solid, some scientists think we can [select mates](#), detect fear or [stress](#), or find out [if someone is sick](#) by smelling another person’s sweat, blood or urine.

“There’s a true underappreciation for the way we use our sense of smell that contributes quite significantly to our overall well-being, the way we appreciate food and the way we interact with our environment,” said Johannes Reiser, who studies olfaction in rodents at the Monell Chemical Senses Center and was not involved in the review.

And a better appreciation of the powers of human olfaction could be important, Dr. McCann said. We could forge new paths to solving problems in medicine, social communication and emotional processing, like the consequences of a malfunctioning sense of smell.

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

Zinc acetate lozenges may increase the recovery rate from the common cold by 3 fold

According to a meta-analysis of three randomized controlled trials zinc acetate lozenges may increase the rate of recovery from the common cold three fold.

On the fifth day, 70% of the zinc lozenge patients had recovered compared with 27% of the placebo patients.

The effect of zinc acetate lozenges was not modified by age, sex, race, allergy, smoking, or baseline common cold severity. Therefore the 3-fold increase in the recovery rate from common cold may be widely

applicable. While some zinc lozenges have an unpleasant taste, the zinc acetate lozenges used in these three randomized trials did not suffer from such a problem.

The dose of zinc in the three studies was between 80 to 92 mg/day. Such doses are substantially higher than the recommended daily zinc intake in the USA, which is 11 mg/day for men and 8 mg/day for women.

However, in certain other controlled studies, unrelated to the common cold, zinc has been administered in doses of 100 to 150 mg/day to patients for months with few adverse effects. Furthermore, 150 mg/day zinc is a standard treatment for Wilson's disease that requires treatment for the rest of a patient's life.

Therefore, it seems highly unlikely that 80-92 mg/day of zinc for one to two weeks, starting very soon after the onset of the first cold symptoms, might lead to long-term adverse effects. None of the three analyzed zinc lozenge studies observed serious adverse effects of zinc. Even though there is strong evidence that properly formulated zinc acetate lozenges can increase the rate of recovery from the common cold by 3 fold, many zinc lozenges on the market appear to have either too low doses of zinc or they contain substances that bind zinc ions, such as citric acid.

Therefore, the findings of this meta-analysis should not be directly extrapolated to the wide variety of zinc lozenges on the current market. Although the lead author, Dr. Harri Hemilä from the University of Helsinki, Finland, suggests that the optimal formulation of zinc lozenges and the best frequency of their administration should be further investigated, he also instructs common cold patients to test individually whether zinc lozenges are helpful for them: "given the strong evidence of efficacy and the low risk of adverse effects, common cold patients may already be encouraged to try zinc acetate lozenges not exceeding 100 mg of elemental zinc per day for treating their colds."

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

Alzheimer's experts call for changes in FDA drug approval standards

Call for FDA to clarify and modernize its current approach for approving new treatments for Alzheimer's disease

Leading Alzheimer's disease researchers and a prominent patient advocate today published an analysis, "Single Endpoint for New Drug Approvals for Alzheimer's Disease," urging the Food and Drug Administration (FDA) to clarify and modernize its current approach for approving new treatments for Alzheimer's disease.

The analysis, authored by George Vradenburg, UsAgainstAlzheimer's Co-Founder and Chairman, and Drs. Howard Fillit, Dave Morgan, Marwan Sabbagh, Paul Aisen and Richard Mohs, recommends that the FDA approve new medicines that demonstrate a proven benefit on at least one therapeutic endpoint - either cognition or function. The current FDA standards require a new drug to show benefits on both proven endpoints, an unnecessarily challenging hurdle the authors say may be inhibiting investment in new Alzheimer's treatments.

The authors are members of ResearchersAgainstAlzheimer's (RA2), an UsAgainstAlzheimer's global network of more than 450 disease researchers.*

"If the FDA were to state that meaningful efficacy on a single endpoint is sufficient for approval, we believe that it would impact prospective investments in this therapeutic area as well as clinical-trial design," wrote the authors. "We believe a clarified and modernized FDA approval standard for Alzheimer's disease would catalyze renewed investment in the discovery and development of new medical advances for Alzheimer's disease, particularly in early-stage companies and for venture investment."

The analysis points out that Alzheimer's disease biopharmaceutical research is lagging well behind that of other diseases, despite the fact that Alzheimer's diagnoses will triple in future decades and that there is no current means to prevent, treat or cure the disease. The analysis

notes that in 2014-2015, there were only 135 ongoing interventional Alzheimer's disease clinical trials compared to nearly 5,000 similar trials for oncology drugs.

