

<https://wb.md/3tOsKO9>

Lawsuit: Misplaced Test Result Leads to Unneeded Surgery
Errors are inevitable, which is why good systems have built-in processes that require double-checking activities and results. But when the "double-check" gets overlooked, all of that effort can come to naught.

Gordon T. Ownby

A woman in her mid-40s with a history of tubal ligation visited Dr OB with lower left abdominal pain after having been in the emergency department 10 days earlier. An ultrasound by Dr OB revealed an empty uterus with some fluid around the ovary. Earlier, Dr OB's office had erroneously placed a report for a positive serum pregnancy test in the woman's chart, causing Dr OB to assess a probable ectopic pregnancy.

Dr OB and the woman discussed options and agreed to proceed with surgery that day. The patient went to the emergency department to get prepared for the exploratory surgery and consented to an "operative laparoscopy for ectopic pregnancy with possible partial salpingectomy." In his note early that afternoon, the ED physician documented the patient's constant abdominal pain. Immediately following his reference to the woman's visit to her obstetrician, he noted: "Risk factors consist of pregnancy."

From a blood sample ordered at the hospital later that afternoon, however, the patient tested negative for pregnancy. Dr OB did not learn of the negative test result prior to his surgery that evening.

Medscape Editor's Key Notes:

- *Develop policies and procedures that lessen the chance of putting test results in the wrong patient's file.*
- *When tests are ordered prior to surgery, make sure you review the results before the operation.*
- *Make sure staff communicates test results with the care team.*

At surgery, Dr OB found no ectopic pregnancy but he did remove

an ovarian cyst and performed an endometrial curettage in an effort to remove possible products of conception that might account for the original positive pregnancy test. Following surgery, Dr OB realized that the positive pregnancy test was from another patient and he explained the error to the patient.

Though there were no complications from the surgery, the patient hired an attorney to initiate a claim alleging that Dr OB failed to follow up on a pregnancy test that he had ordered before surgery, performed an unnecessary surgery, and committed a battery by exceeding her consent. The legal dispute was resolved informally.

The electronic medical record lists Dr OB as having ordered the pregnancy test at the hospital. Whether or not that was accurate, regardless of *who* ordered the test, *someone* thought it was a good idea but then failed to follow up.

For physicians, it is not enough to be respected for your knowledge; you also want to be known as the one who always dots your i's and crosses your t's. Such care will help you avoid medical errors and lawsuits.

This case comes from the "Case of the Month" column featured in the member newsletter published by the Cooperative of American Physicians, Inc. The article was originally titled "[Be Sure To Check the Double-Check.](#)"

<https://bit.ly/2SOsEcC>

Turns out developing a taste for carbs wasn't a bad thing

Findings on Neanderthal oral microbiomes offer new clues on evolution, health

A new study looking at the evolutionary history of the human oral microbiome shows that Neanderthals and ancient humans adapted to eating starch-rich foods as far back as 100,000 years ago, which is much earlier than previously thought.

The findings suggest such foods became important in the human diet well before the introduction of farming and even before the

evolution of modern humans. And while these early humans probably didn't realize it, the benefits of bringing the foods into their diet likely helped pave the way for the expansion of the human brain because of the glucose in starch, which is the brain's main fuel source.

"We think we're seeing evidence of a really ancient behavior that might have been part encephalization -- or the growth of the human brain," said Harvard Professor Christina Warinner, Ph.D. '10. "It's evidence of a new food source that early humans were able to tap into in the form of roots, starchy vegetables, and seeds."

The findings come from a seven-year study published in the *Proceedings of the National Academy of Sciences* on Monday that involved the collaboration of more than 50 international scientists. Researchers reconstructed the oral microbiomes of Neanderthals, primates, and humans, including what's believed to be the oldest oral microbiome ever sequenced -- a 100,000-year-old Neanderthal. The goal was to better understand how the oral microbiome -- a community of microorganisms in our mouths that help to protect against disease and promote health -- developed since little is known about its evolutionary history.

"For a long time, people have been trying to understand what a normal healthy microbiome is," said Warinner, assistant professor of anthropology in the Faculty of Arts and Sciences and the Sally Starling Seaver Assistant Professor at the Radcliffe Institute. "If we only have people today that we're analyzing from completely industrialized contexts and that already have high disease burdens, is that healthy and normal? We started to ask: What are the core members of the microbiome? Which species and groups of bacteria have actually co-evolved with us the longest?"

The scientists analyzed the fossilized dental plaque of both modern humans and Neanderthals and compared them to those of humanity's closest primate relatives, chimpanzees and gorillas, as

well as howler monkeys, a more distant relative.

Using newly developed tools and methods, they genetically analyzed billions of DNA fragments preserved in the fossilized plaque to reconstruct their genomes. It's similar in theory to how archeologists painstakingly piece together ancient broken pots, but on a much larger scale.

The biggest surprise from the study was the presence of particular strains of oral bacteria that are specially adapted to break down starch. These strains, which are members of the genus *Streptococcus*, have a unique ability to capture starch-digesting enzymes from human saliva, which they then use to feed themselves. The genetic machinery the bacteria uses to do this is only active when starch is part of the regular diet.

Both the Neanderthals and the ancient humans scientists studied had these starch-adapted strains in their dental plaque while most of the primates had almost no streptococci that could break down starch.

"It seems to be a very human specific evolutionary trait that our *Streptococcus* acquired the ability to do this," Warinner said.

The findings also push back on the idea that Neanderthals were top carnivores, given that the "brain requires glucose as a nutrient source and meat alone is not a sufficient source," Warinner said.

Researchers said the finding makes sense because for hunter-gatherer societies around the world, starch-rich foods -- underground roots, tubers (like potatoes), and forbs, as well as nuts and seeds, for example -- are important and reliable nutrition sources. In fact, starch currently makes up about 60 percent of calories for humans worldwide.

"Its availability is much more predictable across the annual season for tropical hunter-gatherers," said Richard W. Wrangham, Ruth B. Moore Professor of Biological Anthropology and one of the paper's co-authors. "These new data make every sense to me, reinforcing

the newer view about Neanderthals that their diets were more sapien-like than once thought, [meaning] starch-rich and cooked."

The research also identified 10 groups of bacteria that have been part of the human and primate oral microbiome for more than 40 million years and are still shared today. While these bacteria may serve important and beneficial roles, relatively little is known about them. Some don't even have names.

Focusing on Neanderthals and today's humans, the analysis surprisingly showed the oral microbiome of both groups were almost indistinguishable. Only when looking at individual bacterial strains could they see some differences. For example, ancient humans living in Europe before 14,000 years ago during the Ice Age shared some bacterial strains with Neanderthals that are no longer found in humans today.

The differences and similarities from the study are all part of what makes us human, Warinner said. It also touches on the power of analyzing the tiny microbes that live in the human body, she said.

"It shows that our microbiome encodes valuable information about our own evolution that sometimes gives us hints at things that otherwise leave no traces at all," Warinner said.

<https://bit.ly/2Ok1F7S>

Bacteria do not colonize the gut before birth, says collaborative study

It happens during and after birth

Hamilton, ON - It is well known that each person's gut bacteria is vital for digestion and overall health, but when does that gut microbiome start?

New research led by scientists from McMaster University and Charité - Universitätsmedizin Berlin in Germany has found it happens during and after birth, and not before.

McMaster researchers Deborah Sloboda and Katherine Kennedy examined prenatal stool (meconium) samples collected from 20

babies during breech Cesarean delivery.

"The key takeaway from our study is we are not colonized before birth. Rather, our relationship with our gut bacteria emerges after birth and during infancy," said Kennedy, first author of the study and a PhD student, whose findings are published in *Nature Microbiology*.

Recent studies have sparked controversy by claiming that we are colonized by gut bacteria before birth. But, Kennedy said, studies such as these have been criticized for the ways they control for contamination.

"By including only breech caesarean deliveries in healthy pregnant women we were able to avoid the transmission of bacteria that occurs naturally during a vaginal birth," said Thorsten Braun, co-senior author and lead obstetric consultant and deputy director of the Department of 'Experimental Obstetrics' at Charité - Universitätsmedizin Berlin.

Kennedy said recent data suggest that a person's relationship with their own gut bacteria is most important in early life, during critical stages of immunological and physiological development.

Sloboda, co-senior author, agrees.

"The fact that colonization of infants' guts occurs during and after their births, means that not only is it vulnerable to early environmental influences, but could also offers a window of potential intervention," said Sloboda, professor of biochemistry and biomedical sciences at McMaster and the Canada Research Chair in perinatal programming.

"While many of the exact mechanisms surrounding gut bacteria and their role in our early development is unclear, discovering when and how we are colonized is a key first step."

External funding for the study came from the Canadian Institutes of Health Research.

Editors:

The paper is available at <https://go.nature.com/3tDd5ky>

<https://bit.ly/2OgKtjw>

Pregnant women hospitalized for COVID-19 infection do not face increased risk of death

UM School of Medicine researchers find reassuring evidence that pregnancy does not increase patient's risk of dying when hospitalized with pneumonia

Pregnant women who develop severe COVID-19 infections that require hospitalization for pneumonia and other complications may not be more likely to die from these infections than non-pregnant women. In fact, they may have significantly lower death rates than their non-pregnant counterparts. That is the finding of a new study [published today in the *Annals of Internal Medicine*](#) conducted by researchers at the University of Maryland School of Medicine (UMSOM).

The study examined medical records from nearly 1,100 pregnant women and more than 9,800 non-pregnant patients aged 15 to 45 who were hospitalized with COVID-19 and pneumonia. Slightly less than 1 percent of the pregnant patients died from COVID-19 compared to 3.5 percent of non-pregnant patients, according to the study findings.

There are, however, some important caveats to the study data in terms of differences between the two populations. Pregnant patients were more likely to be younger and have fewer health conditions, including diabetes, obesity, hypertension, and chronic lung disease, compared to the non-pregnant patients. Given the small number of deaths seen in the study, the researchers were unable to control for these differences to determine whether they significantly affected mortality risk.

"I think this is reassuring news for women who are pregnant and worried about getting infected with COVID-19 as new variants emerge," said study corresponding author Anthony Harris, MD, MPH, Professor of Epidemiology & Public Health at UMSOM.

"While the study does not tell us for certain that pregnancy does not pose added risks for women, the data certainly point in that direction."

