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100,000-Year-Old Fossil of Giant Vampire Bat Found in Argentina

Paleontologists in Argentina have found a fossilized jaw of the extinct bat species Desmodus draculae inside an ancient burrow of a giant sloth.

by Enrico de Lazaro

***Desmodus draculae in a burrow of a giant sloth.* Daniel Boh / Museo de Ciencias Naturales de Miramar.**

Desmodus draculae is an extinct species of leaf-nosed bat that inhabited Central and South Americas from the Pleistocene epoch until the early Holocene epoch.

First described in 1988, its fossils are known from Argentina, Mexico, Ecuador, Brazil, Venezuela, Belize, and Bolivia.

Desmodus draculae had a wingspan of up to 50 cm (20 inches) and a body mass of 60 g, making it the largest known vampire bat of all time. It belongs to the subfamily Desmodontinae (vampire bats), which also includes three extinct and three living species.

"The size of *Desmodus draculae* was larger than that of a computer keyboard and significantly larger than that of its living relatives," said Dr. Santiago Brizuela, a paleontologist at the Universidad Nacional de Mar del Plata and CONICET.

The food source of *Desmodus draculae* and other vampire bats is blood, a dietary trait called hematophagy.

"Their name came from the legends of the Transylvania and its creepy Count Dracula," said Dr. Mariano Magnussen, a paleontologist at the Museo de Ciencias Naturales de Miramar.

"In reality, they are peaceful animals that feed on the blood of animals, and sometimes humans, for a few minutes without causing discomfort." "The only bad thing is that they can transmit rabies or other diseases if they are infected. Surely their prehistoric representatives had similar behaviors."

***The fossilized jaw of Desmodus draculae.* Museo de Ciencias Naturales de Miramar.**

The new fossil of *Desmodus draculae* is at least 100,000 years old (Late Pleistocene epoch). It was found at a paleontological site near southeastern Buenos Aires in Argentina.

"The jaw of *Desmodus draculae* was found inside a cave or burrow 1.2 m (3.9 feet) in diameter attributed to a giant sloth of the family Mylodontidae, such as *Scelidotherium*," said Dr. Daniel Tassara, a paleontologist at the Museo Municipal de Ciencias Naturales Pachamama. "We do not know if this vampire entered the cave to feed, take refuge, or was prey to another animal."

"*Desmodus draculae* was the last of the giant flying mammals. It became extinct during the colonial period, around 1820, possibly as a consequence from the Little Ice Age," the researchers said.

The team's paper was published in the journal *Ameghiniana*.

Santiago Brizuela & Daniel A. Tassara. 2021. New Record of the Vampire Desmodus draculae (Chiroptera) from the Late Pleistocene of Argentina. Ameghiniana 58 (2): 169-176; doi: 10.5710/AMGH.30.12.2020.3379

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Nerve damage in cornea could be sign of 'long COVID,' study hints

Findings hint at something scientists already suspected: Some symptoms of long COVID emerge due to peripheral nerve damage

By Nicoletta Lanese - Staff Writer

Nerve damage and a buildup of immune cells in the cornea may be a sign of "long COVID," a long-term syndrome that emerges in some people after COVID-19 infection, a new study suggests.

These preliminary results will need to be verified in a larger group

of people with long COVID, or COVID-19 long-haulers, as they're known, an expert told Live Science. But the findings do hint at something scientists already suspected: Some symptoms of long COVID emerge due to peripheral nerve damage, she said.

COVID-19 long-haulers experience a wide range of symptoms, and a large proportion report neurological problems, including headache, numbness in the body, loss of smell and "brain fog," or trouble thinking and concentrating, Live Science previously reported. This constellation of symptoms hints that long COVID may partly arise from damage to nerve cells in the body, said senior author Dr. Rayaz Malik, a professor of medicine and consultant physician at Weill Cornell Medicine-Qatar in Doha.

Specifically, preliminary evidence suggests that long COVID may involve damage to small nerve fibers — thin wires that branch off of specific nerve cells in the body and relay sensory information about pain, temperature and itchiness, among other sensations to the central nervous system. Small-fiber nerve cells also help control involuntary bodily functions, such as heart rate and bowel movements; therefore, damage to these cells can cause a wide array of symptoms.

Malik and his colleagues study small-fiber nerve loss in people with diabetes and neurodegenerative diseases like multiple sclerosis; they noticed that people with long COVID appear to share similar symptoms with these patients, so they decided to investigate the potential link.

Using a technique called corneal confocal microscopy (CCM), the team took snapshots of nerve cells in the cornea, the transparent layer of the eye that covers the pupil and iris. The team used the non-invasive procedure to count the total number of small-fiber nerve cells in the cornea, while also assessing the length and degree of branching of those fibers. In their work with other conditions, the team has found that, when you find damage in the small-fiber nerves of the cornea, that often indicates that there's similar damage elsewhere in the body. "This is like a very good barometer, almost, of nerve damage elsewhere," Malik explained.

According to the new study, published Monday (July 26) in the British Journal of Ophthalmology, people who develop neurological symptoms after a COVID-19 infection show significant small-fiber nerve loss in the cornea, compared with COVID-19 survivors without lingering neurological symptoms. What's more, the degree of nerve-fiber damage correlated with the participants' symptom severity, meaning greater nerve damage was linked to more pronounced symptoms.

The small study included 40 people who had recovered from COVID-19 between one and six months prior to their assessment; out of the full group, 29 people had recovered from COVID-19 at least three months prior. In addition to getting the corneal scan, each participant completed a survey that included questions about any neurological symptoms of long COVID.

They also filled out questionnaires about neuropathic pain, which can include numbing, prickling and burning sensations in the body, as well as muscle weakness, according to UC Davis Health. Another questionnaire helped the researchers to pinpoint the location and severity of the participants' muscle pain; it also helped flag additional symptoms like fatigue and bowel issues, the authors noted.

Of the 40 participants, 22 showed lingering neurological symptoms — including headache, dizziness and numbness — four weeks after recovering from their initial COVID-19 infections. And 13 out of the 29 who had been recovered for at least three months reported having neurological symptoms at week 12 post-infection. "It's very clear, if you look at the graphs ... people who've got the neurological symptoms definitely have a reduction" in small-fiber nerves, while the other participants don't, Malik said.

The study authors also assessed 30 healthy individuals with no history of COVID-19 infection for comparison. They found that, compared with these 30 control participants, all the COVID-19 survivors harbored a large number of immune cells on their corneas; more specifically, immune cells called dendritic cells that help inform the immune system of foreign invaders appeared in unusually high quantities.

The people with lingering neurological symptoms showed a roughly fivefold increase in these dendritic cells, compared with the healthy controls; those without neurological symptoms showed about a twofold increase.

"So there's clearly something, there's an immune process that is still ongoing," even after the initial COVID-19 infection clears, Malik said. "So maybe there is an immune trigger that is switched on and it takes time for it to kind of settle down," he said. And in the meantime, this runaway immune response damages nerve cells.

The new study cannot prove that an immune response caused the observed nerve damage. However, the idea does align with existing evidence that most neurological damage from COVID-19 is caused by inflammation, not by the virus infecting nerve cells directly, according to a 2020 commentary in the journal Pain.

"It's not the infection, per se, it's the immune response it provokes," said Dr. Anne Louise Oaklander, an associate professor of neurology at Harvard Medical School and assistant in pathology at the Massachusetts General Hospital, who was not involved in the new study. "Infection revs up your immune cells to start firing, to fight the enemy, and there's going to be collateral damage," she said. In this case, small-fiber nerve cells may fall victim to friendly fire.

Oaklander added that she was "excited" about the new study, as it provides evidence of small-fiber nerve damage in long COVID patients. The data are helpful to biomedical researchers, like Oaklander, who are trying to understand the causes of long COVID and how to treat the syndrome. However, for now, she said the research doesn't necessarily provide any solutions for patients.

In their paper, Malik and his colleagues suggest that corneal confocal microscopy could be used as a diagnostic tool to help identify people with long COVID — particularly those with neurological symptoms. However, currently, the technique is primarily used for research and is not widely available in clinical settings, Oaklander said.

The gold standard for assessing small-fiber nerve damage involves taking a small skin biopsy from a patient's leg and measuring the nerve endings within, she said. Doctors can screen for symptoms of nerve damage with written surveys and neurological exams, but they currently require a skin biopsy to confirm their diagnoses. For this reason, it would be helpful if future studies of long COVID patients included these skin biopsies, along with the standard questionnaires used to screen for small-fiber sensory neuropathies, Oaklander suggested. ("Neuropathy" refers to damage to the nerves that run through the body outside the brain and spinal cord.)

For now, Malik said his group plans to follow up with their initial group of 40 participants, to see how their corneal nerves and long COVID symptoms change through time. In addition, they plan to replicate their study in larger groups of patients to validate the results.

"People might say, 'Well, 40 patients isn't enough.' We agree; you need larger studies," Malik said. Assuming the results can be confirmed in larger cohorts, eventually, this line of research may provide helpful hints as to how doctors can treat long COVID, he added. Treatments for post-infectious neuropathies do exist, it's just a question of whether they'd work for long COVID patients with post-infectious small-fiber neuropathy, and if so, how they can best be applied, Oaklander said.

https://go.nature.com/3BZ5K4r

The unnoticed eye motions that help us see the world

Eye movements lasting only a few hundredths of a second create an information-laden 'smear' on the retina.

When we look at a scene, our eyes dart from one point to another an estimated three times per second. Although we don't perceive this rapid-fire jitter, experiments reveal that it produces visual information that helps us to make sense of the world around us.

To see in sharp detail, a person's eyes frequently shift to focus on objects in their peripheral vision. These extremely rapid eye movements create 'motion streaks', visual smears on the back of the eye. A motion streak stretches from an object's starting position on the retina to its position after eye movement.

Richard Schweitzer and Martin Rolfs at the Humboldt University of Berlin showed six differently patterned objects to volunteers and asked them to focus on one object. While the volunteers' eyes were moving towards that target, the objects' positions changed. The researchers then overlaid all of the objects with the same pattern to make them indistinguishable.

Participants successfully found the target in most cases, but were more likely to do so if its movement had generated a motion streak. This suggests that information gleaned from the streaks helps our jittering eyes to keep track of where objects are. *Sci. Adv.* (2021)

https://bit.ly/3j6TuWD

Scientists Bred Healthy Mice Using Artificial Eggs and Ovaries Made From Stem Cells

Born from bioengineered eggs matured inside a man-made ovary

By Shelly Fan

The baby mice popcorning around their cages looked utterly normal. But in fact, they're a technological wonder: they were born from bioengineered eggs matured inside a man-made ovary. Even crazier, both the eggs and the ovary were grown from stem cells.