The authors wrote that a modernized FDA standard for Alzheimer's medications would reflect changes in the field and in treatment since the 1990s, and it would also align with draft guidance issued in 2013 for drug development for early Alzheimer's. Specifically for Alzheimer's, the authors argue, if a new drug improves memory but has less positive impact on a patient's daily functioning skills, the medication should still meet standards for FDA approval, because clinically meaningful improvements in cognition matter importantly to persons with Alzheimer's independent of functional improvement and vice-versa.

"Irrespective of the degree of impact on secondary measures, the notion that the FDA would deny approval for a safe and well-tolerated drug candidate that achieves its primary endpoint of improving cognition in patients with Alzheimer's disease is almost unthinkable," the authors wrote.

The authors emphasized that the new standard is essential at a time in which recent clinical trial failures on Alzheimer's drugs have adversely affected investment in disease research. The FDA has not approved a novel Alzheimer's treatment since 2003, and the 5.5 million Americans with Alzheimer's and their caregivers are desperate for innovation.

**While authors of the analysis are affiliated with ResearchersAgainstAlzheimer's, the viewpoints published in the analysis may not reflect or represent the opinions or positions of all RA2 members.*

UsAgainstAlzheimer's is an innovative, patient-centered non-profit demanding - and delivering - a solution to Alzheimer's. Driven by the suffering of millions of families, UsAgainstAlzheimer's presses for greater urgency from government, industry and the scientific community in the quest for an Alzheimer's cure - accomplishing this through its own patient-centered effective leadership, collaborative advocacy and strategic investments.

ResearchersAgainstAlzheimer's (RA2) is a global network of more than 450 Alzheimer's researchers in the United States and abroad established by UsAgainstAlzheimer's to advocate for greater research funding, policy reform and multi-sector collaboration in order to stop Alzheimer's disease. RA2 believes that an effective treatment for Alzheimer's disease is within reach if government, industry and citizens are willing to commit the resources and work together to disrupt business-as-usual to achieve the 2025 goal set by the United States and the G7.

"A cure for Alzheimer's: a fantasy, a wish, an impossible dream; the same words that were said to Galileo, Edison, Curie, Salk and whoever dreamed up the internet. Yesterday's dream is today's reality." - Trish Vradenburg, Co-Founder and Vice-Chair of UsAgainstAlzheimer's, who passed away in April 2017.

<http://bit.ly/2r7ieFs>

Study shows 'walking a mile in their shoes' may be hazardous to your health

UB researcher says how we arrive at empathy is as important as being empathetic

BUFFALO, N.Y. - When it comes to empathy, the idiom that suggests "walking a mile in their shoes" turns out to be problematic advice, according to new research published in the Journal of Experimental Psychology.

"That's because there are two routes to empathy and one of them is more personally distressing and upsetting than the other," says Michael Poulin, an associate professor in the University at Buffalo Department of Psychology and co-author of the study led by University of Pennsylvania psychologist Anneke E.K. Buffone, who was a PhD student at UB when the research was conducted.

The findings, based on stress physiology measures, add a new and previously unexplored dimension to understanding how choosing a path to empathy can affect a helper's health and well-being. The study's conclusions provide important insights into areas ranging from training doctors to raising children.

The routes to empathy Poulin mentions diverge at the point of the helper's perspective. The two may sound similar, but actually turn out to be quite different in terms of how they affect the person who is trying to help another.

One approach observes and infers how someone feels. This is imagine-other perspective-taking (IOPT). The other way to empathize is for helpers to put themselves into someone else's situation, the imagined "walking a mile" scenario. This is imagine-self perspective-taking (ISPT).

"You can think about another person's feelings without taking those feelings upon yourself (IOPT)," says Poulin. "But I begin to feel sad once I go down the mental pathway of putting myself into the place of someone who is feeling sad (ISPT).

"I think sometimes we all avoid engaging in empathy for others who are suffering partially because taking on someone else's burdens (ISPT) could be unpleasant. On the other hand, it seems a much better way to proceed is if it's possible to show empathy simply by acknowledging another person's feelings without it being aversive (IOPT)."

Some previous research has tried to get at the question of stress relative to IOPT and ISPT by asking people to report how they felt after a helping behavior. But the current study breaks new ground by examining the effects of perspective taking while someone is engaged in helping behavior.