Researchers from The University of Texas Health Science Center at Houston also participated in this study. UMSOM faculty who were co-authors of this study include Katherine Goodman, JD, PhD, Lisa Pineles, MA, Lyndsay O'Hara, PhD, Gita Nadimpalli, MD, MPH, Laurence Magder, PhD, and Jonathan Baghdadi, MD, PhD.

"I am so pleased we can provide some reassuring news to pregnant women who have faced an added burden during the COVID-19 pandemic," said E. Albert Reece, MD, PhD, MBA, Executive Vice President for Medical Affairs, UM Baltimore, and the John Z. and Akiko K. Bowers Distinguished Professor and Dean, University of Maryland School of Medicine. "This is an important study that adds to our knowledge of the COVID-19 pandemic at a critical time."

<https://bit.ly/3oedjOb>

Focus on outliers creates flawed snap judgments *Our quick scan of a crowd isn't as reliable as we think, new research suggests*

Durham, N.C. -- You enter a room and quickly scan the crowd to gain a sense of who's there - how many men versus women. How reliable is your estimate?

Not very, according to new research from Duke University.

In an experimental study, researchers found that participants consistently erred in estimating the proportion of men and women in a group. And participants erred in a particular way: They overestimated whichever group was in the minority.

"Our attention is drawn to outliers," said Mel W. Khaw, a postdoctoral research associate at Duke and the study's lead author.

"We tend to overestimate people who stand out in a crowd."

For the study, which appears online in the journal *Cognition*, researchers recruited 48 observers ages 18-28. Participants were

presented with a grid of 12 faces and were given just one second to glance at the grid. Study participants were then asked to estimate the number of men and women in the grid.

Participants accurately assessed homogenous groups - groups containing all men or all women. But if a group contained fewer women, say, participants overestimated the number of women present. The researchers also tracked participants' eye movements. They found that participants looked more often at whichever group was in the minority - men or women.

All of this occurred very quickly -- during a glance of just one second, said co-author and Duke psychologist Scott Huettel.

"We should recognize that our visual system is set up to orient ourselves towards some types of information more than others," Huettel said. "People form an initial impression very quickly, and that impression biases where we look next."



Study participants saw a grid of faces like this one, for just one second.

Photo courtesy of Mel Khaw and Duke University. Credit: Duke University

Interestingly, the same tendency to focus on the outlier also extended to scanning other kinds of images.

In a second experiment, study participants were shown a grid of nature photos showing a variety of indoor and outdoor scenes. Participants consistently overestimated whatever type of scene appeared less often.

For instance, if a grid of 12 photos contained two outdoor scenes - say, a waterfall and a mountain range -- participants reported, on average, that the grid contained three such scenes.

In other words, the same behavior occurred whether people were

looking at faces or scenes. That's important, Huettel said.

"That fact that this occurs with indoor and outdoor scenes suggests that this doesn't represent a social bias," Huettel said. "It really has to do with a fundamental feature of human perception."

And that built-in flaw in human perception suggests our quick judgments should be viewed with caution. "Snap judgments are powerful," Huettel said. "But they're not perfect."

Co-author Rachel Kranton, an economist, noted that as the research was coming together, she received an invitation to an economics conference including a photo from a past event.

The photo showed a meeting room full of mostly men, a situation Kranton frequently encounters at economics conferences. Kranton said she found herself scanning the photo for the presence of women -- and smiling in recognition.

"When human beings walk into a social situation, we immediately try to suss out the setting," Kranton said. "We scan to see who's there and how we fit in - that's a common human experience. It's one I've experienced many times."

The research was supported by a grant from the National Institute of Mental Health (NIMH R01-108627; S.H.).

CITATION: "Oversampling of Minority Categories Drives Misperceptions of Group Compositions," Mel W. Khaw, Rachel Kranton and Scott Huettel. Cognition, Vol. 214, September 2021. DOI: 10.1016/j.cognition.2021.104756

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

Is It Covid or the Flu? New Combo Tests Can Find Out.

New tests for respiratory illnesses can look for more than 20 pathogens at a time.

By Roxanne Khamsi

In January, a man in his 60s with heart disease and diabetes went to a South Dakota hospital with a cough and fever, worried he had Covid. A nurse swabbed the inside of his nose, and the sample went into a small device [resembling an inkjet-printer cartridge](#), which was then placed into a machine about the size of a printer.

This so-called quad test, now available at thousands of hospitals and clinics around the country, could detect not only the coronavirus, but two types of influenza and the respiratory syncytial virus, or R.S.V. A little more than a half-hour later, Dr. Blake Gustafson had the patient's result: He had the flu.

"I remember giving myself a fist bump like, 'Yes! It's not Covid. It's the flu,'" said Dr. Gustafson, chief of emergency medicine of the Sanford USD Medical Center in Sioux Falls, S.D. He relayed the news to the patient and his wife, happily adding that there was a treatment he could offer right away, Tamiflu. "The relief in their eyes above their masks was very satisfying," Dr. Gustafson said.

The patient's situation was somewhat unusual this past winter given that the United States, like many other countries, witnessed a [shocking absence of a flu season](#). But as the country begins to reopen, doctors say that flu and other pathogens might make a comeback this autumn. What's more, even as a growing number of people get vaccinated against Covid, there are still some [40,000 new infections every day](#) in the United States, and a significant number of people who [may be resistant](#) to taking the vaccines.

The Sanford Health system, which includes [46 hospitals and 1,400 physicians](#) in South Dakota, carries out 600 to 800 tests for the coronavirus a day in its clinics using antigen tests, which detect proteins made by the virus. But according to Rochelle Odenbrett, the senior executive director of laboratories, the organization is now in the process of replacing all of those tests with the quad tests used in its emergency settings.

Unlike the antigen tests, the quad test looks for a virus's genetic material using a polymerase chain reaction, or P.C.R. for short. The P.C.R.-based method is far more accurate than the antigen approach, Ms. Odenbrett says. She notes that P.C.R. sequencing of patient samples used to be more cumbersome and relied on multistep procedures across different laboratory rooms. "It's just amazing

how the technology has evolved," she said.

The quad test used by the Sanford system is made by the California-based company Cepheid, which received emergency authorization from the Food and Drug Administration [in late September](#).

Although last year's flu season was nonexistent, Dr. Geoffrey Baird of the University of Washington in Seattle said that a confluence of factors might precipitate its return in the fall: children returning to school buildings, declining use of masks and perhaps a lack of recent immune system exposure to the flu. If more people get sick in the fall, he added, they will want to know if it is flu or the coronavirus.

"We in the laboratory are preparing for another big boom in testing," said Dr. Baird, whose team has run [more than two million coronavirus tests](#) since the beginning of the pandemic. "Even if people are vaccinated, they're going to wonder, 'Am I the breakthrough case?'"

In addition to Cepheid, other companies have developed tests that look for influenza and the coronavirus at the same time, including Roche, which has received emergency use authorization for a test that looks for the coronavirus, influenza A and influenza B at once.

In recent years various hospitals have developed in-house versions of these combination tests as well, some of which look for more than a dozen different respiratory pathogens simultaneously using P.C.R. technology. Those "multiplex" tests are especially helpful in diagnosing illnesses in people with weak immune systems because they allow doctors to swiftly discern what pathogen is making a person sick before it is too late to start the right treatments.

A French company, bioMérieux, sells a P.C.R. test that looks for the coronavirus as well as 21 other viruses and bacteria simultaneously. And Roche recently bought a company that sells a machine that can screen for more than 20 pathogens in one go.

Testing for multiple pathogens does not always lead to a simple treatment, however. Co-infections, in which a person is infected with multiple viruses simultaneously, are more common than doctors expected, and sometimes the multiplex tests might detect a viral infection but miss a bacterial one, said Dr. Daniel Griffin, chief of infectious diseases at ProHealth New York. A patient could carry the influenza virus but also test positive for a bacterium such as pneumococcus, for example.

“We initially thought that every time we identified a virus, we would just be able stop all antibiotics and just treat the virus if effective antiviral therapy was available,” Dr. Griffin said. “We now know that we often need to continue antibiotics,” he explained, because sometimes the multiplex tests are not sensitive enough to rule out a bacterial culprit.

Doctors and test developers are still grappling with how many pathogens to test patients for in different settings. “A burning question at every company is what panel is best — is it one, two, four, 20?” said Dr. Mark Miller, chief medical officer at bioMérieux. Relatively young and healthy adults might just need a quad test to know if they should start on Tamiflu for influenza, for example, but patients with underlying chronic diseases who are very sick might benefit from receiving the test for 22 different pathogens so that doctors can decide whether they need to be admitted to a hospital.

Before the pandemic, people were not always as curious to know the exact pathogen causing respiratory symptoms, according to Dr. Alexandra Valsamakis, head of clinical development and medical affairs at Roche Diagnostics Solutions.

“I think there was always this perception of ‘Oh, whatever it is, it’s not going to kill us,’” Dr. Valsamakis said. But the terrible toll of Covid-19 has changed that. “There’s this need to actually know what’s there, more than there ever was before.”

<https://bit.ly/3w6ARag>

Bizarre Discovery Suggests Pink Drinks Make People Run Faster, But Why?

If you're going to gargle something next time you go for a run, here's some free advice: Try using a pink-colored drink.

[Peter Dockrill](#)

As strange as it sounds, pink drinks appear to be linked with enhanced running performance.

In a [new study](#), scientists found that runners who rinsed their mouths with a pink-colored liquid solution – as opposed to a clear, identical-tasting one – ran for longer and at a faster average speed, while having a more enjoyable running experience too.

“Adding a pink colorant to an artificially sweetened solution not only enhanced the perception of sweetness, but also enhanced feelings of pleasure, self-selected running speed, and distance covered during a run,” [explains](#) performance nutritionist Sanjoy Deb from the University of Westminster in the UK.

Before you make a beeline for the drinks aisle in your local supermarket, though, let's get some caveats out of the way.

This is a small study that only involved 10 participants in total, so bear that in mind.

Plus, as with any experiment like this, all the researchers found was an association with pink drinks – not definitive scientific confirmation that pink drinks actually cause your legs to move quicker or anything like that.

That said, the results are certainly suggestive that pink-colored drinks could be making a significant difference to people's overall running performance... so how exactly is that possible?