That's right—for the first time, scientists were able to grow functional egg cells completely outside the (mouse) body.

The experiment is the brainchild of Dr. Katsuhiko Hayashi of Kyushu University, who's led the pursuit of making gametes—sperm and eggs—without the constraints of a living body. If adapted for humans, these wild reproductive pursuits are bound to shake up our entire conception of the beginning of life—similar to the way "test-tube" babies did when *in vitro* fertilization (IVF) was first introduced.

Hayashi dreams of even bigger possibilities. Because stem cells can be rapidly created from skin or other cells, they are an endless source of raw material to make sperm and egg cells. If fully functional, these basic components of reproduction can merge into a fertilized egg inside a test tube, be transplanted into a surrogate, and birth a new generation without ever seeing testes or ovaries.

"This technical breakthrough…holds enormous potential for germ cell research," commented Drs. Lin Yang and Huck-Hui Ng at the Genome Institute of Singapore, who were not involved in the study.

The technology, *in vitro* gametogenesis, or IVG, comes with mind-bending possibilities. Researchers can use these lab-grown models to better understand how reproductive cells form and mature—and how the process can falter. For couples struggling to conceive, or people who've lost reproductive function due to diseases like cancer, IVG would offer a new route towards pregnancy. It also raises the potential of same-sex couples conceiving children with their own genetic makeup.

To be clear: there are far more hurdles to clear before IVG can be tested in humans. But Hayashi shows a rainbow of potential applications ahead—and reigniting debates on the limits of how IVG should be tested and used in humans.

Engineering Life

For the past decade, Hayashi has been rewriting the classic tale of

boy meets girl. Or rather, sperm meets egg. His secret ingredient? Stem cells.

Stem cells are like the playdough of our bodies. By dousing them with specific mixes of biomolecules, it's possible to nudge them into different types of cells—including sperm and egg. Back in 2011, Hayashi dazzled the world of reproductive science. By bathing stem cells in a particular chemical soup, his team was able to make the precursor to sperm cells outside the body. It didn't matter where the stem cells came from. Those naturally occurring in embryos or those "reversed" or "deprogrammed" from skin cells, called induced pluripotent stem cells (iPSCs), both had the capacity to turn into functional sperm.

Fast-forward to 2016, and the team achieved the same with eggs in mice. Using stem cells, they were able to mimic the entire process of how ovaries make eggs. The tube-grown eggs went on to create healthy, living mouse pups—another scientific first.

During the study, however, the team ran into a massive technological bottleneck. Eggs made in a test tube couldn't develop naturally outside the ovary. For the cells to mature, the team had to incubate them with fresh ovarian tissue from mice—a workaround that's both a bit icky and totally impractical for any future infertility treatments.

Living Incubator

The new study tackled that bottleneck: Is it possible to make an artificial ovary floating in a dish?

The team honed in on support cells that normally encapsulate a developing egg. These support cells thrive inside the ovary and secrete hormones and other nutrients that help support the metabolic needs of an egg. "This connection is crucial for many developmental milestones," explained Yang and Ng, including forming ovarian follicles, or fluid-filled sacks in the ovaries that work as living incubators for the eggs to mature.

Similar to any other cell type, these ovary-supporting cells can also be made from stem cells—if we know the secret chemical recipe. After five long years of tenacious work, Hayashi figured out the keys to building these ovary tissues. Many have fanciful names—for example, sonic hedgehog (SHH)—but most of these proteins are in a family called morphogens, in that they can morph the physical structure and identity of a tissue.

After dousing stem cells with this soup, the cells shed their previous identity, instead adopting that of fetal ovary supporting cells. Their gene expression profile also closely mimicked that of their natural counterparts.

The team next mixed in a dose of precursor immature egg cells, also made from stem cells. Together, the cells coalesced into tiny ovarian follicles, with support cells forming a bubble that tightly hugged the developing egg. The eggs were then fertilized with sperm, transplanted into surrogate mouse mothers, and after normal pregnancies, gave rise to roughly a dozen healthy pups. The baby mice, covered with a silky coat of white or brown fur, eventually gave birth to babies of their own.

This is the "gold standard" of making sperm or eggs inside a test tube, said Yang and Ng.

"It's a very serious piece of work," said Dr. Richard Anderson at the University of Edinburgh, who was not involved in the study.

A New Concept of Reproduction?

The new paper has been hailed as a "technological breakthrough" with enormous potential.

For one, it opens the floodgates for researching the very early stages of how our bodies make reproductive cells—something that remains relatively mysterious. One clue is that the artificial ovary produces mature eggs less effectively than its natural counterpart, suggesting there's much we still don't know.

As for assisted reproductive technologies in humans, this particular

technology is still decades away. That said, "the proof-of-concept study…has made clear strides towards enabling IVG at scale," wrote Yang and Ng. What remains to be seen is how much the method translates to humans. Compared to mice, our reproductive cells take far longer to mature, and likely require different supporting nutrients for the sperm, egg, and surrounding tissue.

The team is now testing their chemical soup in marmosets. If successful, they may move towards nonhuman primates before attempting to create life for expecting parents.

Even with these cautions, it's easy to see how things could go wrong when it comes to creating a new human being. So far, we don't yet have existing international legal or ethical frameworks around IVG babies—humans essentially made from stem cells, or even skin cells—largely because the technology isn't there. But it's not too soon to consider the ethical implications and potential impacts on society as a whole.

Hayashi is taking it very slow, while welcoming public discourse before even considering any clinical use. The first step, he said, is to verify the quality of the lab-made eggs, adding, "That could take a long, long time."

https://nyti.ms/3xdyZqa

Ever Feel Your Skin Crawling? Maybe You Can Thank Evolution.

A new study suggests that humans have a distinct, itchy defense response to ticks and other ectoparasites.

By Sabrina Imbler

In a way, nausea is our trusty personal bodyguard.

Feeling nauseated is widely accepted to be an evolutionary defense measure that protects people from pathogens and parasites. The urge to gag or vomit is "well-suited" to defend ourselves against things we swallow that might contain pathogens, according to Tom Kupfer, a psychological scientist at Nottingham Trent University in England. But vomiting is somewhat futile against a tick, an ectoparasite that latches on to skin, not stomachs.

In an experiment that produced both stomach churning and skin crawling sensations — I can confirm these and some other physiological responses firsthand — Dr. Kupfer and Daniel Fessler, an evolutionary anthropologist from the University of California, Los Angeles, argue in a paper published on Wednesday in the journal Proceedings of the Royal Society B that humans have evolved to defend themselves against ectoparasites through a skin response that elicits scratching.

Although some outside experts say more research is needed, the findings align with some understandings of the evolution of disgust. "It makes sense to have developed adaptive defensive strategies against the 'nasty' ones," Cécile Sarabian, a cognitive ecologist studying animal disgust at the Kyoto University Primate Research Institute in Japan, wrote in an email.

The disgusting investigation began in 2017 on the grounds of Chicheley Hall in Buckinghamshire, England. Here, Dr. Kupfer was presenting findings to colleagues on trypophobia, *the aversion to clustered holes* experienced by some people. His data showed that participants with trypophobia often reacted to holey images with the urge to itch or scratch, sometimes to the point of bleeding. Dr. Kupfer suggested that trypophobia might not represent fear, but rather a disgust reaction to signs of parasites or infectious diseases, which can both result in clusters of lesions or pustules.

Dr. Kupfer's presentation included images that typically set off trypophobic reactions, like lotus seed pods or foam bubbles. At one point during the presentation, a distressed researcher in the front row began shouting for Dr. Kupfer to take an image down.

When one hole closes, another opens. Dr. Fessler approached Dr. Kupfer after the presentation and the two researchers began talking about how the human body might have two types of defensive

responses in reaction to certain threats. If nausea and vomiting protect against ingesting dangerous microbes, scratching might protect against ectoparasites. They then began working on a review paper that was published in 2018.

For the new paper, Dr. Kupfer and Dr. Fessler developed a study where they showed people a series of 90-second videos — a suggestive medley of pathogens and ectoparasites — and asked the participants about their emotional and physical response.

Selecting the videos was an art. "We didn't want people just to say, 'It's disgusting,'" Dr. Kupfer said. "We wanted the physiological sensations that accompany the response: nausea, gagging, itching and scratching."

So Dr. Kupfer along with Sonia Alas and Tiffany Hwang, then undergraduate students at U.C.L.A., pored through YouTube. They watched and debated for hours in order to select the most rank and vile footage possible. Many options were too weak, such as footage of "mildly moldy food," Dr. Kupfer said. "We wanted feces, we wanted some sort of infection," he clarified.

Dr. Kupfer's dream came true. The final ectoparasite clips included a kitten riddled with fleas, a nightmarish bed bug infestation and a beauty shot of a mosquito sucking blood. The final pathogen clips included meat pulsing with maggots, an infected arm lesion oozing pus — Dr. Fessler called it the "pus volcano" — and a clump of earwax as dark as an asteroid.

The meat was Dr. Kupfer's own creation; unable to find an adequately disgusting video of rotten food, he left a slab of meat in his garden for two weeks and returned when it "seemed maximally disgusting," he said.

The video that the researchers found most disgusting — titled "Dirty festival toilets" in the paper's supplementary information — has since been removed from YouTube. This, perhaps, is for the best. I tried to watch every video used in the experiment. I did not vomit, but I did experience heart palpitations and had to sit in my bathroom with the lights off for several minutes until I stopped seeing the pus volcano. Missing out on the dirty festival toilets, it seemed, was an act of self-care.

The researchers conducted essentially the same experiment three times, twice in the United States and once in China, surveying in total more than 1,000 people. In all three surveys, participants had distinct reactions to the ectoparasite videos when compared with the pathogen videos.

When watching ectoparasites, participants reported more urges to itch and scratch, theoretically protecting the surface of their skin from danger. And when watching pathogens, the participants reported more feelings of nausea and urges to vomit.

The researchers plan to expand this project internationally to see how ectoparasite disgust responses vary in different countries and in different languages. Understanding the nuances of disgust, they say, could inform our understanding of disorders such as delusional parasitosis, the mistaken belief that parasites have invaded the body.

Bunmi O. Olatunji, a psychologist at Vanderbilt University who was not involved in the research, said that he considered the new paper's results too preliminary to make inferences about clinical conditions. But it does offer "interesting possibilities for thinking about the mechanism by which disgust may contribute to the development and maintenance of skin-picking disorder."

"Your mind is a compilation of a whole bunch of mechanisms produced by natural selection," Dr. Fessler told me over the phone. "If you understand why you respond to the world in the ways that you do, then you have agency."

After we hung up, I noticed I had been scratching a bug bite on my leg that I did not know about before the call.