"I have some degree of uncertainty about how well people are parsing out the distinction when reporting how much they were feeling for themselves versus the other person," says Poulin.

That uncertainty motivated the current study's design, which measured a cardiovascular response that reliably indicates the difference between feeling personally anxious or not.

"When we are feeling threatened or anxious, some peripheral blood vessels constrict making it harder for the heart to pump blood through the body," says Poulin. "We can detect this in the lab and what we found is that people who engaged in ISPT had greater levels of this threat response compared to people who engaged in IOPT."

This conclusion could be especially useful in the context of medical professions, like doctors and nurses, especially in areas with high rates of burnout, according to Poulin.

"Many of these professionals see so much pain and suffering that it eventually affects their careers," he says. "That might be the result of habitually engaging in ISPT. They put themselves in their patients' shoes. "Maybe we can train doctors and nurses to engage in IOPT so they can continue to be empathetic toward their patients without that empathy creating a burden."

Poulin says this applies as well to teachers and students, social workers and clients. "In fact, now that we're transitioning to such a

service economy, it's nearly everybody: technical support, complaint hotline operators, restaurant servers."

Parents might even consider the study's finding when thinking about how they speaking to their children in certain circumstances. "Rather than saying to a child, 'How would you feel if that were done to you?' maybe we should be saying, 'Think about how that person is feeling.'"

<http://wb.md/2qhTHN3>

The Surgical Soundtrack: The Effects of Music in the OR
It was in 1914 that Pennsylvania surgeon Dr Evan O'Neil Kane first hauled a gramophone into the operating room.

Bret S. Stetka, MD

Kane believed that playing soft, soothing music for surgical patients helped them relax prior to receiving anesthesia. The practice of incorporating music into clinical care soon caught on, and eventually surgeons began spinning records with their own mental state in mind. Yet, as it has for years, debate continues as to whether music in the OR is helpful or harmful—whether it might distract surgeons and put patients at risk or instead help to steady scalpel-wielding hands.

The Data

A 2007 study^[1] found that noise levels in operating rooms can exceed 120 decibels, louder than a busy highway. And music could be seen as only adding to the clamor. But many surgeons swear by their surgical soundtracks, claiming that music in the OR calms them down, improves their performance, and helps them find their "flow," that transcendent state of focus surgeons hope to achieve while operating.

Evidence on surgeons' use of music in the OR is scant, but in a 2014 editorial^[2] for the *BMJ's* Christmas issue—which typically publishes on lighthearted medical topics—three surgeons from the University of Wales estimated that music is played between 62% and 72% of the time during surgery. (They jokingly recommended Coldplay's "Fix You" and cautioned against Queen's "Another One Bites the Dust.")

A questionnaire-based study from 2011,^[3] published in the *Journal of Anaesthesiology Clinical Pharmacology*, found that of 100 surveyed

surgeons, anesthesiologists, and nurses in India, 87 were comfortable with music being played in the OR. Generally speaking, survey respondents reported that music helps them relax, improves cognitive function, and elevates their mood. As the study authors wrote, "Music helped in reducing the autonomic reactivity of [operating] theatre personnel in stressful surgeries, allowing them to approach their surgeries in a more thoughtful and relaxed manner."

A growing body of research has linked music in the OR with improved surgical performance, including a study^[4] from 1994 reporting that listening to music of their choice can help experienced surgeons with simulated procedures. Similarly, in 2015, Texas plastic surgeon Dr Andrew Zhang co-published a study^[5] in *Aesthetic Surgery Journal* reporting that not only did listening to music while operating improve the speed with which residents performed wound closures, but it also improved the quality of the repair, as assessed by blinded surgeon observers. The authors speculate that music may be a means of improving surgery efficiency and lowering healthcare costs.

"The evidence suggests that carefully self-selected music can have a beneficial effect on some surgeons during specific stages of the surgery," says Dr Jonathan D. Katz, a clinical professor of anesthesiology at Yale University School of Medicine who has studied the effects of noise on surgical outcomes.

Yet Katz points out that music in the OR affects each member of the operating team differently. "It is not clear that music benefits less experienced surgeons, who can become distracted from their primary tasks by background noise, including music," he comments, citing a 2008 randomized controlled trial^[6] suggesting that music in the OR has a disruptive effect on novice surgeons.

He also points to other work^[7-10] showing that music and other distractions, perhaps expectedly, can impair communication among the surgical team and hinder surgeon performance. One study even found that excessive OR noise increased the incidence of surgical-site infections.^[11]

As one surgeon (who asked to remain anonymous) commented to Medscape, "I used to do music in the OR, but I began to find it distracting. I think it's become a badge of cool, and I am in favor of treating surgery seriously."