According to the researchers, the answers have to do with how our bodies respond to energy intake during exercise, even if it's only perceived energy intake.

Previous studies have already shown that performance in sports like

running and cycling seems to be enhanced when people use carbohydrate mouth rinses, with the stimulus thought to [deliver a boost](#) to areas in the brain involved with motor output and reward system functions – effects that may make exercise seem simultaneously [more pleasurable and less tiring](#).

[Caffeine](#) is another substance that can deliver [enhancements to physical performance](#), but the same kinds of benefits can be realized without actually consuming energy or stimulants, it seems.

As for the specific color pink, the team chose this based on previous research [that has demonstrated](#) we associate pink with sweetness.

"Although there may be no immediate link between drink color, taste perception and performance nutrition, if the color pink is [associated with perceived sweetness](#), and therefore expectations of sugar/carbohydrate intake, it may be plausible that the provision of a pink-colored mouth rinse during exercise may elicit a similar ergogenic [[performance-enhancing](#)] benefit to that of carbohydrate mouth rinse through a potential placebo effect," Deb and his co-authors [write in their new paper](#).

To test their [placebo effect](#) hypothesis, the researchers recruited 10 fit, healthy adults experienced with running as part of their regular exercise, and got them to run on a treadmill for 30 minutes, with instructions to set their own speed for a challenging workout.

At several times during the experiment, the volunteers were asked to rinse their mouths out with an artificially sweetened, non-caloric solution – either a clear liquid, or the same solution colored pink with a food dye (but otherwise identical to the clear drink).

That one simple addition made a notable difference to running performance, the researchers say, with the pink drink linked to an average speed boost of roughly 0.5 kilometers (about 0.3 miles) per hour, which in the experiment meant an extra 213 meters (almost 700 ft) being run, for an overall 4.4 percent improvement in

performance.

"An increase in feelings of pleasure was also reported during exercise in the pink mouth rinse condition, a potential psychophysiological mechanism which may have underpinned the performance improvement reported," [the authors write](#).

This mechanism, the researchers suggest, is underpinned by a placebo effect, in which the runners may have expected to receive an energy boost from potential sugar/carbohydrate consumption in the sweet-tasting mouth rinse they used.

It's worth noting that prior to the experiment, the participants did watch a video detailing the performance-enhancing benefits of carbohydrate mouth rinses, and were informed that the tests they were about to undertake were designed to measure the effects of mouth-rinsing two commercial sports drinks.

That was a ruse, of course, designed to 'blind' the volunteers to what the experiment was actually about.

But it also means they were perhaps primed for a placebo effect to happen – in a way that might be difficult to replicate at home by simply gargling pink-colored liquid when you go for a run. (Could still be worth a shot though!)

In any case, it's a pretty fascinating result, and one that the researchers say warrants further investigation in future studies – to see just how far this pink (and maybe other colored) placebo effect might extend in terms of potential performance enhancement during exercise and sport.

Oh, and if you are going to rinse your mouth with something when you exercise, maybe steer clear of actual mouthwash.

That has some [pretty weird effects, too](#).

The findings are reported in [Frontiers in Nutrition](#).

<https://bit.ly/2RT4Svs>

Rare fungal infections that destroy eyeballs and kill are on the rise in India

People with diabetes are particularly vulnerable to the aggressive fungus.
Beth Mole

As the pandemic coronavirus continues to ravage India, doctors are reporting a disturbing uptick in cases of a rare, potentially fatal fungal infection among people recovered or recovering from COVID-19.

The infection is called [mucormycosis](#), or sometimes “black fungus” in media reports, and it appears to be attacking COVID-19 patients through the nose and sinuses, where it can aggressively spread to facial bones, the eyes, and even the brain (rhinocerebral mucormycosis). In other cases, the fungus can also attack the lungs, breaks in the skin, and the gastrointestinal system or spread throughout the body in the blood stream.

A classic feature of mucormycosis is tissue necrosis—the death of flesh, essentially—which in the rhinocerebral form of the disease can lead to black, discolored lesions on the face, particularly on the bridge of the nose and the roof of the mouth. Mucormycosis is fatal in [around 50 percent](#) of cases.

If the fungus is able to spread to the eyes, patients may develop blurred vision, drooping eyelids, swelling, and vision loss. Patients may even need to have their [eyes surgically removed](#) to prevent the infection from spreading further, according to doctors who spoke to the BBC.

Dr. Akshay Nair, a Mumbai-based eye surgeon, told the BBC that he treated 40 patients with mucormycosis in April. Eleven of them needed to have an eye surgically removed.

The total number of mucormycosis cases in India is unclear, but media reports have tallied dozens to hundreds of cases. Dr. Renuka

Bradoo, head of the ear, nose, and throat wing of Sion Hospital in Mumbai, told the BBC that doctors there have seen 24 cases of mucormycosis in the past two months. Usually, they see only about six cases in a whole year.

Worse for diabetics

[A report in The New York Times](#) out of New Delhi relayed that local news media in the western state of Maharashtra, which includes Mumbai, had tallied around 200 cases. In the western state of Gujarat, state officials have reportedly ordered 5,000 doses of amphotericin B, an antifungal medicine used to treat mucormycosis. The startling increase in cases may be explained by India’s high number of people with diabetes, coupled with poor hygiene amid the critical COVID-19 surge, doctors speculate. Mucormycosis is known to strike people who have compromised immune systems, especially people with diabetes—and those with poorly controlled diabetes in particular.

Not only does diabetes dampen immune responses, welcoming invasive fungi, it also provides a comfortable environment for the infections. Mucormycosis is caused by mucormycetes, a ubiquitous group of molds that live in soil and decaying organic matter, like wood, leaves, and compost. These molds love iron-rich, acidic environments, and [diabetic ketoacidosis](#)—a complication of diabetes that causes the blood to become acidic—is a key risk factor for developing mucormycosis. [A literature review](#) published in the New England Journal of Medicine in 1999 estimated that about 50 percent of all cases of rhinocerebral mucormycosis occur in people with diabetes.

India doesn’t have exceptionally high rates of diabetes compared with other countries. But because of its population of over 1.36 billion people, the country has one of the highest raw totals of diabetes cases in the world, estimated to be [around 77 million people](#), second only to China. India also has some of the [highest](#)

[estimated levels of death and disability from diabetes](#), according to a study published in the journal *Scientific Reports* last year.

“Triple whammy”

Adding to this problem is the current COVID-19 crisis crippling India’s healthcare system. With hospitals overwhelmed, experts who spoke with the Times noted that many COVID-19 patients are being treated with oxygen at home without proper hygiene. Moreover, many COVID-19 patients are given powerful steroids—which further tamps down the immune system.

“You’ve got a high rate of mucormycosis, you’ve got a lot of steroids—maybe too much—being used, and then you’ve got diabetes, which is not being well controlled or managed,” David Denning, an expert in fungal infections at Manchester University, told the Associated press. It’s a “[triple whammy](#),” he said.

<https://bit.ly/3btks0F>

Ancestors may have created 'iconic' sounds as bridge to first languages

Our ancestors may have begun communicating with iconic sounds, rather than charades-like gestures

The 'missing link' that helped our ancestors to begin communicating with each other through language may have been iconic sounds, rather than charades-like gestures—giving rise to the unique human power to coin new words describing the world around us, a new study reveals.

It was widely believed that, in order to get the first languages off the ground, our ancestors first needed a way to create novel signals that could be understood by others, relying on visual signs whose form directly resembled the intended [meaning](#).

However, an international research team, led by experts from the University of Birmingham and the Leibniz-Center General Linguistics (ZAS), Berlin, have discovered that iconic vocalizations can convey a much wider range of meanings more accurately than

previously supposed.

The researchers tested whether people from different linguistic backgrounds could understand novel vocalizations for 30 different meanings common across languages and which might have been relevant in early [language](#) evolution.

These meanings spanned animate entities, including humans and animals (child, man, woman, tiger, snake, deer), inanimate entities (knife, fire, rock, water, meat, fruit), actions (gather, cook, hide, cut, hunt, eat, sleep), properties (dull, sharp, big, small, good, bad), quantifiers (one, many) and demonstratives (this, that).

The team [published their findings in *Scientific Reports*](#), highlighting that the vocalizations produced by English speakers could be understood by listeners from a diverse range of cultural and linguistic backgrounds. Participants included speakers of 28 languages from 12 [language families](#), including groups from oral cultures such as speakers of Palikúr living in the Amazon forest and speakers of Daakie on the South Pacific island of Vanuatu. Listeners from each language were more accurate than chance at guessing the intended referent of the vocalizations for each of the meanings tested.

Co-author Dr. Marcus Perlman, Lecturer in English Language and Linguistics at the University of Birmingham, commented: "Our study fills in a crucial piece of the puzzle of language evolution, suggesting the possibility that all languages—spoken as well as signed—may have iconic origins.

"The ability to use iconicity to create universally understandable vocalizations may underpin the vast semantic breadth of spoken languages, playing a role similar to representational gestures in the formation of signed languages."

Co-author Dr. Bodo Winter, Senior Lecturer in Cognitive Linguistics at the University of Birmingham, commented: "Our findings challenge the often-cited idea that vocalizations have

limited potential for iconic representation, demonstrating that in the absence of words people can use vocalizations to communicate a variety of meanings—serving effectively for cross-cultural communication when people lack a common language."

An online experiment allowed researchers to test whether a large number of diverse participants around the world were able to understand the vocalizations. A field experiment using 12 easy-to-picture meanings, allowed them to test whether participants living in predominantly oral societies were also able to understand the vocalizations.

They found that some meanings were consistently guessed more accurately than others. In the online experiment, for example, accuracy ranged from 98.6% for the action 'sleep' to 34.5% for the demonstrative 'that'. Participants were best with the meanings 'sleep', 'eat', 'child', 'tiger', and 'water', and worst with 'that', 'gather', 'dull', 'sharp' and 'knife'.

The researchers highlight that while their findings provide evidence for the potential of iconic vocalizations to figure in the creation of original spoken words, they do not detract from the hypothesis that iconic gestures also played a critical role in the evolution of human communication, as they are known to play in the modern emergence of signed languages.