At least, I think it was a bug bite.

https://go.nature.com/3iaIWGX

Sponge-like fossil could be Earth's earliest known animal

Fossil discovered in northwestern Canada could rewrite the early history of animal life — but some palaeontologists are not convinced it's real.

Max Kozlov

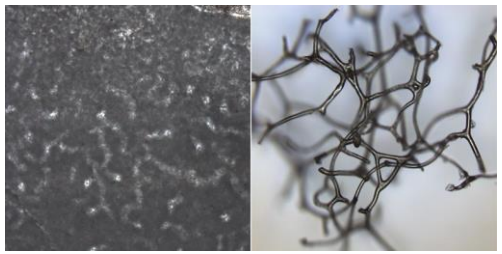
Most major groups of animals — including arthropods, molluscs and worms — first appear in the fossil record during the Cambrian explosion, 541 million years ago. But according to a paper published today in *Nature*[1], sponge fossils from northwestern Canada could be 350 million years older, significantly pushing back the date of Earth's earliest-known animals.

The ancient discovery is igniting debate among palaeontologists, who have long contested when complex animal life first evolved.

"If I'm right, animals emerged long, long before the first appearance of traditional animal fossils," says study author Elizabeth Turner, a sedimentary geologist at Laurentian University in Sudbury, Canada. "That would mean there's a deep back history of animals that just didn't get preserved very well."

Weird and wonderful shapes

Some scientists, however, are not convinced that the microscopic patterns in Turner's 890-million-year-old fossils indicate an ancient sponge, given the evidence provided in the study.



Crystalline tubes seen in rocks (left) might have been formed when the collagen-like skeleton of an 890-million-year-old sponge decayed and fossilized. Some modern sponges have internal scaffolding (right) that resembles the shapes in the rocks. **Credit: Elizabeth C. Turner**

"It's such a big claim that you really have to eliminate all the other possibilities," says Rachel Wood, a geoscientist at the University of Edinburgh, UK, who researches fossil reefs. "Microbes, for example, produce weird and wonderful shapes and forms." Sometimes crystals also grow in a way that looks like patterns formed by living organisms, she says, meaning that the rock samples Turner found might not be fossils at all.

Turner counters that none of the known reef-building organisms that existed 890 million years ago, such as cyanobacteria or algae, can explain the complex structures in her samples.

She collected the purported fossils from ancient microbial reefs preserved in the rocks of Canada's remote Northwest Territories, starting during her graduate studies in the 1990s.

When Turner examined slices of the rock under a microscope, she saw branching networks of crystalline tubes. She later realized that these structures resemble the internal scaffolding of modern horny sponges, and line up with the expected decay and fossilization patterns of spongin, a collagen protein that forms their scaffolding.

"These rocks are beautiful, but you don't expect to find something that complicated or weird in them," she says.

Early history of animal life

It wasn't until the past few years, when she saw studies that described similar structures in much younger rocks — from a time when sponges were known to exist — that Turner felt confident in publishing her results. But those studies, too, are disputed on the grounds that they might not be actual sponge fossils.

The authors of one of these papers[2] took photographs of many thin slices of their rock sample and used them to generate a 3D model of the purported sponge. Wood says that a similar piece of evidence would have strengthened Turner's claim.

If Turner's structures do prove to be sponge fossils, says David Gold, a geobiologist at the University of California, Davis, "it would be very exciting, and help us nail down the early story of

animal evolution", a subject that has been hotly debated for decades. But although "it's easy to find things that look like sponges in the fossil record", he says, it's more difficult to back them up with other evidence. He and other researchers, for instance, have supported[3] fossil claims by pointing to rock samples containing traces of biological molecules that are linked to sponges. Unfortunately, given the sheer age and type of Turner's rock samples, this type of preservation isn't really possible, he adds.

It's not inconceivable that sponges could have pre-dated the Cambrian explosion, says Phoebe Cohen, a geobiologist at Williams College in Williamstown, Massachusetts. Scientists estimate how long ago the ancestors of groups of living animals diverged using 'molecular clocks', which measure the rate of mutation in DNA and proteins over time.

The majority of these estimates suggest that the last common ancestor of all animals alive today evolved before the Cambrian explosion, but not by as much as 350 million years, says Cohen. Nevertheless, she says she could be convinced that Turner's samples are sponge fossils if she saw more evidence, including studies on how horny sponges fossilize.

Molecular-clock estimates

The palaeontological community is split on whether the dearth of animal fossils from before the Cambrian period is because the creatures that lived then rarely survived as fossils to the present day, or because molecular-clock estimates of animal origins are wrong. Gold is convinced there were sponges before the Cambrian, but says that exactly how far back is a big, unresolved question.

If the ancestors of modern sponges really were alive 890 million years ago, then it means early animals survived through very trying conditions for life, such as extremely low levels of oxygen and 'snowball Earth' periods during which the surface of the planet almost entirely froze over, says Gold.

Turner argues that sponges could have survived the low-oxygen environment by eking out a living in cavities and crevices in the microbial reef next to photosynthetic cyanobacteria, which release oxygen. The sponges might also have been nourished by organic ooze that the bacteria produced. "There was probably a delicious and very copious supply of 'snot' for these filter-feeding organisms to have eaten," she says.

Scientists are passionate about their views of when animal life started on Earth. The paper could reinvigorate the debate that has been quietly simmering for decades, says Gold. "But I suspect it's not going to change a lot of minds for those who have made a decision about how old animals are."

doi: https://doi.org/10.1038/d41586-021-02066-9

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Citing Safety, French Institutions Temporarily Halt Prion Research

The three-month moratorium comes after a former prion researcher was diagnosed with Creutzfeldt-Jakob disease.

Stephanie Melchor

On Tuesday (July 27), five public research institutions in France announced they will suspend research on prions for three months. According to their joint press release, the decision was spurred by a case of Creutzfeldt-Jakob disease (CJD) in someone who may have been exposed to prions in a research lab.

According to *Science*, CJD is the most common prion disease in humans. Prions are infectious misfolded proteins that cause other proteins to misfold and aggregate in the brain. The US Centers for

Disease Control and Prevention defines two types of CJD: classical, which generally arises through spontaneous protein misfolding in the brain, and variant CJD (vCJD), which is believed to be caused by exposure to the same prion that causes mad cow disease. There are no vaccines or treatments for CJD, which is universally fatal. The type of CJD can only be diagnosed by examining postmortem brain tissue.

An anonymous source tells *Science* that the woman newly diagnosed with CJD used to work in a prion lab in Toulouse. The woman is still alive, and doctors don't know if she has classical or variant CJD.

"This is the right way to go in the circumstances," structural biologist Ronald Melki—who works at a prion lab jointly operated by two of the French institutions adopting the moratorium, The French Alternative Energies Commission and the French National Centre for Scientific Research—tells *Science*. "It is always wise to ask questions about the whole working process when something goes wrong." The other institutions participating in the moratorium are the French Agency for Food, Environmental and Occupational Health & Safety; the National Research Institute for Agriculture, Food and Environment (INRAE); and Inserm.

According to a Google Translate translation of the press release, the purpose of the research suspension is to allow time to investigate "the possibility of a link between the observed case and the person's former professional activity," as well as to adopt any necessary additional safety measures in prion labs.

If the investigation reveals that the patient contracted CJD from a lab, it wouldn't be the first time this has happened in France.

In 2010, INRAE lab worker Émilie Jaumain accidentally cut open her finger (through two layers of latex gloves) while cleaning lab equipment that was used with prion-containing samples, according to *Gizmodo*. Despite immediately alerting doctors to her potential exposure, Jaumain's widower tells *Science*, she began developing painful symptoms in 2017 and severe psychological symptoms in early 2019, which led to a diagnosis of "probable vCJD." She died the same year at the age of 33, and the diagnosis was confirmed after her death.

According to *Science*, independent safety reports found no safety violations in Jaumain's lab, although Jaumain's family's lawyer tells *Science* there were precautions that could have saved the young researcher's life, including wearing metal mesh gloves and soaking the cut finger in bleach. The safety reports did find at least 17 lab accidents within the last decade in French prion labs.

Neuroscientist Stéphane Haïk of the Paris Brain Institute tells *Science* that following Jaumain's diagnosis, prion labs across the country began adopting additional safety procedures, such as using plastic scalpels and cut-resistant gloves.

"The occurrence of these harsh diseases in two of our scientific colleagues clearly affects the whole prion community," Emmanuel Comoy, deputy director of CEA's Unit of Prion Disorders and Related Infectious Agents, tells *Science*. The diagnoses "necessarily reinforces the awareness of the risk linked to these infectious agents," he says.

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2 Red Objects Were Found in the Asteroid Belt. They Shouldn't Be There.

The space rocks may have come from beyond Neptune, and potentially offer hints at the chaos of the early solar system.

By Jonathan O'Callaghan

Two red things are hiding in a part of the solar system where they shouldn't be.

Scientists led by Sunao Hasegawa from JAXA, the Japanese space agency, reported in The Astrophysical Journal Letters on Monday that two objects spotted in the asteroid belt between Mars and

Jupiter appear to have originated beyond Neptune. The discoveries could one day provide direct evidence of the chaos that existed in the early solar system.

"If true it would be a huge deal," says Hal Levison, a planetary scientist at the Southwest Research Institute in Colorado, who was not involved in the research.

Earth's stellar neighborhood is fairly stable today. But 4 billion years ago, chaos reigned as the orbits of Jupiter and other giant planets beyond it may have shifted. The gravitational havoc caused by this planetary dance likely threw pieces of rock and ice all over the place.

"It was very dynamic," said Karin Öberg, an expert in solar system evolution from Harvard University who was not involved in the new study.

Some of those rocks settled into the gap between Mars and Jupiter and became the asteroid belt. Most of the material is believed to be fairly similar hunks of inactive rock that failed to form planets.

An artist's concept of Arrokoth, a Kuiper Belt object visited by the New Horizons spacecraft in 2019. Scientists say two asteroids, 203 Pompeja and 269 Justitia, appear to have a similar color. **Credit...Science Photo Library/Alamy**

But then there are two objects called 203 Pompeja and 269 Justitia. They orbit at about 2.7 and 2.6 times the Earth-sun distance, well within the asteroid belt. 203 Pompeja, at about 70 miles across, appears to be structurally intact, whereas 269 Justitia, only 35 miles or so, is likely a fragment of a previous collision. Both have stable circular orbits, meaning they must have settled into this space long ago.

Both also have an unusual color. Objects in the inner solar system tend to reflect more blue light because they are devoid of organic material — things like carbon and methane — whereas objects in the outer solar system are redder because they have a lot of organics, perhaps the building blocks of life on Earth.