Still, the vast majority of surgeons I interviewed for this article prefer to operate to music.

"I recently learned of the evidence that listening to music you enjoy enhances creativity and facilitates one's ability to perform a task," says Dr Robert G. Marx, an orthopedic surgeon at Hospital for Special Surgery (HSS) in New York City. "I realized that I do indeed feel happier and in a better mood when listening to music I like. Feeling relaxed in the operating room is helpful, and I now bring my music collection to the OR on my phone."

Dr David Brenin, a cancer surgeon at the University of Virginia, concurs. "Of course it's probably case-by-case with the specific surgeon, but I often listen to music while operating. It helps me relax and get in the zone," he says, adding that scoring surgeries has gotten easier and easier thanks to streaming services like Pandora and Spotify. "When I was a resident in the '90s, we of course had to bring CDs—which was often the resident's job and which limited the selection. Now we pick any playlist we want with the touch of a button."

What Are Surgeons Listening To?

Most surgeons credit playing music in the OR as a means of relaxing while operating. But this doesn't necessarily mean streaming Enya or some equally meditative minstrel. Surgeons' musical taste appears to run the genre gamut, from pop and classical to hip hop and heavy metal.

Dr Brenin, who I distinctly remember, while on my own medical school surgery rotation, resecting tumors to Talking Heads, recalls a renowned cardiac surgeon who operated to loud hard rock. An orthopedic surgeon I recently spoke with claims to perform just fine with Metallica blaring in the background. And still another told me he works best to Prince and Michael Jackson.

Dr Marx's HSS colleague, Dr Stephen Fealy, also an orthopedic surgeon, is a strong advocate for music in the OR and carefully considers his tune selection depending on the time of day. "I might start the day off with some Jack Johnson or some reggae. Then by afternoon I might want something with a little more energy, like the Ramones. The day would be interminable without music," he says.

Dr Fealy kids that traditionally it is the surgeon who makes the decisions on song selection, but he's willing to cede to the rest of the surgical team if they have requests. Dr Marx adds, "I just want everyone [in the OR] to be comfortable with all aspects of the environment, including the music. I have almost 2000 songs on my phone, with a wide variety ranging from rap to pop to classic artists like Elvis and Frank Sinatra. I hit the 'shuffle' button, and if someone doesn't like the music, I tell them to wait 5 minutes!"

But not all specialties agree.

A 1997 survey^[12] published in *Anesthesia* queried 200 anesthesiologists on their thoughts about music in the OR. Seventy-two percent reported regularly working in operating theaters in which music was played, but 26% of this sample felt that music reduced their vigilance and impaired their communication with other staff. In addition, 51% of anesthesiologists who worked in ORs in which music was played said that the music is distracting when anesthesia-related problems arise.

"It is critical that all of the stakeholders—the patients, the surgeons, the nursing staff, the anesthesia personnel—have a say in what, when, and how the music is to be played," says Dr Katz, a self-professed opera lover. As an example, he cites that there are stages of surgery when it is critical for certain members of the team to be relaxed, such as anesthesiologists during anesthetic induction.

One thing most surgeons and surgical team members can agree on is that in many cases, music is helpful to patients. In surgical cases in which patients are awake, self-selected music has been shown to relax them. Music even appears to decrease intraoperative sedative

requirements in certain procedures.^[13,14] And much like Dr Evan O'Neil Kane realized over a century ago in a Pennsylvania OR, research continues to show that listening to music before and after undergoing surgery can reduce anxiety and possibly even pain.^[15]

But when it comes to the surgeons, music in the OR—like so many things—seems to be simply a matter of taste. "If you can operate better with the music cranked up, then I'm all for it," says Dr Brenin. "If that doesn't work for you or members of the team, then turn it off!"