<https://lat.ms/3tOUK3E>

Doctors fear COVID-19 vaccines are messing with mammograms

Lymph nodes enlarged by the immune system's response to a COVID-19 vaccine are virtually always a sign that the shot is doing its job

By [Melissa Healy](#) Staff Writer

After more than a year of anxious waiting, women newly vaccinated against COVID-19 are flocking back to mammography clinics to catch up on routine tests that were delayed by the

pandemic. In some cases, they're met with one more pandemic surprise: a false red flag for breast cancer.

Like a sore arm or slight fever, lymph nodes enlarged by the immune system's response to a COVID-19 vaccine are virtually always a sign that the shot is doing its job. But to the medical specialists who scour mammograms for signs of malignancy, the unexplained appearance of swollen lymph nodes has typically sparked concern and a recommendation that the patient be called back for further testing. The result has been new uncertainties for women and the doctors who care for them.

If it's a false alarm, women certainly don't need the worry-inducing call reporting an "abnormal reading" on their mammogram. And few welcome the additional tests that tend to follow. But as much as doctors wish to spare their patients unnecessary angst, they also want to avoid missing a signal that could be important.

"It's a bit of a balancing act," said [Dr. Lisa Mullen](#), a breast imaging specialist at Johns Hopkins University School of Medicine in Baltimore. With many basic questions about the rash of enlarged lymph nodes still unanswered, the world of breast cancer screening has been forced to call some audibles.

The radiologists who scour mammograms for signs of cancer are not easily rattled. They examine thousands of breast images each week and make lots of judgment calls.

It's not very often they are downright flummoxed.

On a typical pre-pandemic day, [Dr. Hannah Milch](#) at UCLA Medical Center might have seen one screening mammogram ambiguous enough to recommend further testing. And those cases rarely involved swollen lymph nodes in a woman without a notable risk for breast cancer.

In fact, radiologists say those "axillary" lymph nodes are usually elusive. [Studies](#) have shown that no more than .04% of mammograms reveal enlarged lymph nodes in women with no

other sign of illness or malignancy. Tucked into the armpit, they are more likely to recede from a mammogram image than to photobomb it.

But after COVID-19 vaccines [began to roll out](#), and healthcare workers and older women (the ones at greatest risk of breast cancer) began to pour in for mammograms, Milch started recommending callbacks five to seven times per day. In most cases, they were for “adenopathy” — lymph nodes that seemed unusually enlarged.

Milch’s colleagues reading mammograms across the country were seeing the same thing. “I thought, ‘What is going on here?’” she said. “It definitely stimulated conversation.”

An unheralded piece of human anatomy, the body’s [lymphatic system](#) plays a key role in collecting and removing cellular debris from the body. Like rubbish bins set out along well-traveled corridors, the lymph nodes will bulge noticeably if some unusual process is generating more trash than usual.

When the body is fighting an infection — or thinks it is, after a dose of vaccine — the immune system dispatches an army of cells and proteins to mount a defense, leaving a lot of detritus in its wake. Cancer, too, mobilizes a lot of cellular machinery. It uses the lymphatic system to travel to distant sites and leaves behind a telltale mess.

Close to both the breast and whichever arm gets a jab of vaccine, the 10 to 20 lymph nodes inside each armpit can act as a sentinel when radiologists see signs that they are swollen. But whether a node is enlarged due to infection, vaccine, trauma or cancer is not always clear.

To gain clarity on that life-or-death question, a woman is usually called back for an ultrasound or a biopsy, in which tissue is removed from the breast for further testing.

Getting that call “strikes fear in the heart” of the woman who gets it, said [Dr. Philip M. Bretsky](#), a Santa Monica primary care doctor.

“It’s like getting an abnormal pap smear: You hear it, and then everything else goes blank.”

With COVID-19 vaccine now widely available and coronavirus cases declining, Bretsky has been urging his patients to get current on their breast cancer screenings. But he’s made a point of warning them that if they do get a callback after a mammogram, the culprit is far more likely to be a recent immunization than cancer.

Radiologists have long known that a recent dose of vaccine for shingles, tetanus or flu can cause lymph nodes to appear slightly swollen. But the sudden appearance of so many swollen lymph nodes, in so many women, came as a shock. In many cases, so was the size of the swelling.

“They seemed to be more prominent,” said [Dr. Constance Lehman](#), chief of breast imaging at Massachusetts General Hospital in Boston. “We had seen mildly enlarged nodes with prior vaccinations but not to this degree.”

The arrows point to abnormally enlarged lymph nodes in the armpit near the left breast and in the breast itself. The patient received a dose of Moderna’s COVID-19 vaccine 12 days earlier. Radiological Society of North America

They also tended to be much bigger in one armpit than in the other. In one woman, the swelling would be seen only in the left axilla. In another, it would be all in her right. “It was the craziest thing,” Lehman said. “Everybody said, ‘What’s *this*?’”

[Dr. Devon Quasha](#) has been on both sides of the emerging discussion. A primary care physician at Massachusetts General, she got a jab of Moderna’s COVID-19 vaccine in her left arm in early January. Ten days later, she had a medical workup to investigate pain in her breasts she had noticed while nursing her daughter.

Her mammogram revealed some very enlarged lymph nodes in her left breast. They were hard to miss and potentially worrisome. Her



colleagues in radiology furrowed their brows and asked her more questions. When she recalled when she'd gotten the COVID-19 vaccine, and in which arm, they offered reassurances and suggested a follow-up after a few weeks.

Quasha became her hospital's first case of what she called "post-COVID vaccine adenopathy." Even so, she urges her own patients to get vaccinated and to get their mammograms as soon as they're due. But, she tells them, "be forewarned that if you've had your vaccine recently, there might be some findings that we're coming to understand are likely benign."

Enlarged lymph nodes were showing up in scans of other parts of the body too, Lehman said. Doctors in radiology practices everywhere were finding the swollen nodes in imaging studies of the heads, necks and pelvises of recently vaccinated people.

By late February, [articles](#) in specialty journals began to [detail](#) what radiologists were seeing. And by mid-spring, expert panels had been convened by the [Radiological Society of North America](#) and the [Society of Breast Imaging](#).

Women should be asked if they've been vaccinated against COVID-19, how recently and in which arm they got their jab, the experts advised. If possible, women should plan a screening mammogram at least six weeks following her second dose of vaccine. Women who have had a previous breast cancer should get their shot in the opposite arm. (Enlarged axillary lymph nodes could probably be avoided by getting the shot of vaccine in the thigh instead of the upper arm, Lehman noted.)

And in the absence of other evidence pointing to the possibility of cancer, recently- vaccinated women with enlarged axillary lymph nodes should be called back at least six weeks later to give the lymph nodes time to recover.

Not all mammography practices have taken the recommendations to heart. Some advise women without breast complaints to put four to

six weeks between a dose of COVID-19 and a screening mammogram. Others, wary of discouraging women from getting either the vaccine or a mammogram, are urging women to come in as soon as they can.

While the members of both expert panels acted quickly to issue their recommendations, they acknowledged that the advice amounted to "expert opinion without data," said Milch, who was among the authors of the Society of Breast Imaging recommendations.

The new guidance was largely based on anecdotal evidence generated in response to the Pfizer-BioNTech and Moderna vaccines. It's not clear yet whether Johnson & Johnson's single-dose vaccine will evoke the same response.

Nor is it clear how long it will take for the swelling in some women's lymph nodes to abate or whether their reactions will be more pronounced after the second shot than after a first.

Radiologists wonder whether some configurations of swollen lymph nodes can be dismissed lightly, while others warn of something more ominous. And they wonder how women's lymph nodes will respond to COVID-19 boost shots, if those prove necessary. "There's a lot that's unknown," Mullen said.

One message is clear: If a woman has felt a lump in her breast or is experiencing soreness in or around her breast or discharge from her nipple, she should get her symptoms assessed right away.

Here, too, radiologists are quick to point out that the enlarged nodes they are seeing do not amount to a link between the vaccine and breast cancer.

"I see no connection whatsoever," Lehman said. "There is not one bit of evidence that would even suggest that."

On the contrary, she said, "I like to think of this as a good thing: In response to vaccine, the immune system is doing the work it's designed to do."

After a year in which screening mammography [declined](#) by at least 20% from recent levels — and when there's growing evidence that patients are being diagnosed with more advanced cancers as a result — women certainly should not skip their mammograms after getting the COVID-19 vaccine, doctors said. Nor should they skip the vaccine for the sake of a mammogram.

"The truth is, this is something that has always occurred," Milch said. Only the scale of the phenomenon has been magnified.

<https://bit.ly/3tHTOhT>

There may be up to 70 times more hydrogen in Earth's core than in the oceans

High-temperature and high-pressure experiments demonstrate that hydrogen can bond strongly with iron in extreme conditions

High-temperature and high-pressure experiments involving a diamond anvil and chemicals to simulate the core of the young Earth demonstrate for the first time that hydrogen can bond strongly with iron in extreme conditions. This explains the presence of significant amounts of hydrogen in the Earth's core that arrived as water from bombardments billions of years ago.

Given the extreme depths, temperatures and pressures involved, we are not physically able to probe very far into the [earth](#) directly. So, in order to peer deep inside the Earth, researchers use techniques involving [seismic data](#) to ascertain things like composition and density of subterranean material. Something that has stood out for as long as these kinds of measurements have been taking place is that the [core](#) is primarily made of iron, but its density, in particular that of the liquid part, is lower than expected.

This led researchers to believe there must be an abundance of light elements alongside the iron. For the first time, researchers have examined the behavior of water in laboratory experiments involving metallic iron and silicate compounds that accurately simulate the metal-silicate (core-mantle) reactions during Earth's formation.

They found that when water meets iron, the majority of the hydrogen dissolves into the metal while the oxygen reacts with iron and goes into the silicate materials.

"At the temperatures and pressures we are used to on the surface, hydrogen does not bond with iron, but we wondered if it were possible under more [extreme conditions](#)," said Shoh Tagawa, a Ph.D. student at the Department of Earth and Planetary Science at the University of Tokyo during the study. "Such extreme temperatures and pressures are not easy to reproduce, and the best way to achieve them in the lab was to use an anvil made of diamond. This can impart pressures of 30–60 gigapascals in temperatures of 3,100–4,600 kelvin. This is a good simulation of the Earth's core formation."