"In order to have these organics, you need to initially have a lot of ice at the surface," said Michaël Marsset from the Massachusetts Institute of Technology, a co-author on the paper. "So they must have formed in a very cold environment. Then the solar irradiation of the ice creates those complex organics."

These two rocks, as it turns out, are extremely red — more red than anything else seen in the asteroid belt. While tentative hints of other red asteroids have been found, these two appear to be special.

The finding, if correct, would offer evidence for planetary migration in the early solar system, particularly in support of an idea called the Nice Model, with Saturn, Uranus and Neptune all moving outward, and Jupiter inward slightly, over a few hundred million years. This would have perturbed organic-laden asteroids leftover from the formation of the planets, sending them pinging around the solar system.

"It's an exciting discovery with implications for the origins of life," Dr. Öberg said.

Most of these leftover objects in the present day are known as trans-Neptunian objects and orbit in the Kuiper belt beyond Neptune. Many are red in color, like Arrokoth, the rock that NASA's New Horizons mission got a close-up of in 2019. 203 Pompeja and 269 Justitia both appear to match them.

"People have been talking about some fraction of asteroids coming from the Kuiper belt for quite a while now," said Josh Emery, a planetary scientist from Northern Arizona University who was not involved in the paper. He said the research "definitely takes a step" toward finding evidence to support that hypothesis.

Not everyone is convinced just yet. Dr. Levison, who was also not involved in the paper, says objects should become less red as they

approach the sun. Even captured asteroids in Jupiter's orbit known as Trojans, thought to possibly be trans-Neptunian objects, aren't this red. "It seems to be inconsistent with our models," said Dr. Levison, who is the head of NASA's Lucy mission, which is scheduled to launch in October to study Jupiter's Trojans.

Dr. Marsset agrees that it's not clear why they would be so red, but it is possibly related to how long it took them to become implanted into the asteroid belt. Some Trojans may also be as red, but haven't been found yet.

To truly confirm the origin of 203 Pompeja and 269 Justitia, a spacecraft would likely need to visit them. Such a mission could potentially offer a glimpse at the outer solar system, but without spending a decade or more to fly there.

"You could flyby one of these strange asteroids, and a more typical asteroid for comparison," Dr. Emery said. "That would be a really compelling spacecraft mission."

https://wb.md/3zPXH7S

FDA Approves First Interchangeable Biosimilar Insulin

First interchangeable insulin which can be substituted for glargine at the pharmacy without the need for a separate prescription.

Miriam E. Tucker

The US Food and Drug Administration (FDA) has approved the first interchangeable insulin, Semglee (Mylan Pharmaceuticals), which can be substituted for glargine (Lantus, Sanofi) at the pharmacy without the need for a separate prescription.

The approval will allow Semglee to function like a generic drug in the market and may reduce insulin costs.

It is indicated to improve glycemic control in adults and pediatric patients with type 1 diabetes and in adults with type 2 diabetes.

Originally approved in June 2020 as a biosimilar to glargine, Semglee is now an "interchangeable biosimilar," meaning that it has no clinically meaningful difference from the reference product and also may be substituted for that product — in this case, glargine (Lantus) — without prescriber intervention, just as generic drugs typically are, subject to state pharmacy laws.

For approval as an interchangeable biosimilar, manufacturers are required to provide additional data reflecting how the interchangeable biosimilar may be used in the marketplace with patients.

"Access to affordable insulin is critical and long-acting insulin products, like insulin glargine, play an important role in the treatment of types 1 and 2 diabetes mellitus," said Peter Stein, MD, director of the Office of New Drugs in the FDA's Center for Drug Evaluation and Research, in an FDA statement. "The FDA's high standards for approval mean healthcare professionals and patients can be confident in the safety and effectiveness of an interchangeable biosimilar product, just as they would for the reference product."

"Biosimilar and interchangeable biosimilar products have the potential to reduce health care costs, similar to how generic drugs have reduced costs. Biosimilars marketed in the US typically have launched with initial list prices 15% to 35% lower than comparative list prices of the reference products," the FDA notes in their statement.

Semglee comes in 10-mL vials and 3-mL prefilled pens, and is administered subcutaneously once daily, with individualized doses. The most common side effects are hypoglycemia, edema, lipodystrophy, weight gain, and allergic reactions.

The FDA released new materials for health care providers regarding biosimilar and interchangeable biosimilar products, including a fact sheet about interchangeable biosimilar products.

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Sediments from lake in Japan reveal stable climate led to origin of agriculture

The development of agriculture was a landmark feat for modern humans.

It marked the beginning of a sedentary lifestyle and development of 'civilizations'. However, the environmental factors that drove this revolutionary change in how humans lived have been debated until now.

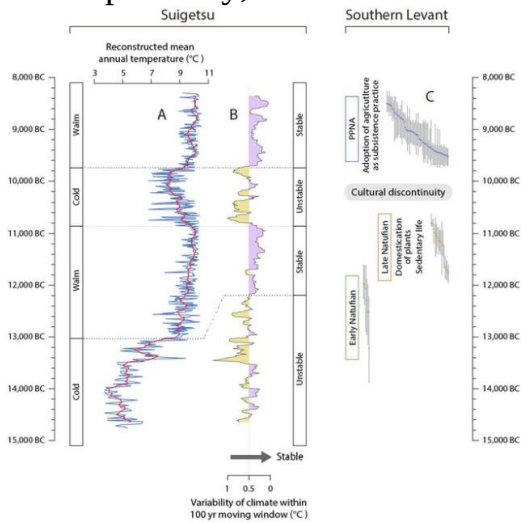
One of the most widely supported theories about the origin of agriculture is that a food shortage crisis brought about by a climatic cooling event that started at ca. 10,900 BC and lasted until ca. 9,700 BC drove humans to adopt agriculture to enhance food production. However, this conventional theory is being questioned: this is because several radiocarbon ages of plant remains that seemed to support the hypothesis were re-assessed recently, and the updated results suggested that the period of climatic cooling coincided with a decline and discontinuation of sedentary life, rather than the beginning of it.

Based on the archaeological observation that agriculture seemed to have originated independently in multiple regions within a few millennia after the end of the last ice age, some researchers believe that the elevated temperature of the post-glacial age resulted in humans adopting agriculture.

However, this theory cannot explain why humans did not start agriculture much earlier in tropical regions, where the temperature was already sufficiently high even during the coldest phase of the last ice age.

A very detailed climate reconstruction from ca. 16,000 BC to ca. 8,000 BC, based on analyses of pollen fossils included in the annually layered sediments from Lake Suigetsu, Japan, shed new light on this debate. According to the time-series reconstruction of the climate change through this period, as well as the world's most accurate chronology of the sediment established by counting annual layers and radiocarbon dating of hundreds of leaf fossils, a research team, led by Takeshi Nakagawa of Ritsumeikan University, Japan, demonstrated that the first attempts of domesticating plants and constructing settlements based on agriculture coincided with periods of relatively warm and, more importantly, stable climate.

The team's latest data show that the transition from the ice age to the post-glacial age was characterized by alternations between stable and unstable periods. The domestication of plants didn't start when the warm climate was established in ca. 13,000 BC, but had to wait until the climate stopped oscillating in short intervals and large amplitudes in ca. 12,000 BC.



A: Change of mean annual temperature reconstructed at Lake Suigetsu. B: Change of climatic stability/instability. C: Radiocarbon dates of cultures that contributed towards the commencement of agriculture. PPNA stands for Pre-Pottery Neolithic-A. **Credit: Professor Takeshi Nakagawa from Ritsumeikan University**

A couplet of dark- and light-colored layers corresponds to one year. The average thickness of annual layers is about 0.7 mm. Lake Suigetsu accommodates a 45 m thick accumulation of such sediments that spans over the last ca. 70,000 years. Using this unique archive, scientists can reconstruct past climatic changes in exceptionally high temporal resolution. Credit: Professor Takeshi Nakagawa from Ritsumeikan University

Agriculture is a subsistence practice that requires planning. But to plan in advance, a stable future is important. When the climate was

generally unstable, agriculture was too risky a practice because accurately predicting the weather in the future wasn't possible, thus making it difficult to select appropriate crops for agriculture. In such climatic conditions, hunting-and-gathering was a more reasonable subsistence strategy than agriculture because the natural ecosystem consists of diverse species from which humans could expect "something" edible, as opposed to the farmlands.

These new findings by Nakagawa and colleagues, therefore, challenge the traditional view that agriculture was a revolutionary step forward for the history of humanity. Instead, agriculture and hunting-and-gathering were equally reasonable adaptation strategies, depending on whether the climate was stable or unstable.

Climatic stability has not been actively discussed by paleoclimatologists, partly because annually resolved natural archives of climate change are rare, and because analyzing such archives at a sufficiently high time-resolution inevitably involves extensive effort.

The unique sediments from a small lake in Japan, as well as the research team's two-decade-long efforts to extract information from the sediments, finally paved the way to a new finding that may alter self-image of modern humans.

More information: *Takeshi Nakagawa et al, The spatio-temporal structure of the Lateglacial to early Holocene transition reconstructed from the pollen record of Lake Suigetsu and its precise correlation with other key global archives: Implications for palaeoclimatology and archaeology, Global and Planetary Change (2021). DOI: 10.1016/j.gloplacha.2021.103493*

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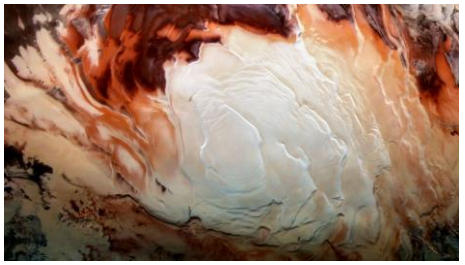
Mars' bright south pole reflections may be clay—not water

Bright reflections observed at Mars' south pole serve as evidence for water. But, seeing may be deceiving.

by Blaine Friedlander, Cornell University

After measuring the area's electrical properties with orbiting, ground-penetrating radar, an international group of scientists now say that reflections of the red planet's south pole may be smectite, a form of hydrated clay, buried about a mile below the surface, according to a July 29 report in the journal *Geophysical Research Letters*.

The research, led by Isaac B. Smith of York University, Toronto, with major contributions by second author Dan Lalich, research associate in the Cornell Center for Astrophysics and Planetary Science in the College of Arts and Sciences, said the presence of liquid water requires implausible amounts of heat and salt.



Mars' south pole – which looks like creamy swirls in cappuccino – is an icy cap with carbon dioxide and other geologic traits. About a mile below the cap is smectite, a hydrated version of clay. **Credit: ESA/Mars Express**

"Those bright reflections have been big news over the last few years because they were initially interpreted as liquid water below the ice," Lalich said. "That interpretation is inconsistent with other observations that imply the ice isn't warm enough to melt, given what we know about conditions on Mars."