References

1. Kracht JM, Busch-Vishniac IJ, West JE. Noise in the operating rooms of Johns Hopkins Hospital. *J Acoust Soc Am*. 2007;121:2673-2680. [Abstract](#)
2. Editorial. Making music in the operating theatre. *BMJ*. 2014;349:7436.
3. George S, Ahmed S, Mammen KJ, John GM. Influence of music on operation theatre staff. *J Anaesthesiol Clin Pharmacol*. 2011;27:354-357. [Abstract](#)
4. Allen K, Blascovich J. Effects of music on cardiovascular reactivity among surgeons. *JAMA*. 1994;272:882-884. [Abstract](#)
5. Lies SR, Zhang AY. Prospective randomized study of the effect of music on the efficiency of surgical closures. *Aesthet Surg J*. 2015;35:858-863. [Abstract](#)
6. Miskovic D, Rosenthal R, Zingg U, et al. Randomized controlled trial investigating the effect of music on the virtual reality laparoscopic learning performance of novice surgeons. *Surg Endosc*. 2008;22:2416-2420. [Abstract](#)
7. Way JT, Long A, Weihing J, et al. Effect of noise on auditory processing in the operating room. *J Am Coll Surg*. 2013;216:933-938. [Abstract](#)
8. Kumar M, Dash HH, Chawla R. Communication skills of anesthesiologists: an Indian perspective. *J Anaesthesiol Clin Pharmacol*. 2013;29:372-376. [Abstract](#)
9. Pluyter JR, Buzink SN, Rutkowski AF, Jakimowicz JJ. Do absorption and realistic distraction influence performance of component task surgical procedure? *Surg Endosc*. 2010;24:902-907. [Abstract](#)
10. Ayoub CM, Rizk LB, Yaacoub CI, Gaal D, Kain ZN: Music and ambient operating room noise in patients undergoing spinal anesthesia. *Anesth Analg*. 2005;100:1316-1319. [Abstract](#)
11. Kurmann A, Peter M, Tschan F, Mühlemann K, Candinas D, Beldi G. Adverse effect of noise in the operating theatre on surgical-site infection. *Br J Surg*. 2011;98:1021-1025. [Abstract](#)
12. Hawksworth C, Asbury AJ, Millar K. Music in theatre: not so harmonious: a survey of attitudes to music played in the operating theatre. *Anaesthesia*. 1997;52:79-83. [Abstract](#)
13. Ayoub CM, Rizk LB, Yaacoub CI, Gaal D, Kain ZN: Music and ambient operating room noise in patients undergoing spinal anesthesia. *Anesth Analg*. 2005;100:1316-1319. [Abstract](#)
14. Lepage C, Drolet P, Girard M, et al. Music decreases sedative requirements during spinal anesthesia. *Anesth Analg*. 2001;93:912-916. [Abstract](#)
15. Hole J, Hirsch M, Ball E, Meads C. Music as an aid for postoperative recovery in adults: a systematic review and meta-analysis. *Lancet*. 2015;386:1659-1671. [Abstract](#)

<http://wb.md/2qHLcMI>

Music in the OR: Turn It Up, or Turn It Off?

Is an operating room the right place for Beethoven, Beyoncé, or Phil Collins?

Brandon Cohen

Does music soothe the patient and enhance the surgeon's skill, or is it an unnecessary and unprofessional distraction? Does the genre of music or type of surgery make a difference? A recent [article on Medscape by Dr Bret Stetka](#) spurred healthcare professionals to debate the question of music in the operating room (OR). [Comments may have been edited for clarity and length.]

Want to hear the songs our readers mentioned in the original article? Medscape has created a "[Surgical Soundtrack](#)" playlist on Spotify (medscapetunes) based on what readers love to listen to in the OR.

Familiar Tunes and Soothing Songs

Many surgeons view music in the OR as a clear benefit. An orthopedic surgeon wrote, "The team seems to relax more, and they even hum along."

A plastic surgeon agreed, and added, "I like music in the OR. I play it for the benefit of patients. Many times, patients comment that the music is relaxing. I usually ask them what they like to listen to."

An anesthesiologist who approves of music in the OR was also solicitous of patients' tastes:

Generally, I find music in the OR helps to create a positive attitude among all members of the staff and makes everyone's long working day more enjoyable. Before induction of anesthesia, I ask patients about their favorite music, and then we play those tunes when the patient is being prepped for surgery.

A cosmopolitan colleague added that "a little bit of mutually enjoyed music adds a certain *je ne c'est quoi* to the OR environment. For me, this enhances the work experience."

A urologist who advocates for a songful operating room took the opportunity to get in a few digs at coworkers:

I always operate with music—light music without too much noise, and it helps a lot, especially because I am not disturbed by the "blah, blah" conversation of the nurses and anesthesiologists.

And a surgeon recalled a specific case in which music made a clear difference. He was doing a minor procedure on a 90-year-old patient, and playing '50s music calmed her down.

A Dangerous Distraction?