Isotope imaging lab at Hokkaido University. The research was a collaboration between institutions, including Hokkaido University. Credit: Hisayoshi Yurimoto

The team, under Professor Kei Hirose, used metal and water-bearing silicate analogous to those found in the Earth's core and mantle, respectively, and compressed them in the diamond anvil whilst simultaneously heating the sample with a laser. To see what was going on in the sample, they used high-resolution imaging involving a technique called secondary ion mass spectroscopy. This allowed them to confirm their hypothesis that [hydrogen bonds](#) with iron, which explains the apparent lack of ocean water. Hydrogen is said to be [iron](#)-loving, or siderophile.

Sample from high-pressure experiment. High-resolution chemical analyses with secondary ion mass spectroscopy showed the abundance of water left in silicate melt after compressing with liquid iron metal. Credit: Tagawa et al.

"This finding allows us to explore something that affects us in quite a profound way," said Hirose. "That hydrogen is siderophile under high pressure tells us that much of the water that came to Earth in

mass bombardments during its formation might be in the core as hydrogen today. We estimate there might be as much as 70 oceans' worth of [hydrogen](#) locked away down there. Had this remained on the surface as [water](#), the Earth may never have known land, and life as we know it would never have evolved."

More information: Shoh Tagawa et al. *Experimental evidence for hydrogen incorporation into Earth's core*, *Nature Communications* (2021). [DOI: 10.1038/s41467-021-22035-0](#)

<https://go.nature.com/33Npx6Q>

Voyager 1 captures faint ripples in the stuff between the stars

The first spacecraft to visit interstellar space has now become the first to make continuous measurements of waves in that remote realm.

The Voyager 1 spacecraft has detected persistent ripples in the interstellar plasma, through which it has been travelling since it left the Solar System in 2012. By measuring these waves, astrophysicists have made the first continuous measurements of the density of the interstellar plasma, the rarefied medium between the stars.

Launched by NASA 44 years ago, Voyager 1 became the first human-made object to enter interstellar space — the region between star systems — and is still motoring along. Stella Ocker at Cornell University in Ithaca, New York, and her collaborators detected the interstellar-plasma waves by examining regular variations that Voyager recorded in the electric field it encounters as it flies away from the Solar System.

The waves consist of displacements between the plasma's two components: positively charged ions and negatively charged electrons. Despite this displacement, the plasma tends to stay put and the waves go in no particular direction — like the stationary ripples in a lake on a windy day, Ocker says.

In the past, astrophysicists had made similar measurements of interstellar-plasma waves that had been triggered by solar events, but this is the first time that they have measured plasma density continuously.

Nat. Astro. (2021)

<https://bit.ly/3bxcjPQ>

What is mucormycosis, the fungal infection affecting COVID patients in India?

This week we've seen reports of an infection called mucormycosis, often termed "[black fungus](#)", in patients with COVID, or who are recovering from COVID, in India.

Monica Slavin¹ Karin Thursky²

Fungal infections can be devastating. And in this case mucormycosis is adding to the burden of suffering in a country already in a deep COVID crisis.

As of March this year [41 cases](#) of COVID-19-associated mucormycosis had been documented around the world, with 70% in India. Reports suggest the [number of cases](#) is now much higher, which is unsurprising given the current wave of COVID infections in India.

But what is mucormycosis, and how is it linked with COVID-19?

What is mucormycosis?

Mucormycosis, formerly known as zygomycosis, is the disease caused by the many fungi that belong to the fungal family "[Mucorales](#)".

Fungi in this family are usually found in the environment (for example, in soil) and often associated with decaying organic material such as fruit and vegetables.

The member of this family which most often causes infection in humans is called [Rhizopus oryzae](#). In India though, another family member called [Apophysomyces](#), found in tropical and subtropical climates, is also common.

In the lab, these fungi grow rapidly and have a black/brown fuzzy

appearance. The family members causing human disease grow well [at body temperature](#) and in an acidic environment (seen when tissue is dead or dying or with uncontrolled diabetes).

How do you get mucormycosis?

Mucorales are considered opportunistic fungi, meaning they [usually infect people](#) with an impaired immune system, or with damaged tissue. Use of drugs which suppress the immune system such as corticosteroids can lead to impaired immune function, as can a range of other immunocompromising conditions, like [cancer or transplants](#). Damaged tissue can occur after trauma or surgery.

There are three ways humans can contract mucormycosis — by inhaling spores, by swallowing spores in food or medicines, or when spores contaminate wounds.

Inhalation is most common. We actually [breathe in](#) the spores of many fungi every day. But our immune system and healthy lungs generally prevent them from causing an infection.

When the lungs are damaged and the immune system is suppressed, such as is the case in patients with severe COVID, these spores can grow in our airways or sinuses and invade our bodies' tissue.

Mucormycosis can manifest in the lungs, but the [nose and sinuses are the most common site](#) of mucormycosis infection. From there it can spread to the eyes, potentially causing blindness, or the brain, causing headache or seizures.

It can also affect the skin. Life-threatening wound infections have been seen after injuries sustained during [natural disasters](#) or on [battle fields](#) where wounds have been contaminated by soil and water.

In the environment

We haven't seen mucormycosis infections associated with COVID in Australia, and there have been very few in [other countries](#). So why is the situation in India so different?

Before the pandemic, mucormycosis was already [far more common](#)

in India than in any other country. It affects an estimated [14 per 100,000 people](#) in India compared to 0.06 per 100,000 in Australia, for example. Globally, outbreaks of mucormycosis have occurred due to contaminated products such as [hospital linens, medications and packaged foods](#). But the widespread nature of the reports of mucormycosis in India suggests it's not coming from a single contaminated source.

Mucorales [can be found](#) in soil, rotting food, bird and animal excretions, water and air around construction sites, and moist environments.

Although never compared, it may be that in Australia we have a lower environmental burden of Mucorales than in India.

Mucormycosis and diabetes

When diabetes is poorly controlled, blood sugar is high and the tissues relatively acidic — a good environment for Mucorales fungi to grow. This was [identified](#) as a risk for mucormycosis in India (where diabetes is increasingly prevalent and often uncontrolled) and [worldwide](#) well before the COVID pandemic.

Of all mucormycosis cases published in scientific journals globally between 2000-2017, [diabetes was seen in 40%](#) of cases. A recent [summary](#) of COVID-19-associated mucormycosis showed 94% of patients had diabetes, and it was poorly controlled in 67% of cases.

A perfect storm

People with diabetes and obesity tend to develop more [severe COVID infections](#). This means they're more likely to receive corticosteroids, which are frequently used to treat COVID-19. But the corticosteroids — along with their diabetes — increase the risk of mucormycosis.

Meanwhile, COVID itself can damage airway tissue and blood vessels, which could also increase susceptibility to fungal infection. So damage to tissue and blood vessels from COVID infection, treatment with corticosteroids, high background rates of diabetes in

the population most severely affected by COVID, and, importantly, more widespread exposure to the fungus in the environment are all likely to be playing a part in the situation we're seeing with mucormycosis in India.

Treatment challenges

In Australia, as in many other Western countries, we've seen increased cases of another fungal infection, [Aspergillosis](#), in patients who had severe COVID infections, needed intensive care management and received corticosteroids. This fungus is found in the environment but belongs to a different family.

As Aspergillosis is the [most common opportunistic fungus globally](#), we have tests to rapidly diagnose this infection. But this is not the case with mucormycosis.

For the many patients affected with mucormycosis, the outcome is poor. About half of patients affected [will die](#) and many will sustain permanent damage.

Diagnosis and intervention as early as possible is important. This includes control of blood sugar, urgent removal of dead tissue, and antifungal drug treatment.

But unfortunately many infections [will be diagnosed late](#) and [access to treatment limited](#). This was the case in India prior to COVID and the current demands on the health system will only make things worse.

Controlling these fungal infections will require increased awareness, better tests to diagnose them early, a focus on controlling diabetes and using corticosteroids wisely, access to timely surgery and antifungal treatment, and more research into prevention.

¹ Head, Department Infectious Diseases, Peter MacCallum Cancer Centre, Peter MacCallum Cancer Centre

² Professor, The Peter Doherty Institute for Infection and Immunity

Disclosure statement

Monica Slavin receives funding from NHMRC and MRFF.

Karin Thursky receives funding from NHMRC

<https://bit.ly/3w8CGn5>

Complete genome of the raccoon dog

For the first time the assembled and annotated complete genome of the raccoon dog!

A study, in which the UPV/EHU-University of the Basque Country participated, has for the first time assembled and annotated the complete genome of the raccoon dog, a species originating in East Asia but introduced into Europe, where it has settled. The work will provide a reference for future evolutionary, ecological, carnivore-based studies that involve gene-disease association and chromosome architecture.

The ongoing technological development of DNA sequencing, as well as the remarkable reduction in data production costs, have led to a boom in recent years in the sequencing of whole genomes of various organisms.

In a recent paper now published in *Frontiers in Genetics*, the complete [genome](#) of the raccoon dog (*Nyctereutes procyonoides*), a close relative of the fox (*Vulpes vulpes*), has been assembled and annotated for the first time. This [species](#) originated in East Asia, but due to a fur-breeding interest it has since the 1940s been introduced into Europe where it has become established. Although the most southerly populations detected so far are in France, the distribution modeling of the species indicates that the raccoon dog could colonize the Iberian Peninsula over the next 20 years. This [invasive species](#) is of great importance from a public health point of view as it is known to be a reservoir and vector of numerous diseases that can affect humans, including COVID-19.

Long, third-generation sequencing (PacBio and Oxford Nanopore Technologies) as well as state-of-the-art bioinformatics techniques for gene prediction and annotation have been used to assemble the genome. The main challenges faced by the research have been the raccoon dog's complex chromosome structure, which is

characterized by the display of unusually large telomeres and centromeres, plus the presence of a variable number of B-type chromosomes. All these elements are characterized by non-coding, repetitive DNA regions, which are very difficult to sequence and subsequently study.

The size of the genome obtained in the study is 2.39 gigabases, in which more than 27,000 genes have been identified and annotated. In addition, 39% of the assembled genome is made up of repetitive regions, although this may be an underestimate due to these complex repetitive regions. On the other hand, although the divergence between the [raccoon](#) dog and the wolf is estimated to be around 12 million years, a greater than expected similarity between the structure and composition of the genomes of the two species has been detected.