Even on Earth, Lalich said, it is rare to see subsurface reflections from radar that are brighter than the surface reflection.

The reflection is about a mile below the planet's surface, where "you don't expect as bright of a reflection," he said. "We were getting radar reflections that were much brighter than the surface. And that's really weird. It's not something that we had really seen before and it's not something we expected."

The group had pored over data from the MARSIS (Mars Advanced Radar for Subsurface and Ionosphere Sounding) instrument—a radar that examines the Martian subsurface with a 130-foot antenna via the European Space Agency's Mars Express orbiter.

The MARSIS instrument, jointly developed by the Italian Space Agency and NASA's Jet Propulsion Laboratory, can probe the planet to a depth of three miles.

Lalich and the other scientists used a diagnostic physical property in ground-penetrating radar called dielectric permittivity, which measures the ability to store electric energy. The group used the reflection strength to estimate the permittivity difference between the ice and the base of the polar cap, and then compared that estimate to lab measurements of smectite.

"Smectites are very abundant on Mars, covering about half the planet, especially in the Southern Hemisphere," said York University's Smith. "That knowledge, along with the radar properties of smectites at cryogenic temperatures, points to them being the most likely explanation to the riddle."

Lalich said the data to confirm the hydrated clay was easily reproduced from the observed data, meaning that liquid water is not necessary to generate bright reflections. The scientists were hoping to find lakes and other geologic forms.

"Unfortunately, that's a bit of a downer," he said, "because lakes below the ice cap would have been very exciting. We believe the smectite hypothesis is more likely and it's more consistent with other observations."

In addition to Smith and Lalich, the co-authors on "A Solid Interpretation of Bright Radar Reflectors Under the Mars South Polar Ice," are Craig Rezza, graduate student, York University; Briony Horgan, associate professor, Purdue University; Jennifer L. Whitten, assistant professor, Tulane University; and Stefano Nerozzi, postdoctoral research associate and Jack Holt, professor, University of Arizona.

More information: *I. B. Smith et al, A Solid Interpretation of Bright Radar Reflectors Under the Mars South Polar Ice, Geophysical Research Letters (2021). DOI: 10.1029/2021GL093618*

https://bit.ly/3jdfTSq

Reversing Obesity: Cytokine Treatment Causes Mice to Lose Weight by "Sweating" Fat

A seemingly unremarkable observation — greasy hair — showed Penn researchers how the immune system could be targeted to reverse obesity

Treating obese mice with the cytokine known as TSLP led to significant abdominal fat and weight loss compared to controls, according to new research published today (July 29, 2021) in *Science* from researchers in the Perelman School of Medicine at the University of Pennsylvania. Unexpectedly, the fat loss was not associated with decreased food intake or faster metabolism. Instead, the researchers discovered that TSLP stimulated the immune system to release lipids through the skin's oil-producing sebaceous glands.

"This was a completely unforeseen finding, but we've demonstrated that fat loss can be achieved by secreting calories from the skin in the form of energy-rich sebum," said principal investigator Taku Kambayashi, MD, PhD, an associate professor of Pathology and Laboratory Medicine at Penn, who led the study with fourth-year medical student Ruth Choa, PhD. "We believe that we are the first group to show a non-hormonal way to induce this process, highlighting an unexpected role for the body's immune system." The animal model findings, Kambayashi said, support the possibility that increasing sebum production via the immune system could be a strategy for treating obesity in people.

The Hypothesis

Thymic stromal lymphopoietin (TSLP) is a cytokine — a type of immune system protein — involved in asthma and other allergic diseases. The Kambayashi research group has been investigating the expanded role of this cytokine to activate Type 2 immune cells and expand T regulatory cells. Since past studies have indicated

that these cells can regulate energy metabolism, the researchers predicted that treating overweight mice with TSLP could stimulate an immune response, which could subsequently counteract some of the harmful effects of obesity.

"Initially, we did not think TSLP would have any effect on obesity itself. What we wanted to find out was whether it could impact insulin resistance," Kambayashi said. "We thought that the cytokine could correct Type 2 diabetes, without actually causing the mice to lose any weight."

The Experiment

To test the effect of TSLP on Type 2 diabetes, the researchers injected obese mice with a viral vector that would increase their bodies' TSLP levels. After four weeks, the research team found that TSLP had not only affected their diabetes risk, but it had actually reversed the obesity in the mice, which were fed a high-fat diet. While the control group continued to gain weight, the weight of the TSLP-treated mice went from 45 grams down to a healthy 25 grams, on average, in just 28 days.

Most strikingly, the TSLP-treated mice also decreased their visceral fat mass. Visceral fat is the white fat that is stored in the abdomen around major organs, which can increase diabetes, heart disease, and stroke risk. These mice also experienced improved blood glucose and fasting insulin levels, as well as decreased risk of fatty liver disease.

Given the dramatic results, Kambayashi assumed that the TSLP was sickening the mice and reducing their appetites. However, after further testing, his group found that the TSLP-treated mice were actually eating 20 to 30 percent more, had similar energy expenditures, base metabolic rates, and activity levels, when compared to their non-treated counterparts.

The Findings

To explain the weight loss, Kambayashi recalled a small observation he had previously ignored: "When I looked at the coats of the TSLP-treated mice, I noticed that they glistened in the light. I always knew exactly which mice had been treated, because they were so much shinier than the others," he said.

Kambayashi considered a far-fetched idea — was their greasy hair a sign that the mice were "sweating" out fat from their skin?

To test the theory, the researchers shaved the TSLP-treated mice and the controls and then extracted oils from their fur. They found that Kambayashi's hypothesis was correct: The shiny fur contained sebum-specific lipids. Sebum is a calorically-dense substance produced by sebocytes (highly specialized epithelial cells) in the sebaceous glands and helps to form the skin barrier. This confirmed that the release of oil through the skin was responsible for the TSLP-induced fat loss.

The Conclusions

To examine whether TSLP could potentially play a role in the control of oil secretion in humans, the researchers then examined TSLP and a panel of 18 sebaceous gland-associated genes in a publicly-available dataset. This revealed that TSLP expression is significantly and positively correlated with sebaceous gland gene expression in healthy human skin.

The study authors write that, in humans, shifting sebum release into "high gear" could feasibly lead to the "sweating of fat" and weight loss. Kambayashi's group plans further study to test this hypothesis.

"I don't think we naturally control our weight by regulating sebum production, but we may be able to highjack the process and increase sebum production to cause fat loss. This could lead to novel therapeutic interventions that reverse obesity and lipid disorders," Kambayashi said.

Reference: "Thymic stromal lymphopoietin induces adipose loss through sebum hypersecretion" by Ruth Choa, Junichiro Tohyama, Shogo Wada, Hu Meng, Jian Hu, Mariko Okumura, Rebecca M. May, Tanner F. Robertson, Ruth-Anne Langan Pai, Arben Nace, Christian Hopkins, Elizabeth A. Jacobsen, Malay Haldar, Garret A. FitzGerald,

Edward M. Behrens, Andy J. Minn, Patrick Seale, George Cotsarelis, Brian Kim, John T. Seykora, Mingyao Li, Zoltan Arany and Taku Kambayashi, 30 July 2021, Science.
DOI: 10.1126/science.abd2893
This research was supported by grants from the National Institutes of Health (R01-HL111501, R01-10 AI121250, R01-AR070116, T32-HL07439), the Doris Duke Charitable Foundation, and the University of Pennsylvania Medical Scientist Training Program.
Penn researchers who contributed to this work include: Junichiro Tohyama, Shogo Wada, Hu Meng, Jian Hu, Mariko Okumura, Tanner F. Robertson, Ruth-Anne Langan Pai, Arben Nace, Christian Hopkins, Elizabeth A. Jacobsen, Malay Haldar, Garret A. FitzGerald, Edward M. Behrens, Andy J. Minn, Patrick Seale, George Cotsarelis, Brian Kim, John T. Seykora, Mingyao Li, and Zoltan Arany.

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p53 Unleashes Endogenous Retroviruses to Tackle Tumors: Study

New experiments suggest the famous tumor-suppressing protein uses viral elements lingering in the genome to get cancerous cells to announce their presence to the immune system.

Marcus A. Banks

The tumor suppressing protein p53 has earned the nickname "guardian of the genome" because of its well-studied arsenal of techniques for responding to genetic damage. When it binds to damaged DNA, it can activate DNA repair proteins, pause the cell division process until repairs are complete, or trigger programmed cell death if the damage is irreversible. Now, new research suggests p53 has another trick up its sleeve: it can force cancer cells out of hiding by making them go viral.

Often, tumors persist in the body because "cancer cells are hiding from immune cells," says Galina Selivanova, a tumor biologist at the Karolinska Institutet in Sweden. She's the lead author on the new study, published July 6 in *Cancer Discovery*, which finds that p53 stimulates the production of viral RNA within cancerous cells, prompting the immune system to go into overdrive to suppress tumors. This is unexpected, as the viruses it activates—endogenous retroviruses—are notorious for their ability to cause the kind of DNA damage that p53 is charged with fixing.

"The mechanism is novel," says Maureen Murphy, a cancer biologist at the Wistar Institute in Philadelphia who studies p53 but was not involved in this study. She also says the study is strong overall and will likely translate clinically.

Harnessing endogenous retroviruses against cancer

Selinova and her colleagues worked with three in vitro human cancer cell lines: melanoma, osteosarcoma, and breast cancer cells. They boosted the activity of p53 in these cells by inhibiting other proteins known to gum up p53's work: MDM2 and MDMX. (One of the inhibitors they used is a product of Aileron Therapeutics; three authors of the paper work at Aileron).

After the cells were exposed to these inhibitors, quantitative PCR tests revealed that expression of RNA from multiple endogenous human retroviruses increased. These viruses are once-infectious agents that, over evolutionary history, have settled into the genome. They collectively make up an estimated 8 percent of the human genome, and most are inert. Others, however, remain active and do have the potential to cause damage. When active, these viral sequences can multiply and insert themselves into new spots in the genome in harmful ways. That's why there are several mechanisms in place to protect cells against retroviruses, Selivanova notes—including, usually, activating p53, which in most circumstances blocks the ability of retroviruses to access new parts of the genome.

In the team's experiments, however, p53 did the exact opposite: it activated retroviruses. The researchers confirmed this using cell lines edited to lack the protein, which didn't express the viral RNA seen in the other cells. Sequencing of cellular RNA revealed that p53 activated the retroviruses by inhibiting two proteins that normally quash their expression, LSD1 and DNMT1.