But some OR staff saw potential problems. A neurosurgeon and self-declared music lover commented, "I don't need and don't play music while operating. It is very distracting to me."

Another surgeon, who likes a few quiet tunes during procedures, also has apprehensions:

Beware of the effects of operating room music on residents with attention-deficit disorder. If the background music turns into karaoke time with everyone's attention focused on the music, or your circulator asks you to repeat what you said because the music is too loud, it's time to turn it down.

Others concur. One healthcare professional wrote this about a colleague in the OR:

An older nurse who is a bit hard of hearing likes classic rock and frequently has the volume turned up far too high. It's quite surreal having boomer party music playing loudly while a C-section patient lies vomiting on the OR table.

A registered nurse also finds music distracting. "I'd rather be able to hear the communication in the room. We have plenty of time between patients to rock and roll."

A surgeon described a frightening experience. "My colleague loved to operate with very loud music. It made me palpitate, become agitated, and lose focus. It was truly a nightmare."

Another surgeon who finds music distracting also sees real danger in playing music. "The surgical team's attitude becomes casual in lengthy cases."

But one surgeon disagrees that music is a safety concern.

The most important underlying factor in surgical error is communication issues in the OR. I find music to work as a bonding tool between all actors in this setting.

Hammer to the Beat, Suture to the Rhythm

Several surgeons commented that different musical genres suit different situations. A plastic surgeon wrote, "For facelifts, I play orchestral rock like the [Moody Blues](#). For breast implants, it's [Van Halen](#), [Metallica](#), or [ZZ Top](#)."

Another surgeon prefers "classical, soft jazz, or instrumental during surgeries at the end of the day. During colposcopy or hysteroscopy, I like more energy, such as [Maná](#)."

An anesthesiologist grew sick of a surgeon's repetitive choices. "Jimmy Buffet and Bob Marley, every Thursday. Every single time. Same songs, same order."

A lyrical orthopedic surgeon offered this advice:

Having heavy metal blasting in the background while you're packing a bleeding liver is just inappropriate. But having [Enya](#) soothe you as you swing your wrist to the rhythm while suturing the femoral artery is just nice.

A colleague was much more blunt, saying, "Joint replacements need a good beat to hammer to."

Another surgeon prefers "slow and melodic tunes while I perform slow and critical steps, and faster, hip numbers during quicker parts of procedures, such as wound closure."

And a plastic surgeon goes by the clock, listening to "classical in the morning, pop in the afternoon, and rock or heavy metal late in the day or at night just to elevate the adrenaline."

One anesthesiologist made a point that was not appreciated by his colleagues but might find traction among musicians:

I have never worked in an operating theater that possessed a [performing rights society] license, so technically playing all such music is breaking the law and depriving the performance artists of their legitimate income.

The final word, however, goes to an anesthesiologist who has made a surprising observation. "Patients come off bypass with a heart rate that matches the rhythm of the music we were playing at the moment." The following playlist is based the OR favorites of Medscape users. Link to Spotify to listen. The original discussion of this topic, including user comments and song suggestions, is available [here](#).

[Medscape Surgical Soundtrack](#)

Song Title	Artist
Fantasia No. 1 in D Minor (arr. for 8-string guitar)	Andrew Schulman
De Pies a Cabeza	Manà, Nicky Jam
Reflexo	Tagore
Holding Back the Years—2008 Remastered Version	Simply Red
In the Air Tonight—2015 Remastered	Phil Collins
Garota de Ipanema	Bossa Nova
Rocket Man (I Think It's Going to Be a Long Long Time)	Elton John
Summer of '69	Bryan Adams
So Nice	Jim Tomlinson
Nights in White Satin—Single Version	The Moody Blues
Jump—2015 Remastered Version	Van Halen
Enter Sandman	Metallica
La Grange—2005 Remastered Version	ZZ Top
Only Time—Original Version	Enya
Dream On	Aerosmith
Fly Me to the Moon	Frank Sinatra, Count Basie
At Last—Single Version	Etta James
Back in Black	AC/DC
Vivaldi: Violin Concerto in G Minor, RV 315 "L'estate"	Antonio Vivaldi, Nigel Kennedy
Tom Sawyer	Rush
Serenade in G Major: Eine Kleine Nachtmusik, K. 525: I. Allegro	Wolfgang Amadeus Mozart
Bamboleo	Gipsy Kings