Dr. Luis Javier Chueca, lead researcher in this study, says, "The genome presented in the publication will provide a reference for future evolutionary, ecological, carnivore-based studies involving gene-disease association and chromosome architecture."

More information: Luis J. Chueca et al. *De novo Genome Assembly of the Raccoon Dog (Nyctereutes procyonoides)*, *Frontiers in Genetics* (2021). [DOI: 10.3389/fgene.2021.658256](https://doi.org/10.3389/fgene.2021.658256)

<https://bit.ly/3ePSvcu>

Rare plutonium from space found in deep-sea crust

The plutonium-244 hints at how heavy metals form in stars.

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

A rare version of the radioactive element [plutonium](#) embedded in Earth's crust below the deep sea is providing new clues as to how heavy metals form in the stars. The new research finds that the isotope, called plutonium-244, may arrive on [Earth](#) in tandem with iron-60, a lighter metal known to form in supernovas, explosions that occur during the death throes of many types of stars. This finding suggests that supernovas may create both heavy metals — although it's possible that other events, such as the mergers of

[neutron stars](#), are responsible for at least some of the plutonium-244. Understanding how heavy elements formed is one of the top three most burning questions in physics, said Anton Wallner, a nuclear physicist at the Australian National University and the Helmholtz Center Dresden-Rossendorf, a research center in Germany. Half of elements heavier than iron are built in the hearts of stars through a fairly well-understood process of [fusion](#). The other half, though, requires a high density of free neutrons to form. This means they must form in a [more explosive environment](#) than a typical star core — supernovas, perhaps, or massive events such as a neutron-star merger or a collision of a [black hole](#) and a neutron star.

Along with collaborators in Japan, Australia and Europe, Wallner was interested in finding out if he could discover fingerprints of these celestial events on Earth. There are some radioactive versions of heavy metals that don't occur naturally on the planet.

In particular, the researchers were on the hunt for plutonium-244, a variation of plutonium with a half-life of 80.6 million years. This means it takes 80.6 million years for radioactive decay to eat away at half of the initial plutonium produced. Any plutonium-244 originally present during Earth's formation has long since decayed, so any atoms the researchers could find would have to be extraterrestrial in origin. "Can we find plutonium-244 on Earth?" Wallner said. "Then we know it's coming from space."

Rare metals

To hunt for these rare atoms, the researchers turned to samples of Earth's crust from nearly 5,000 feet (1,500 meters) below the Pacific Ocean. These rocks form so slowly that a millimeter of crust records 400,000 years of history, Wallner told Live Science. The sample covered the past 10 million years.

The researchers then probed the samples for iron-60 — the extraterrestrial version of iron that forms in supernovas — and for plutonium-244. They found both.

It was no surprise to find iron-60, Wallner said, as previous research had already shown fluctuations in iron-60 levels in deep-sea sediments and crust over time. The findings confirmed what researchers had previously suspected: There were two increases in iron-60 — one that occurred between 4.2 million and 55 million years ago, and one that happened sometime before 7 million years ago. These influxes of the metal may have been the result of two fairly nearby supernovas, Wallner said.

"The supernova that happened and produced the iron-60 must have been spectacular at the time," he said. "It must have been similar [in brightness] to the full moon, so you would see it even in daytime."

In the past, the researchers did not have sensitive enough methods to accurately count the extremely rare atoms of plutonium-244 scattered in Earth's crust. But in the new study, using cutting-edge technology and methods, they did. The timing of this extraterrestrial plutonium's arrival on Earth is a bit harder to pin down, as the researchers had to search layers of crust corresponding to between 3 million and 5 million years of history. However, the influx of plutonium-244 did correlate with the influx of iron-60.

"The ratio of plutonium-244 to iron-60 seems to be constant," Wallner said. This suggests that both might come from a common origin.

Forged in stars

Although the coordinated arrival of plutonium-244 and iron-60 suggests that both could have come from supernovas, a lot of questions remain. Computer models that attempt to mimic the formation of elements within supernovas really struggle to generate [heavy-element formation](#), Wallner said. The ratio of iron-60 to plutonium-244 found in the new study suggests that the plutonium-244 would be a lot less prevalent than iron-60 after the stellar explosion, perhaps just a small percentage of the total elements formed.

It's also possible, Wallner noted, that the plutonium-244 atoms discovered in the deep-sea crust didn't come from a supernova at all. The plutonium-244 could have been formed in an earlier event and may have been floating aimlessly in deep space when a blast of iron-60 whooshed through, pushing the heavier plutonium-244 along with it. In that situation, both elements would have arrived on Earth at the same time, but the plutonium-244 would be a lot older.

To explore that possibility, the researchers want to look at different classes of atoms with different half-lives. The half-lives act like a clock so that scientists can determine a range of estimates for the ages of the elements. If the plutonium-244 were found in concert with an element of a much shorter half-life, for example, it would suggest that both were younger and fresher. It would also suggest that the amount of plutonium-244 produced in a supernova was lower and that more of it may have come from other events, like a neutron-star merger.

The research team is already studying a piece of crust 10 times larger than the one in this research. Having a larger piece of crust will allow researchers to expand their search for plutonium-244 atoms and get a more precise timeline of when those atoms arrived on Earth.

This image shows SN2014J, one of the closest type Ia supernovas in recent decades. Star explosions like these are thought to generate heavy metals.

(Image credit: NASA, ESA, A. Goobar (Stockholm University), and the Hubble Heritage Team)

"What is fascinating is that you find some six or 10 atoms which you can identify in the end as not from Earth but from space, and then you get some hints about where it had been produced and when it had been produced," Wallner said.

The research was published today (May 13) in the journal [Science](#).



<https://bit.ly/2RU3OPS>

COVID-19's Origins Need Further Investigation, Say Scientists

A letter signed by 18 researchers argues that hypotheses about zoonotic spillover or accidental lab release both “remain viable” in the absence of additional evidence.

[Catherine Offord](#)

Deeper investigation is needed to find out where SARS-CoV-2 came from, according to a letter signed by 18 scientists from various institutions in North America and Europe. Published today (May 14) in [Science](#), the letter notes that the available evidence about the virus' origins doesn't allow researchers to rule out either the hypothesis that the virus [spilled over](#) from animals, or the idea that it was accidentally released from a laboratory.

“We must take hypotheses about both natural and laboratory spillovers seriously until we have sufficient data,” the authors write. “A proper investigation should be transparent, objective, data-driven, inclusive of broad expertise, subject to independent oversight, and responsibly managed to minimize the impact of conflicts of interest.”

Officials at the World Health Organization (WHO) have previously called the theory that SARS-CoV-2 escaped from a lab in Wuhan “extremely unlikely.” Instead, investigators from the organization who spent nearly a month in Wuhan researching the outbreak's origins favored the hypothesis that the virus originated in an animal species and spilled over into humans, perhaps via an intermediate host. A number of virologists have concurred with this view.

However, in a statement in March, WHO Director General Tedros Adhanom Ghebreyesus noted that, although it was still unlikely that the novel coronavirus had come from a lab leak, more research was needed to conclusively rule the theory out, according to [BBC News](#). The WHO-convened investigation has been criticized by the US

and other countries. A March 30 [statement](#) on behalf of the governments of the US, UK, Australia, and a number of other countries described “shared concerns that the international expert study on the source of the SARS-CoV-2 virus was significantly delayed and lacked access to complete, original data and samples. Scientific missions like these should be able to do their work under conditions that produce independent and objective recommendations and findings.”

Citing this statement, the authors of the *Science* letter say that “greater clarity” is needed on the origins of the pandemic. They call for public health agencies and research laboratories to make their records public, and for investigators' analyses to be replicated by “independent experts.”

Responding to the publication of the letter, virologist Angela Rasmussen of the University of Saskatchewan's Vaccine and Infectious Disease Organization tells [The New York Times](#) that she supports additional research on COVID-19's origins, but adds that the lab-leak theory has become politicized and does not represent the most likely scenario. “There is more evidence (both genomic and historical precedent) that this was the result of zoonotic emergence rather than a laboratory accident,” she tells the *Times*.

<https://bit.ly/3okmEUq>

Our dreams' weirdness might be why we have them, argues new AI-inspired theory of dreaming

The overfitted brain hypothesis suggests that the strangeness of our dreams serves to help our brains better generalize our day-to-day experiences

The question of why we dream is a divisive topic within the scientific community: it's hard to prove concretely why dreams occur and the neuroscience field is saturated with hypotheses.

Inspired by techniques used to train deep neural networks, Erik Hoel (@erikphoel), a research assistant professor of neuroscience at

Tufts University, argues for a new theory of dreams: the overfitted brain hypothesis. The hypothesis, described May 14 in a review in the journal *Patterns*, suggests that the strangeness of our dreams serves to help our brains better generalize our day-to-day experiences.

"There's obviously an incredible number of theories of why we dream," says Hoel. "But I wanted to bring to attention a theory of dreams that takes dreaming itself very seriously--that says the experience of dreams is why you're dreaming."



This illustration represents the overfitted brain hypothesis of dreaming, which claims that the sparse and hallucinatory quality of dreams is not a bug, but a feature, since it helps prevent the brain from overfitting to its biased daily sources of learning Credit: Georgia Turner

A common problem when it comes to training AI is that it becomes too familiar with the data it's trained on--it starts to assume that the training set is a perfect representation of anything it might encounter. Data scientists fix this by introducing some chaos into the data; in one such regularization method, called "dropout," some data is randomly ignored. Imagine if black boxes suddenly appeared on the internal screen of a self-driving car: the car that sees the random black boxes on the screen and focuses on overarching details of its surroundings, rather than the specifics of that particular driving experience, will likely better understand the general experience of driving.

"The original inspiration for deep neural networks was the brain," Hoel says. And while comparing the brain to technology is not new, he explains that using deep neural networks to describe the overfitted brain hypothesis was a natural connection. "If you look at

the techniques that people use in regularization of deep learning, it's often the case that those techniques bear some striking similarities to dreams," he says.

With that in mind, his new theory suggests that dreams happen to make our understanding of the world less simplistic and more well-rounded--because our brains, like deep neural networks, also become too familiar with the "training set" of our everyday lives. To counteract the familiarity, he suggests, the brain creates a weirded version of the world in dreams, the mind's version of dropout. "It is the very strangeness of dreams in their divergence from waking experience that gives them their biological function," he writes.