With these inhibitors out of the way, the retroviruses set about making copies of themselves in the form of double-stranded

RNA—molecules that also happen to be a telltale sign of a viral infection. Although no external pathogens were involved, when they detected the double-stranded RNA, the cells acted as if they were infected, activating antiviral immune pathways, including the production of interferons—proteins that, among other activities, can stimulate ill cells to advertise their condition by sticking bits of their proteins on their outer cell membrane. Immune cells use these cell-surface antigens to identify and target infected cells, so increasing interferon production could translate to the cancerous cells losing their ability to evade immune detection.

This apparent infection mimicry also happened in biopsy samples of two people with melanoma. The biopsies were injected with a dual MDM2/MDMX inhibitor (another Aileron product) that boosted the activity of p53, and in both, this increased activity led to greater retroviral expression, interferon activation, and the infiltration of tumor-killing CD8+ T cells.

"It's an interesting mechanism by which you stimulate the immune system when you activate p53," says Wafik El-Deiry, an oncology researcher at Brown University. El-Deiry, the first author of a 1992 *Nature Genetics* paper that shows how p53 binds to genes to suppress tumors, is also working with Aileron Therapeutics to study the benefits of MDM2/MDMX inhibitors.

Connecting cancer treatments

In addition to revealing the unexpected actions of a well-studied tumor suppressor, Murphy says Selivanova and colleagues may have uncovered the missing link as to why using radiation can be an effective way to control cancer. "Something that's been known forever is that radiation actually enhances these endogenous retroviruses, and nobody put two and two together and said: 'gee, radiation induces p53, and maybe that's it.'"

For Selivanova, the next big question is how this mechanism is altered by mutated versions of p53, which she says are present in half of human tumors.

Selivanova says she hopes this knowledge can ultimately help patients. In the study, the researchers were able to shrink melanomas in mice by 75 percent in two weeks by combining an MDM2/MDMX inhibitor with an immune checkpoint inhibitor—an established cancer therapy that invigorates the body's natural anticancer defenses. In mice with colon cancer, the pharmaceutical combo increased CD8+ T cell production in a manner similar to the retrovirus-interferon pathway in vitro. While this is not the first time researchers have combined boosted p53 with an immune checkpoint inhibitor, the team may have uncovered the hidden retroviral mechanism behind why the combination appears effective in cell lines and mice, says Murphy. Further work on retroviruses' role could point toward ways to improve upon these therapies and other cancer treatments.

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Honeybees experience withdrawal symptoms when deprived of alcohol

Scientists are turning to honeybees to understand alcohol dependence in humans

Sam Zlotnik

With our species' long history of creating alcoholic beverages, it is easy to forget that alcohol occurs in nature too. All kinds of wild animals routinely consume alcohol, including non-human apes, birds, and flies. The western honeybee has even emerged as a model species for studying the effects of alcohol consumption.

Honeybees consume alcohol when wild yeast grows in flower nectar. The yeast in nectar produces ethanol through fermentation in the same way that brewers' yeast produces ethanol in beer. In the lab, honeybees will readily drink sugar water spiked with alcohol, which mimics this yeasty nectar. Using this method, scientists have shown that honeybees can get intoxicated and eventually build up a

tolerance when they drink alcohol regularly.

Although alcohol use disorder in humans is driven by a complex set of biological and social factors, studying honeybees may help us understand some of the fundamental physiological processes underlying it. With this goal in mind, a research team in Poland ran an experiment to see if honeybees showed one of the key features of alcohol addiction: withdrawal.

In their recently published study, the researchers fed half of the bees sugar water with ethanol, and the other half without ethanol, for three weeks. After that, half of the bees in each group were switched to the opposite diet for three days. The researchers then tested how eager the bees were to drink alcohol-spiked sugar water.

The bees that had never encountered alcohol before consumed the least of it, while the bees that had been cut off after three weeks of alcohol-drinking consumed the most. These bees drank more alcohol than any of the other groups, including those that had consumed alcohol continuously throughout the experiment.

The researchers concluded that honeybees show signs of alcohol withdrawal after just a few days of deprivation. Of course, more research is needed to fully understand the basis of the bees' behavior and what it means for alcohol studies more broadly. But it is evident that at least some of alcohol's impacts on animal behavior are more widespread than we once believed.

https://bit.ly/3j7SjGJ

People who live to 100 have unique gut bacteria signatures

These bacteria could contribute to a healthy gut and, in turn, **By Rachael Rettner - Senior Writer**

People who live to age 100 and beyond may have special gut bacteria that help ward off infections, according to a new study from Japan. The results suggest that these bacteria, and the specific compounds they produce — known as "secondary bile acids" — could contribute to a healthy gut and, in turn, healthy aging.

Still, much more research is needed to know whether these bacteria promote exceptionally long life spans. The current findings, published Thursday (July 29) in the journal Nature, only show an association between these gut bacteria and living past 100; they don't prove that these bacteria caused people to live longer, said study senior author Dr. Kenya Honda, a professor in the Department of Microbiology and Immunology at the Keio University School of Medicine in Tokyo.

"Although it might suggest that these bile-acid-producing bacteria may contribute to longer life spans, we do not have any data showing the cause-and-effect relationship between them," Honda told Live Science.

Gut microbe "signature"

The community of bacteria and other microorganisms that live in the gut, known as the gut microbiome, is known to play a role in our health and changes as we age. For example, having less diversity in the types of gut bacteria has been linked with frailty in older adults. But researchers suspected that people who reach age 100 may have special gut bacteria that contribute to good health. Indeed, centenarians tend to be at lower risk of chronic diseases and infections compared with older adults who don't reach this milestone.

In the new study, the researchers examined the gut microbiota of 160 centenarians, who were, on average, 107 years old. They compared the centenarians' gut microbiota to those of 112 people ages 85 to 89, and 47 people ages 21 to 55.

They found that centenarians had a distinct "signature" of gut microbes not seen in the other two age groups. For example, certain species of bacteria were enriched or depleted in centenarians compared with the other two groups.

The researchers then analyzed gut metabolites (products of

metabolism) in all three groups, and found that centenarians had significantly higher levels of so-called secondary bile acids compared with the other two groups.

Bile is the yellow-green fluid that's made by the liver and stored in the gallbladder, according to the National Institutes of Health. Bile acids are compounds in bile that aid in digestion, particularly of fats.

After the liver produces bile acids, they are released into the intestine, where bacteria chemically modify them into secondary bile acids, according to a 2009 paper published in the journal Diabetes Care.

The researchers found particularly high levels of a secondary bile acid called isoallolithocholic acid (isoalloLCA) in the centenarians.

The authors didn't know what metabolic process bacteria used to produce isoalloLCA, so they set out to identify the pathway. They screened gut bacterial strains from a 110-year-old who had particularly high levels of secondary bile acids and found that bacteria belonging to a family called Odoribacteraceae produced isoalloLCA.

What's more, isoalloLCA was found to have potent antimicrobial properties, meaning it could inhibit the growth of "bad" bacteria in the gut. In experiments in lab dishes and in mice, the authors found that isoalloLCA slowed the growth of *Clostridium difficile*, a bacterium that causes severe diarrhea and inflammation of the colon. IsoalloLCA also inhibited the growth of vancomycin-resistant enterococci, a type of antibiotic-resistant bacteria known to cause infections in hospital settings.

The findings suggest that isoalloLCA may contribute to a healthy gut by preventing the growth of bad bacteria.

They also suggest that these bacteria or their bile acids could treat or prevent *C. difficile* infection in people, Honda said, although more research would be needed to show this.

If these bile-acid-producing bacteria do contribute to a healthy gut, they might one day be used as a probiotic to improve human health, Honda said. He noted that these bacteria appear safe, as they don't produce toxins or harbor antibiotic-resistance genes.

It's unclear how centenarians come to acquire these beneficial bacteria, but both genetics and diet could play a role in shaping the composition of people's gut microbiota, Honda said.

The study did not collect information on participants' diet, exercise habits or medication use, all of which could affect gut microbiota and help to explain the link, the authors said.

Future studies that follow large groups of people over time could further probe the link between these bacteria and longevity.

https://bit.ly/37azLzN

Scientists create embryos to save northern white rhino

Scientists working to bring back the functionally extinct northern white rhino announced they had successfully created three additional embryos of the subspecies, bringing the total to 12.

One of world's two remaining live specimens—female Fatu who lives with her mother Najin on Kenya's 90,000-acre Ol Pejeta wildlife conservancy—provided the eggs for the project, while the sperm used was from two different deceased males.

Scientific consortium Biorescue described in a press release late Thursday how the eggs were collected from Fatu in early July before being airlifted to a lab in Italy for fertilisation, development and preservation.

Neither Fatu nor Najin is capable of carrying a calf to term, so surrogate mothers for the embryos will be selected from a population of southern white rhinos.

Ol Pejeta director Richard Vigne told AFP on Friday that he believed in the project's chances of success, while emphasising the high stakes. "No one is going to pretend that this is going to be easy," he said. "We are doing things which are cutting-edge from a scientific perspective and we a dealing with genetics, with the two

last northern white rhinos left on the planet," said Vigne.
"There are many, many things that could go wrong," he said. "I think everybody understand the challenges that remain."
Since 2019 Biorescue has collected 80 eggs from Najin and Fatu, but the 12 viable embryos all hail from the younger rhino.
The project is a multi-national effort with scientists from the German Leibniz Institute backing the Kenya Wildlife Service and Ol Pejeta, and the Italian Avantea laboratory providing fertilisation support.
Kenyan Tourism Minister Najib Balala welcomed the news.
"It is very encouraging to note that the project has continued to make good progress in its ambitious attempts to save an iconic species from extinction," he said in the press release.
Rhinoceroses have very few natural predators but their numbers have been decimated by poaching since the 1970s.
Modern rhinos have roamed the planet for 26 million years and it is estimated that more than a million still lived in the wild in the middle of the 19th century.

https://bit.ly/3rO0zzi

A phytoplankton that synthesizes petroleum-equivalent hydrocarbons

Dicrateria rotunda can synthesize a series of saturated hydrocarbons

Director-General Naomi Harada and colleagues from the Research Institute for Global Change at the Japan Agency for Marine-Earth Science and Technology, in collaboration with Assistant Professor Yuu Hirose from Toyohashi University of Technology and Specially Appointed Professor Kazuyoshi Murata from the National Institute for Physiological Sciences, discovered that the phytoplankton *Dicrateria rotunda* (*D. rotunda*) can synthesize a series of saturated hydrocarbons with a carbon number ranging from 10 to 38.
A phytoplankton community was collected from seawater of the Chukchi Sea during a science cruise of the research vessel "Mirai" in the Arctic Ocean in 2013, from which we isolated and cultured the Arctic strain of *D. rotunda*, ARC1. ARC1 contained a series of saturated hydrocarbons with a carbon number ranging from 10 to 38, which are categorized as petrol (carbon number 10 to 15), diesel oils (carbon number 16 to 20), and fuel oils (carbon number 21 or higher) . Moreover, we examined ten additional strains of *Dicrateria* stored in culture collections, all of which were found to be similarly capable of hydrocarbon synthesis, indicating that this was common to the entire *Dicrateria* genus. This study is the first to report on an organism with the capability to synthesize hydrocarbons equivalent to petroleum.
The capability of the ARC1 strain to synthesize saturated hydrocarbons was shown to increase depending on the environmental conditions, and the findings of this study are expected to contribute to the development of biofuels in the future.
More information: *Naomi Harada et al, A novel characteristic of a phytoplankton as a potential source of straight-chain alkanes, Scientific Reports (2021). DOI: 10.1038/s41598-021-93204-w*

https://bit.ly/3C3YGDy

This 900-person delta cluster in Mass. has CDC freaked out—74% are vaccinated [Updated]

CDC estimates 35K symptomatic infections in US per week among 162 million vaccinated.