Stayin' Alive	Bee Gees
Pride and Joy	Stevie Ray Vaughan
Messiah, HWV 56, Pt. 1: For Unto Us a Child is Born Part I	George Frideric Handel
The Way It Is	Bruce Hornsby and The Range
Ave Maria	Johann Sebastian Bach, Charles Gounod, Yo-Yo Ma
Impromptus, D 899, Op. 90: III. Andante	Franz Schubert, Rudolf Buchbinder
Lay Down Sally	Eric Clapton
One Love/People Get Ready	Bob Marley & The Wailers
Ocean Blue	Earl Klugh
Comfortably Numb	Pink Floyd
Clocks	Coldplay
Sultans of Swing	Dire Straits
And She Was (45 Version)	Talking Heads
Better Together	Jack Johnson
I Wanna Be Sedated—Remastered	Ramones
Crazy	Seal

<http://bit.ly/2pAz6o6>

Brain zaps let minimally conscious people communicate for a week

People in a minimally conscious state have been “woken” for a whole week after a brief period of brain stimulation.

By Helen Thomson

The breakthrough suggests we may be on the verge of creating a device that can be used at home to help people with disorders of consciousness communicate with friends and family.

People with severe brain trauma can fall into a coma. If they begin to show signs of arousal but not awareness, they are said to be in a vegetative state. If they then show fluctuating signs of awareness but cannot communicate, they are described as being minimally conscious.

In 2014, [Steven Laureys](#) at the University of Liège in Belgium and his colleagues discovered that 13 people with minimal consciousness and

two people in a vegetative state could temporarily show [new signs of awareness when given mild electrical stimulation](#).

The people in the trial received transcranial direct current stimulation (tDCS), which uses low-level electrical stimulation to make neurons more or less likely to fire. This was applied once over [an area of the brain](#) called the prefrontal cortex, which is involved in [“higher” cognitive functions such as consciousness](#).

Soon after, they showed signs of consciousness, including moving their hands or following instructions using their eyes. Two people were even able to answer questions for 2 hours by moving their body, before drifting back into their previous state.

Aware for a week

Because the improvements in awareness lasted for only a few hours, the team wondered if more stimulation would extend this. They began a new trial, in which 16 people with brain damage received a 20-minute session of tDCS daily for five consecutive days, or a sham session, in which they received a low level of stimulation that had no effect on the brain. Later, they received the opposite treatment.

Each participant had been in a minimally conscious state for at least three months before the start of the trial – meaning spontaneous recovery was unlikely.

After the fifth day of the real treatment, nine of the 16 participants showed significant improvements in conscious awareness. This included being able to respond to commands, recognise objects and perform voluntary motor movements. What’s more, these improvements lasted at least a week after the final day of stimulation.

Two of the participants even started to communicate. “They couldn’t speak but we could ask questions, such as “is your name David?” and they answered yes or no by moving a part of their body, like their tongue or their foot,” says [Aurore Thibaut](#), also at the University of Liège, who led the study. “They correctly answered all of the questions we asked.”

None of the participants showed any signs of improvement after the sham treatment.

Boosting consciousness

The stimulation targeted the prefrontal cortex, which is involved in consciousness. It is also linked to other vital hubs, such as the thalamus, which helps [propagate electrical signals to wider areas of the brain](#).

When a person is conscious, electrical activity [spreads like a wave](#) into brain areas that are never reached while we are unconscious. Thibaut says that as well as increasing activity in the immediate area, the stimulation likely also increased the communication between other areas of the brain – potentially helping to propagate this wave of “conscious” activity.

“This is an encouraging development,” says [John Whyte](#), director of the Moss Rehabilitation Research Institute in Elkins Park, Pennsylvania. “The study suggests that longer treatment intervals lead to more sustained improvements in consciousness.”

However, we don’t know if the improvements from longer treatment will wear off eventually, says Whyte.

Going home

The team says that the results are starting to look clinically relevant – meaning they are good enough to consider how to use the technique to treat patients away from the hospital. The stimulation device can be used at the bedside, and is relatively cheap to produce, so in theory the patient’s family could be taught how to use it at home. More trials will be needed before this happens, though. Although there were no side effects in the recent trial, Thibaut says it first needs to be determined whether using the device for months on end is safe or effective.

“You can find similar devices online, but we don’t know the long-term effects yet,” she says. “We need to see what happens when we use it for perhaps five hours a day, or what happens if we apply it daily for three months. We need to be really careful.”

Journal reference: Brain Injury, DOI: [10.1080/02699052.2016.1274776](#)

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

Test combo could distinguish Alzheimer's earlier than ever

Combining multiple tests could help doctors distinguish between two leading causes of cognitive decline at an earlier stage.