Hoel says that there's already evidence from neuroscience research to support the overfitted brain hypothesis. For example, it's been shown that the most reliable way to prompt dreams about something that happens in real life is to repetitively perform a novel task while you are awake. He argues that when you over-train on a novel task, the condition of overfitting is triggered, and your brain attempts to then generalize for this task by creating dreams.

But he believes that there's also research that could be done to determine whether this is really why we dream. He says that well-designed behavioral tests could differentiate between generalization and memorization and the effect of sleep deprivation on both.

Another area he's interested to explore is on the idea of "artificial dreams." He came up with overfitted brain hypothesis while thinking about the purpose of works of fiction like film or novels. Now, he hypothesizes that outside stimuli like novels or TV shows might act as dream "substitutions"--and that they could perhaps even be designed to help delay the cognitive effects of sleep deprivation by emphasizing their dream-like nature (for instance, by virtual reality technology).

While you can simply turn off learning in artificial neural networks,

Hoel says, you can't do that with a brain. Brains are always learning new things--and that's where the overfitted brain hypothesis comes in to help. "Life is boring sometimes," he says. "Dreams are there to keep you from becoming too fitted to the model of the world."

Erik Hoel is also the author of The Revelations, a novel publishing April 6 from Abrams Books: https://www.abramsbooks.com/product/revelations_9781419750229/. Patterns, Hoel: "The Overfitted Brain: Dreams evolved to assist generalization" [https://www.cell.com/patterns/fulltext/S2666-3899\(21\)00064-7](https://www.cell.com/patterns/fulltext/S2666-3899(21)00064-7)

<https://bit.ly/3yeTmeM>

Pigs And Rodents Can Breathe Through Their Butts, And This Could Be a Vital Discovery

According to new research, rodents and pigs can also respire through their butts

[Michelle Starr](#)

As you're sitting there, reading these words, you're probably breathing.

Down the air goes, into your lungs, via the upper respiratory tract that includes your mouth and nose; up it comes again, back out the same way, after delivering its precious oxygen payload.

This, we assume, is how most mammals breathe - but maybe it's not actually the complete picture. According to new research, rodents and pigs can also respire through their butts.

Technically, delivery of oxygen via their rectal intestines suggests a new, enema-like means of ventilating patients under respiratory distress - if the same strange ability can be demonstrated in humans. Intestinal respiration sounds extremely weird, but it's actually been known about for some time - in fish, anyway.

In emergency low oxygen, or hypoxic, conditions, some aquatic animals such as sea cucumbers, freshwater catfish, and freshwater loaches can maximize their oxygen intake by breathing through their guts.

Naturally, this raised the fascinating question of whether other animals can do the same - including mammals.

Although it seemed unlikely, a team of Japanese and American scientists led by thoracic surgeon Ryo Okabe of Kyoto University decided to try and find out, in the hopes of determining the feasibility of rectal ventilators for human patients.

"Artificial respiratory support plays a vital role in the clinical management of respiratory failure due to severe illnesses such as [pneumonia](#) or acute respiratory distress syndrome," [said gastroenterologist Takanori Takebe](#) of the Tokyo Medical and Dental University and the Cincinnati Children's Hospital Medical Center.

"Although the side effects and safety need to be thoroughly evaluated in humans, our approach may offer a new paradigm to support critically ill patients with respiratory failure."

As the team points out, standard medical options for patients with respiratory failure rely on mechanical ventilation or artificial lung systems; however, the current [pandemic](#) has resulted in a critical shortage of such devices, and a safe alternative method could provide life-saving additional support for patients in dire situations.

However, this next part is not for the squeamish.

Initially, their research subjects were mice, who were thankfully anesthetized for the next part.

The researchers developed an oxygen ventilation system to be inserted anally; they induced hypoxia via tracheal intubation, and compared mice ventilated intestinally to control mice who received no ventilation. Of the control mice, not a single one survived longer than 11 minutes.

This was in marked contrast to the mice receiving intestinal oxygen, 75 percent of which survived for 50 minutes.

That's a fascinating result, but it required abrasion of the intestinal mucosa in order to achieve the most efficient oxygen delivery to the gut [lumen](#).

The mouse group that received intestinal ventilation without

abrasion had a median survival time of just 18 minutes.

Gut abrasion is unlikely to be feasible for human patients - especially human patients ill enough for intestinal ventilation to be an option - so the team went looking for alternatives.

They turned to liquid perfluorochemicals, a class of chemicals in which the hydrogen atoms have been replaced with fluorine.

These have several properties that make them a good prospect for ventilation, including their high gas solubility, as well as their physical properties.

In the past, patients undergoing respiratory distress have been treated using liquid perfluorochemicals by partially filling their lungs to facilitate oxygen transfer, [with varying degrees of success](#).

Perfluorochemicals have been deemed clinically safe for this purpose. So, the team tried enriching a perfluorocarbon with oxygen, and using that to treat mice, rats and pigs.

The mice were placed in a low-oxygen chamber; those treated with the perfluorocarbon ventilation were able to walk for longer than untreated mice, and more oxygen reached their hearts.

Rats were also treated to assess whether their bodies absorbed the perfluorochemical, to determine its safety. Finally, using perfluorochemical intestinal ventilation, respiratory distress was reduced in anesthetized pigs under non-lethal hypoxic conditions.

When treated, their skin grew warm and flushed, and their oxygen levels increased, without obvious side effects.

It's unclear if a similar approach would work for humans, but the team is optimistic.

"The level of arterial oxygenation provided by our ventilation system, if scaled for human application, is likely sufficient to treat patients with severe respiratory failure, potentially providing life-saving oxygenation," [Takebe said](#).

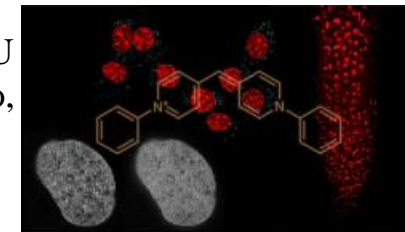
The research has been published in [Med](#).

<https://bit.ly/2Rku3qM>

Scientists reveal unprecedentedly versatile new DNA staining probe

Incredibly versatile DNA fluorescent dye, named 'Kakshine' makes the nucleus shine brightly

A group of scientists at Nagoya University, Japan, have developed an incredibly versatile DNA fluorescent dye, named 'Kakshine' after a former NU student of its members, Dr. Kakishi Uno, but it also means to make the nucleus shine brightly, since the nucleus is pronounced 'Kaku' in Japanese.



Allowing discrimination between organelle DNA using low phototoxicity visible light, Kakshine offers easy imaging even with cutting edge microscopy techniques. Credit: Yoshikatsu Sato

Dr. Uno, with Dr. Yoshikatsu Sato and Nagisa Sugimoto, the other two members of the research team at the Institute of Transformative Bio-Molecules (ITbM), succeeded in developing a DNA binding fluorescent dye with the pyrido cyanine backbone, which satisfied the three principal qualities required of such a dye—that it have high selectivity for DNA, ability to use visible light with limited phototoxicity, and be applicable to a wide range of organisms—in a way that no previous dye has been able to.

Adding to the central set of functions required for such a chemical, Kakshine and its derivatives are highly compatible with cutting-edge microscope techniques. They represent the first dye of its kind to achieve super-resolution imaging of mitochondrial DNA in living cells with STED imaging, a kind of microscopy whose resolution exceeds the diffraction limit of light. Additionally, they also enable deep tissue imaging by two-photon excitation imaging, discrimination of different organelle DNAs with a single dye by fluorescence lifetime imaging.

Kakshine is an exceptionally versatile new dyeing agent which improves upon the capabilities of and solves the shortcomings of current-generation fluorescent dyes in DNA imaging. Moreover, with applications in the medical and life science fields including electrophoresis, quantitative PCR and [flow cytometry](#), Kakshine is expected to make a splash as the next-generation tool for DNA analysis.

More information: Kakishi Uno et al, *N-aryl pyrido cyanine derivatives are nuclear and organelle DNA markers for two-photon and super-resolution imaging*, *Nature Communications* (2021). [DOI: 10.1038/s41467-021-23019-w](https://doi.org/10.1038/s41467-021-23019-w)

<https://bit.ly/2QoDmpm>

Mount Vesuvius victims died just moments away from rescue

A skeleton unearthed at the site may belong to a high-ranking naval officer.

[Kiona N. Smith](#)

When Mount Vesuvius destroyed the Roman city of Pompeii in 79 CE, the eruption also killed hundreds of people huddled on the shores of nearby Herculaneum. A recent study of the remains of one victim, who died on the beach not far from a small naval vessel, suggests that he might have been a senior naval officer. If so, archaeological director Francesco Sirano and his colleagues suggest, the man may have been a rescue mission leader who arrived just in time to die with the people he was trying to save.



armi del soldato

An untimely rescue

Pliny the Elder was a Roman naturalist and author who also found time to command the imperial fleet in the port city of Misenum, across the Bay of Naples from Pompeii and Herculaneum. During

the height of Mount Vesuvius' eruption, Pliny the Elder sent boats to rescue survivors from the beach at Herculaneum, which lies northwest of Pompeii and almost due west of the volcano. At least 300 people had fled for the shore, only to find themselves trapped between the volcano's wrath and the sea. Some sought shelter in nearby boat sheds while others gathered on the beach to wait for help.

They never made it off the beach. A towering plume of material that had blasted skyward from the volcano finally collapsed under its own weight and sent a deadly wave of hot gas and debris, called a pyroclastic flow, flooding down the mountain's slopes at nearly 100 kilometers per hour (62 miles per hour). Like the pyroclastic flows that struck Pompeii, this one [brought instant, searing death](#).

Archaeologists unearthed the remains of the Herculaneum victims in the 1980s. Now it appears that the 300 victims massed on the shore may have been tantalizingly close to being saved. If Sirano and his colleagues are correct about one victim—now known to the world only as Skeleton Number 26—then the deadly pyroclastic flow struck Herculaneum just as its desperately awaited rescue arrived.

A Roman naval officer?

Just like at nearby Pompeii, layers of volcanic ash quickly buried the victims at Herculaneum. The same eruption that killed them also helped preserve detailed [evidence about their lives](#) and [the moment of their deaths](#). For nearly 2,000 years, Skeleton Number 26 lay facedown, with one arm stretched out as if to break his fall. He was probably knocked down by the blast that killed him and everyone else on the beach. Parts of Skeleton Number 26's armor, along with weapons and a leather knapsack, survived nearly 2,000 years of burial.