Beth Mole

An analysis of a COVID-19 cluster of around 900 people in Massachusetts—74 percent of whom are vaccinated—is among the alarming data that spurred the Centers for Disease Control and Prevention to reverse course on masks this week.
According to an internal CDC document first obtained by The Washington Post Thursday evening, data on the Provincetown,

Massachusetts, cluster showed that vaccinated people carried surprisingly high levels of the delta coronavirus in their noses and throats. In a study of a subset of people in the cluster, published at 1pm ET Friday by the CDC, Massachusetts health officials reported that fully vaccinated infected people appeared to have similar viral loads as unvaccinated infected people. More importantly, vaccinated people were found to be spreading the dangerous virus variant to other vaccinated people. *My underline*

The CDC-published study included 469 cases from the cluster, 346 of which were in fully vaccinated people. Of those breakthrough infections, 79 percent had symptoms, with cough, headache, sore throat, myalgia, and fever being the most common symptoms. There were five hospitalizations in the subset: one in an unvaccinated person with underlying medical conditions and four in fully vaccinated people, two of whom had underlying medical conditions. No deaths from cases linked to the cluster have been reported to date.

Nationwide, the CDC estimated that there are 35,000 symptomatic breakthrough infections per week among 162 million fully vaccinated Americans.

The internal CDC document overall highlights that delta is extremely contagious—much more so than previous versions of the virus, as well as the common cold or even the seasonal flu. Delta is more in line with the contagiousness of chickenpox, the CDC document said.

US officials should acknowledge that with delta dominating the country, "the war has changed," the document read. Officials who spoke with the Post say that the analyses and the urgency the document contains are what prompted the CDC to reverse its masking guidance earlier this week. The CDC now recommends indoor masking, regardless of vaccination status, in schools, in areas with "high" or "substantial" COVID-19 transmission, or when there's contact with vulnerable people, such as unvaccinated children or immunocompromised people.

But the document shared with the Post two days after the CDC mask update goes further, saying, "Given higher transmissibility and current vaccine coverage, universal masking is essential to reduce transmission of the delta variant."

The document also focused on the needle that the CDC must now thread with its unpopular health messaging—emphasizing the critical need for everyone to be vaccinated, while also acknowledging the perhaps not-so-rare risk of breakthrough infections and the need to keep up mitigation efforts even after vaccination. Despite the concerning data on delta, vaccines have still proven to be highly effective against severe disease, hospitalization, and death. They remain the most powerful tool to end the health crisis and reclaim some version of normality. But there are clearly caveats, and the CDC has yet to publicly release all the data it has to back up its new alarm over delta.

In May, CDC officials abruptly told people that once they were fully vaccinated, they could rip off their masks in most settings, even in crowded, indoor ones. The rhetoric around the change highlighted the effectiveness of vaccines and suggested the guidance was crafted as an incentive for vaccination—dangling freedom from masks as a reward for getting your shots. But vaccines were never 100 percent effective and many health experts were critical of the abruptness of the move and the fact that it wasn't carried out in stages or phases, linked to transmission levels or vaccination rates, for instance. Some also noted that, without clear metrics for issuing and retracting health measures, it would be difficult to go back on masking if a game changer—such as delta—arose.

This post has been updated to include new data from the study published by the CDC Friday.

https://wb.md/3A0TTRE

International Push for Recognition of Unique Frontotemporal Dementia Variant

Characterized by right temporal atrophy and a unique combination of cognitive, behavioral, and psychiatric symptoms, as well as language problems

Pauline Anderson

Denver — An international group of researchers is pushing for recognition of what they believe on the basis of new research is a unique variant of frontotemporal dementia (FTD).

This distinct syndrome is characterized by right temporal atrophy and a unique combination of cognitive, behavioral, and psychiatric symptoms, as well as language problems. This syndrome is not currently recognized as a variant of frontotemporal dementia (FTD) – but should be, said investigator, Hulya Ulugut Erkoyun, MD, Alzheimer Center, Department of Neurology, Vrije Universiteit, Amsterdam, the Netherlands. Doing so could have important implications for patient management, she added.

To that end, an international working group of 19 research centers has been created to establish international consensus diagnostic criteria for right temporal variant FTD (rtvFTD), Ulugut Erkoyun said. "Everyone will agree...that none of the current diagnostic criteria cover this unique symptom distribution," Ulugut Erkoyun said during a presentation here at the Alzheimer's Association International Conference (AAIC) 2021.

"Our collective data will enable us to understand the genetic and pathological background of this syndrome as well as the relationship between amyloid pathology and right temporal lobe atrophy," she added.

Unrecognized Condition

FTD involves behavioral or language symptoms associated with frontal and/or temporal atrophy. Semantic dementia (SD), a variant of FTD that involves word comprehension deficits and aphasia characterized by difficulty recalling names of everyday objects, is associated with left anterior temporal atrophy. Although patients with damage on the right side have a different presentation, they might be considered as having a behavioral variant FTD or SD.

"Unfortunately, if a patient is not in a dementia center, right frontal variant FTD is often unrecognized," Ulugut Erkoyun told meeting delegates.

The investigators retrospectively collected MRI findings and other data on 70 patients with rtvFTD from a single center. They identified clinical characteristics on the basis of case notes and compared them with those reported for patients with Alzheimer's disease (n = 70), behavioral FTD (n = 70), and SD (n = 70).

On the basis of those data, they determined that the core clinical features of the syndrome include cognitive symptoms, such as face recognition and memory impairments; behavioral or psychiatric symptoms, such as disinhibition, apathy, depression, and bizarre preoccupations; and language problems, such as word-finding difficulties and anomia.

Other features involve compulsions, including cleaning, clock watching, and pathologic dwelling on a single thought or activity; and rigid personality characteristics, including a fixation with schedules and routines, complex compulsive behavior, and a deficit in logical reasoning, Ulugut Erkoyun noted.

Other symptoms of note include changes in sleep, appetite, and libido; a lack of empathy; and a propensity to "get lost" or to have a deficit regarding place recognition, said Ulugut Erkoyun.

"The role of the right temporal lobe in social cognition will probably be quite important in explaining this symptom," she said.

Overall, rtvFTD has characteristic clinical features that require further exploration, Ulugut Erkoyun said.

She emphasized the importance of making this behavioral profile

"more recognizable and distinguishable" for clinicians.

The main aim of the international working group is to establish international consensus diagnostic criteria for rtvFTD, Ulugut Erkoyun said. "Our collective data will enable us to understand the genetic and pathological background of this syndrome as well as the relationship between amyloid pathology and right temporal lobe atrophy," she added.

To date, the group has collected data on a sample size of 260 cases, 38 of which have genetic and/or pathologic confirmation.

Two of the most common mutations are in the microtubule-associated protein and granulin genes. Pathologic diagnoses include frontotemporal lobar degeneration TAR DNA-binding protein (FTLD-TDP) type C and FTLD-tau (which involves the accumulation of tau proteins).

Social Deficits

During a question-and-answer session, Ulugut Erkoyun said that although there are many tools with which to describe language deficits related to the left-side FTD syndrome, it is more difficult to describe social cognitive deficits related to the right side.

Asked what she thinks is the most pressing issue facing the FTD field, Ulugut Erkoyun pointed to the importance of determining behavioral problems affecting various cultures. "The cross-cultural perspective is missing in FTD research. We are trying to understand all brains by using Western-based studies," she said.

Session co-chair Jonathan Rohrer, MD, Dementia Research Center, UCL Institute of Neurology, London, United Kingdom, agreed that studying a much more diverse population is "a big topic" in the field. Other important research topics flagged by session presenters regarding FTD included interpretation of how pain and somatic symptoms change as the disease progresses and the development of more precise high-resolution neuroanatomy strategies to discriminate subregions affected by different pathologies.

Alzheimer's Association International Conference (AAIC) 2021: Abstract 53310. Session: Contemporary Developments and Controversies in the Frontotemporal Dementia. Presented July 27, 2021

https://wb.md/3xfBLla

Vaccination Alone Won't Counter Rise of Resistant Variants: Study

Changes in our behavior and mindset will be increasingly required to stay ahead of vaccine-resistant strains

Ricki Lewis, PhD

Relaxation of nonpharmaceutical interventions once vaccination of the population has reached a tipping point short of herd immunity can increase the probability of the emergence of a resistant strain that natural selection then favors, according to new findings of a modeling study published online on July 30 in *Scientific Reports.*

Although vaccination is the best strategy for controlling viral spread, changes in our behavior and mindset will be increasingly required to stay ahead of vaccine-resistant strains, according to the four authors of the report.

"We have become accustomed to thinking of the pandemic from the point of view of epidemiology, and advised to reduce transmission and the number of people getting sick and the death rate. As the pandemic spreads across years, there will be a new dimension to our thinking, both for policymakers and the public. And that's the evolutionary perspective," said co-author Fyodor Kondrashov, PhD, an evolutionary biologist at the Institute of Science and Technology (IST), Klosterneuburg, Austria, at a press briefing Thursday.

The coming "change of mentality" that Kondrashov foresees should reassure people that masking and social distancing even after being vaccinated aren't futile. "It decreases the possibility that a vaccine-resistant strain is running around. We're not just trying to prevent the spread, but the evolution of novel variants, which are so rare at this point that we haven't yet identified them," he said.

The study focused on evolution generically, rather than on specific variants. "We took the classical model used to study epidemiology of pandemics, the SIR [susceptible, infected, recovered] model, and we modified it to study the dynamics of rare mutations associated with emergence of a vaccine-resistant strain," Simon A. Rella, the lead author of the study and a PhD student at IST, explained at the briefing.