By Andy Coghlan

Being able to separate the earliest signs of Alzheimer's from another degenerative brain condition called [dementia with Lewy bodies](#) (DLB) could be crucial to finding treatments for both kinds of dementia.

When someone starts to exhibit mild cognitive impairments, it is often difficult to tell whether these might be the earliest signs of Alzheimer's or DLB, or just normal age-related declines in cognition. Yet this distinction is vital: so far, despite billions of dollars spent on research, progress towards drugs that stabilise or cure dementia has stalled. Many blame the failure on [treating people too late](#) and argue that the same drugs might work better if given a decade or two before symptoms fully develop.

Now, Dilman Sadiq at University College London and her colleagues have attempted to rectify this problem by analysing clinical histories, the results of cognitive tests and psychiatric interviews with 429 people originally diagnosed with mild cognitive impairment, who were monitored for up to 14 years. Each person was diagnosed at one UK hospital between 1994 and 2015. Of this group, 107 progressed to Alzheimer's, 21 to DLB and 164 remained stable with mild cognitive impairment. The rest developed a mixture of other conditions.

Early prediction

Sadiq's team used their findings to identify a variety of tests and symptom profiles that appear to predict which condition a person might get at the earliest stage of the disease.

For instance, people who went on to have Alzheimer's scored much worse than those who went on to have DLB on a word memory task. Those who went on to develop DLB, meanwhile, were more likely to

report visual hallucinations, [Parkinson's-like tremors](#) and unconsciously acting out their dreams while they slept.

Sadiq hopes to build on these results to produce an algorithm to distinguish early-stage disease. "We need to replicate this in much larger samples of patients," she says.

"The results from this study suggest that combined tests could help distinguish between early Alzheimer's or DLB, but how powerful these are in providing an accurate diagnosis on an individual level still needs to be explored," says Laura Phipps of [Alzheimer's Research UK](#).

"While it's too early for this to be used in the clinic, this represents an important step forward in allowing researchers and doctors to help people with dementia receive a more accurate diagnosis, increasing their chances of taking part in relevant clinical trials," says James Pickett, head of research at the [Alzheimer's Society](#) in the UK.

Journal reference: Journal of Alzheimer's Disease, DOI: 10.3233/JAD-161089

<http://bit.ly/2qiWfu1>

Canada Unveils 'Dinosaur Mummy' Found With Skin And Gut Contents Intact

"We don't just have a skeleton. We have a dinosaur as it would have been."

By Nina Golgowski

A 110-million-year-old fossil of an armored plant-eating dinosaur called a nodosaur is seen after its discovery in Canada. After 110-million years encased in stone, an impeccably preserved, dragon-like dinosaur has been unveiled by paleontologists in Canada and it's unlike anything they've seen before.

The remains of an armor-plated nodosaur, a 3,000-pound plant-eating horned creature, [went on display in Alberta](#) on Friday after its accidental discovery by miners nearly six years ago, [National Geographic reported](#).

"We don't just have a skeleton," Caleb Brown, a postdoctoral researcher at the Royal Tyrrell Museum of Paleontology where the

fossil went on display, told the magazine. “We have a dinosaur as it would have been.”

Researchers say the fossil is remarkable, with it being a never-before-seen species of nodosaur, as well as the oldest dinosaur ever found in Alberta. It’s preserved skin and gut contents are also providing invaluable clues on these extinct creatures.

“I’ve been calling this one the Rosetta Stone for armor,” Donald Henderson, curator of dinosaurs at the Royal Tyrrell Museum, told National Geographic.



Royal Tyrrell Museum

“It’s basically a dinosaur mummy — it really is exceptional,” Don Brinkman, director of preservation and research, also [told The New York Times](#).

For the last five years, researchers have spent more than 7,000 hours chiseling away at the fossil’s surrounding rock to expose the incredible creature. The researchers have had their share of ups and downs, with the fossil breaking into pieces upon its removal from Alberta’s Millennium Mine in 2011. The 15,000-pound, plaster-covered block it was encased in is seen shattering during a video [uploaded to YouTube by Suncor Energy](#), which owns the mine.

“One of the good things about this, believe it or not, is because it’s in smaller pieces it will make preparation go a little faster,” Darren Tanke, a paleo technician with the Royal Tyrrell Museum, says in the video. “This is restorable. Everything broke cleanly and in big pieces,” he adds. “It’s unfortunate that this happened but this is restorable.”