The researchers simulated the probability that a vaccine-resistant strain will emerge in a population of 10,000,000 individuals over 3 years, with vaccinations beginning after the first year. For eight scenarios, rates of infection, recovery, death, vaccination, and mutation and the percentage of individuals with resistant viral strains were factors in the model.

The model also simulated waves of low and high transmission, similar to the effects of large-scale interventions such as lockdowns.

Three Factors

The study showed that a trio of factors increases the probability of a vaccine-resistant strain taking hold:

- ***Slow rates of vaccination***
- ***High number of infected individuals***
- ***Faster mutation rate***

These factors, Rello said, are obvious to some degree. "Every infected individual is like a mini-bioreactor, increasing the risk that mutations will appear that will endow the virus with the property of avoiding the immune system primed by a vaccine," he said.

Not as obvious, Rello added, is that when most people are vaccinated, a vaccine-resistant strain has an advantage over the original strain and spreads faster.

But we can stop it, he said. "Our model shows that if at the time a vaccine campaign is close to finishing and nonpharmacological interventions are maintained, then there's a chance to completely remove the vaccine-resistant mutations from the virus population."

In scenarios in which a resistant strain became established, resistance initially emerged after about 60% of the population had been vaccinated. That makes nonpharmaceutical interventions such as masking and social distancing vitally important. Just under 50% of the US population over the age of 12 has been fully vaccinated, according to the Centers for Disease Control and Prevention.

"Our results suggest that policymakers and individuals should consider maintaining non-pharmaceutical interventions and transmission-reducing behaviors throughout the entire vaccination period," the investigators conclude.

A "Powerful Force"

"We hope for the best, that vaccine resistance has not developed, but caution that evolution is a very powerful force, and maintaining some precautions during vaccination may help to control that evolution," said Kondrashov.

The investigators are relying on epidemiologists to determine which measures are most effective.

"It's necessary to vaccinate as many people as fast as possible and as globally as possible and to maintain some level of nonpharmaceutical intervention to ensure rare variants have a chance to be suppressed instead of spread," concluded Kondrashov.

He's pessimistic because many countries are still having difficulty accessing vaccines, and vaccine efficacy wanes slightly over time. The authors warn that "the emergence of a partially or fully vaccine-resistant strain and its eventual establishment appears inevitable."

The worst-case scenario is familiar to population biologists: rounds of "vaccine development playing catch up in the evolutionary arms race against novel strains," the authors write.

Limitations of the study are that some parameters of the rate of evolution for vaccine-resistant strains aren't known, and in creating the model, consideration was not given to effects of increased

testing, rigorous contact tracing, rates of viral genome sequencing, and travel restrictions.

Rather, the model illustrates general principals by which vaccine resistance can evolve, Kondrashov said.

Sci Rep. Published online July 30, 2021. Full text

https://wapo.st/37f97Gc

Deep in the forest, Germany fights another virus. This one hits pigs.

African swine fever kills almost every pig it infects in about a week to 10 days

By Loveday Morris

Oder-Spree, Germany — In the Brandenburg forest, a bounding 4-year-old black Belgian shepherd named Uschi picks up a scent. Wearing a neon high-visibility jacket, she stops by an overturned tree and barks.

In the mud, teeming with maggots, is the rotting carcass of a wild boar. “Hero Uschi,” shouts a member of the search team. It’s exactly what they spent the day hunting.

As the world fights the coronavirus pandemic, teams in Europe are battling another outbreak: African swine fever. Hundreds of miles of fencing have been thrown up in Europe to stop its steady march west across the continent, threatening the major pig farming industries in Germany and elsewhere.

While the virus cannot be passed to humans, it kills almost every pig it infects in about a week to 10 days, and it has been spreading in Europe in recent years.

Authorities find a dead wild boar in the forest near Beeskow

A search party looking for wild boars, dead or alive, infected with African swine fever find a dead piglet in a forest near Beeskow, Germany, on July 13. (Loveday Morris)

In fenced-off “red zones,” such as those in the forests of the Oder-Spree district southeast of Berlin, teams work to clear the area of the infectious wild boars that have succumbed to the sickness and hunt any still alive in an attempt to break infection chains.

The carcasses of the dead boars lie scattered in gullies and wooded clearings, sending the putrid scent of decaying flesh through the forest air. The stakes are high for Germany, Europe’s largest pork producer, exporting $4.7 billion in pig products each year.

The arrival of the virus in the wild boar population in Germany last year triggered bans on pork exports to countries outside Europe, wiping out $867 million in sales to China. Then, in mid-July, the first case was discovered in a domestic pig farm in Germany, exactly the spread that the teams picking through the forests had been hoping to prevent.

“We are fighting the pandemic nobody knows about and nobody cares about, because all eyes are on corona,” said Christian Tost, a 35-year-old reservist with the German military, one of five on the 17-member search team that spent six hours scouring an area of around a square mile last month.

They found 16 dead or dying boars.

From an office in Beeskow, about 20 miles from the Polish border, Petra Senger, the head veterinarian for the Oder-Spree district, oversees operations to contain the spread. Maps of various infection zones cover the walls.

“It’s a huge task,” Senger said. The first dead boars were found in her district on Sept. 10. They crossed from Poland, where the virus was already rife.

In response, the local authorities fenced off an area of fields and forest the size of Belgium.

But it wasn’t enough. A month later, they found new cases in an area 15 miles away, and a new red zone was cordoned off.

Endemic in sub-Saharan Africa, the disease arrived in the European Union in 2014, with the first cases in Lithuania. It slowly spread to neighboring countries.

The more spread there is in wild boars, the bigger the possibility it can infiltrate pig farms, Senger said. Distancing is also important. Traps laid with corn are also set to capture boars in buffer zones.

"With people, you can ask them to wash their hands or stay at home," Senger said. "You can't tell a pig to stay home."

More hardy than the coronavirus, the African swine fever can survive in the environment for many months, and it can be spread by people through vehicles, clothing and tools. It can also live for months or years in pork products. Consumption of infected pork doesn't pose a risk to humans, but it can cause a fresh outbreak if eaten by a pig.

"We think we'll have a vaccine," Senger said. "But not until 2023 or 2024."

Meanwhile, the search teams fan out in the forests several times a week to hunt for their rotten prey, scrambling through dense thickets.

On one scorching day in mid-July, forestry personnel, hunters and dog handlers joined the 17-member team in neon vests to comb the forest, thick with pine and birch. One of the dogs, Karl, a 2½-year-old dachshund, struggled with some of the denser undergrowth.

In charge was an easily angered hunter who occasionally snapped at those lagging behind. "Do you see the people next to you?" he yelled as the forest closed in, making it more challenging to keep sights on other searchers.

They checked gullies and puddles, with dying boars drawn to water as they sicken. Circling ravens can give clues as to where boar carcasses can be found.

Leaning over the putrid remains of a boar under a log, Reiner Favre, a 53-year-old hunter, speculated that it had been there for three or four weeks.

"Maybe it was one of the first ones to get sick around here," he said.

That morning, there had been fresher finds, a sick boar piglet that Favre then shot, and what the group assumed to be her siblings and mother, already dead not far away.

The coordinates for each carcass are called in, with a separate team looping back to find them in the thick forest in the afternoon and load them into body bags.

They scoop up soil with the carcasses and cover the area in lime. "[The virus] can stay there for a long time otherwise," Favre said. "That's the risk of this virus. It's not a soft virus."

Even the presence of the virus in wild boar populations is a major disruption to local farmers. If dead boars are found on farmers' land, it can affect their ability to sell their crops because of the fear of contagion.

With German pork exports blocked outside the E.U., countries such as Spain have stepped in to help meet China's pork appetite. China itself has had its own struggles with swine fever, with nearly half its own herds estimated to have been wiped out by outbreaks in 2018 and 2019.

The discovery of the virus at two Brandenburg region pig farms in July was a "huge catastrophe for Brandenburg's farmers," said Tino Erstling, a spokesman for the Brandenburg State Farmers' Association. But Germany is still able to export within the E.U. from regions without the virus.

So more fences are going up. The heartland of Germany's pork industry lies in states farther west. Germany's neighbors are already working on their defenses. Denmark has constructed a 40-mile-long, five-foot-high fence along its southern border in an attempt to keep out infected boars.

"We will double down on everything we've already been doing to try to stop this," Senger said. "That means finding infected pigs, building more fencing. We have to be stricter about keeping domestic and wild pigs separate."

Senger said she hopes that lakes and highways might act as natural

barriers for infected boars roaming west.

“If it hits where a lot of pig farmers operate, then, of course, they will have a huge problem on their hands,” said Heike Harstick, head of the German Association of the Meat Industry.

Practices in the pork industry have already come under increased scrutiny during the coronavirus pandemic. And the industry was already in decline because of a diminishing appetite in Germany for wurst and schnitzel.

Animal rights groups say the culls are senseless, with the virus also spread by contaminated food and carried between areas by people.

For dog trainer Michaela Botz, 49, the boar hunts are a good day’s work for Uschi, whose vest is made of Kevlar in case of a run-in with an angry boar. But as for containing the virus, she’s not optimistic, as the group finds dead boar after boar.

“It’s like a bucket without a bottom,” she said.

https://bbc.in/37eFPrc

No Covid traces found in railway stations or trains

Tests have found no traces of Covid-19 in swabs and air samples of four major railway stations and intercity train services, Network Rail has said.

By Mary O'Connor

Two lots of testing took place at London Euston, Birmingham New Street, Liverpool Lime Street and Manchester Piccadilly station.

Heavily touched areas such as escalator handles were swabbed, while hour-long air samples checked for airborne virus.

Tests were repeated on trains running between the stations.

There has been extra cleaning of transport services throughout the pandemic to protect against the virus spreading through contaminated surfaces and the air.

Imperial College London researchers examined the results of the tests - which took place in January and June - and found no coronavirus contamination of any surface or airborne virus particles.

It follows similar tests on London's Tube trains, buses and stations earlier this year, which found no sign of Covid-19 or new variants.

Researchers said at the time that this did not mean none is circulating.

David Green, senior research fellow at Imperial College London, said using filters and taking swabs provided a "way of quantifying the amount of virus circulating in these public environments and the effect of mitigation strategies like cleaning and wearing face coverings".

Rob Mole, senior programme manager for Network Rail's response to the pandemic, said the test results were "proof" the "dedicated approach" by station cleaning teams and train staff to keep passengers safe had worked.

He added that staff would continue "doing our part by rigorously cleaning trains and stations" and asked passengers to "do their bit" by continuing to wear face coverings while travelling.

Last month, almost all legal restrictions on social contact were lifted in England - including the legal requirement to wear a face covering in settings such as public transport - but they must still be worn on London's transport network.

The government still advises face coverings are worn in crowded and enclosed spaces.