Sirano and his colleagues recently took a second look at the skeleton and his belongings, and based on his high-end weapons

and gear, the archaeologists suggest that he was probably a high-ranking officer in Pliny the Elder's imperial fleet from Misenum.

The man, who was between 40 and 45 years old when he died, wore a leather belt decorated with plates of gold and silver. He carried a finely crafted sword with an ornate ivory hilt and a correspondingly elegant dagger. And mingled with his bones, archaeologists found 12 silver and two gold Roman denarii, which would have added up to three or four times the monthly pay of an average enlisted soldier in Rome's Legions. All together, those accouterments mark him as a military officer with rank and status—and the wealth to show it off.

In a leather knapsack, the man carried a set of carpenter's tools. That detail seems to clash with the sword, dagger, and armor, unless the dead man was a *faber navalis*, or master carpenter. If so, he would have been something like engineering officers aboard modern naval vessels, both a naval leader and a highly advanced technical specialist.

And if that's the case, then it's probably not a coincidence that he died not far from a Roman naval vessel beached nearby. "He may be an officer of the fleet that took part in the rescue mission launched by Pliny the Elder to help the people in the towns and villas nestled on this part of the Bay of Naples," Sirano [told Italian news agency Ansa](#).

Although the artifacts and their context lend support to that idea, there's not enough evidence to say for certain that Skeleton Number 26 died in the line of duty. It's a reasonable conclusion, though—much less of a stretch than last year's sensational claim, by a different team of researchers, that a skull unearthed near Stabiae belonged to *the* Pliny the Elder.

The fleet commander set sail himself during the eruption to rescue a friend's wife near the town of Stabiae, and he died on the beach not far from the friend's villa. Based on his nephew's secondhand

description of events, written years later, the great naturalist and admiral probably died of either a heart attack or respiratory damage from inhaling too much volcanic gas and dust. His remains weren't recovered, and identifying them definitively today would be nearly impossible.

Pliny the Elder, and at least some of the men he sent into harm's way as their commander, died doing the same thing: trying to save lives. And 2,000 years later, it's hard not to respect that.

<https://bit.ly/3flqoBc>

Human Impact on Earth Is Shrinking an Entire Layer of The Atmosphere, Scientists Warn

Since 1980 the thickness of the stratosphere has already shrunk by 400 meters (1,312 feet)

[Tessa Koumoundouros](#)

Our world is hugged by complex layers of gases that make up the atmosphere. They protect and nurture all life as we know it. Now, we're shrinking an entire one of those layers – the stratosphere – thanks to the profound impacts we are having on our planet.

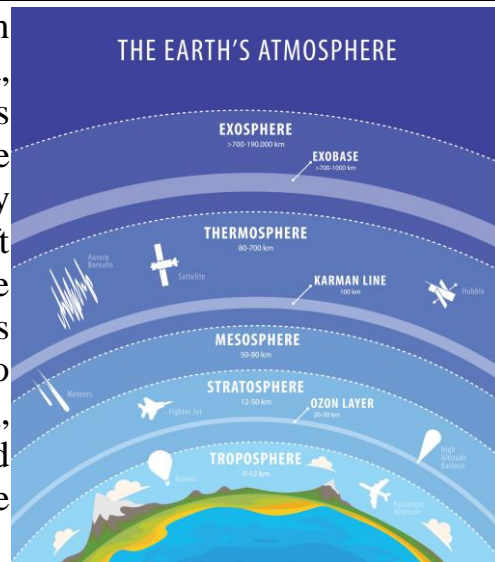
An alarming new study has found that the thickness of the stratosphere has already shrunk by 400 meters (1,312 feet) since 1980. While local decreases in the stratosphere's thickness have [previously been reported](#), this is the first examination of this phenomenon on a global scale.

"It is shocking," one of the research team, University of Vigo Earth physicist Juan Añel [told](#) Damian Carrington at *The Guardian*. "This proves we are messing with the atmosphere up to 60 kilometers."

Enveloping the sky around 20 to 60 kilometers (12 to 37 miles) above us, the stratosphere blankets the atmospheric layer we're breathing (the troposphere). [Few clouds](#) venture this high and only the [occasional birds](#). It holds the all-important [ozone](#) layer, which [we've already wreaked havoc upon](#) through our emissions of [CFCs](#).

While collective global efforts have managed [to stem ozone](#)

[depletion](#), which caused a hole in the ozone layer above Antarctica, our emissions of greenhouse gases have been altering the entire stratosphere. Charl's University atmospheric physicist Petr Pisoft and colleagues used satellite observations since the 1980s combined with climate models to determine that the rise of CO₂, rather than previously suspected ozone depletion, is causing the stratosphere to contract.



(shoo_arts/iStock/Getty Images Plus)

"[We] demonstrate that the stratospheric contraction is not only a response to cooling, as changes in both tropopause and stratopause pressure contribute," [the team wrote](#) in their paper.

Greenhouse gas-induced warming in the troposphere is causing it to expand and squash the stratosphere above it, they explain. On top of this, the addition of CO₂ into the stratosphere itself is [causing its combination of gasses to cool and huddle closer together](#) (the opposite effect they have on the troposphere) – shrinking the entire layer.

"In a plausible [climate change](#) scenario, our planet's stratosphere could lose 4 percent of its vertical extension (1.3 km [0.8 mi]) from 1980 to 2080," Anel [told](#) the Anadolu Agency.



Above: Earth's atmospheric layers: troposphere (orange-red) and stratosphere (blue) as viewed from the ISS. (NASA/JSC Gateway to Astronaut Photography of Earth)

Ozone and molecular oxygen in the stratosphere absorb most of the ultraviolet radiation from the sun, shielding us all from the most harmful sunlight – wavelengths of less than ~300 nm. Here, the [air temperature increases with altitude](#) (the opposite of the troposphere beneath), which keeps this layer of gases stable. So aircraft can retreat here when the weather gets rough below, but this stability also means any chemicals that reach the stratosphere tend to linger. If the predicted changes come to fruition, their scale becomes large enough to potentially affect satellites, GPS, and radio communications, Pisoft and team warned.

It may also change the altitude distributions of absorbing and emitting molecules and therefore alter how the stratosphere absorbs radiation and its overall dynamics, but there is still a lot to figure out before we can understand if and how these impacts would occur.

This is just the latest discovery of the astonishing global-wide impacts the climate crisis has on our world. Another recent find showed the redistribution of weight due to melting glaciers has [shifted the Earth's axis](#).

"It is remarkable that we are still discovering new aspects of climate change after decades of research," University of Reading's atmospheric scientist Paul Williams, who was not involved in the study, [told The Guardian](#).

"It makes me wonder what other changes our emissions are inflicting on the atmosphere that we haven't discovered yet."

This research was published in [Environmental Research Letters](#).

<https://bit.ly/3ePCPWT>

The secret of how Amundsen beat Scott in race to south pole? A diet of raw penguin

Starving and trapped by ice, the Norwegian's crew had discovered how to beat scurvy on an earlier voyage. The benefits proved

crucial

[Donna Ferguson](#)

Thirteen years before he became the first person ever to reach the south pole in 1911, the Norwegian explorer Roald Amundsen experienced his first merciless taste of winter in the [Antarctic](#). Stuck onboard the Belgian expedition ship *Belgica*, which was grounded in pack ice, he and the rest of the crew contracted scurvy and faced certain death.



The leader of the Belgica voyage, Adrian de Gerlache, with an Emperor penguin he captured to eat. Photograph: © De Gerlache Family Collection

That is when, according to a new book published later this month, Amundsen started eating raw penguin meat – and discovered a secret that would later give him a huge advantage over Captain Robert Falcon [Scott](#) in the race to the south pole.

“If you eat almost any kind of meat, as long as it’s raw enough, you can get the vitamin C that the body requires to avoid scurvy,” said Julian Sancton, author of the forthcoming book, [Madhouse at the End of the Earth](#).

This was the great insight, he said, of the *Belgica*’s American doctor, Frederick Cook. “He had spent time among the Inuit and observed that although their diet consisted largely of fresh game, they didn’t get scurvy. The food the crew of the *Belgica* had brought along on the voyage was not working – so he assumed, partly because he had no other choice, that eating fresh penguin and seal would do the trick. And he was right.”

Unfortunately for the *Belgica*’s crew, the chef who was in charge of preparing the meat was an inexperienced cabin boy. “He was absolutely incompetent and his preparations of penguin and seal were inedible. And that’s one reason a lot of people on board initially refused to eat it and kept suffering from scurvy.”

The cabin boy’s lack of cooking skills didn’t matter to Amundsen, who was prepared to eat the penguins completely raw. “He pronounced it ‘the most delicious steak you could wish for’ while everybody else found it absolutely repulsive. I think he equated suffering with accomplishment – he loved being able to do what other people didn’t have the courage to do or felt incapable of doing.”

The penguin flesh, even cooked a little, did not appeal to every palate. “Imagine a piece of beef, an odoriferous codfish, and a canvasback duck, roasted in a pot, with blood and cod liver oil for sauce,” was how Cook described it later.

The crew of the *Belgica* all finally accepted the need to eat the meat. They discovered the penguins loved music, so one crew member would play tunes on a cornet, a brass instrument similar to a trumpet, when they wanted to kill them. Sancton said: “Apparently, it was like the Pied Piper. They would just come right up and serve themselves up. And so it was very easy to trap them and kill them.” Eventually, Amundsen and the crew managed to break their ship out of the ice, using three hand saws. “They ended up sawing more than a mile of ice, three feet thick at its thinnest. These were men in a pitiful physical shape, withered and weakened by almost a year of entrapment in the ice. It’s absolutely remarkable that they should find the strength to do this – and the way they managed it was by just scarfing down five or six penguin steaks a day. The penguin allowed them to rebuild their bodies and regain their hope.”

It was thanks to these experiences on board the *Belgica* that Amundsen understood how important it would be to constantly eat fresh meat when he set off for the south pole in 1911. “His diet was absolutely one of the key reasons he managed to beat Scott,” said Sancton.

Scurvy ravaged Scott and his team in 1912. “It’s not clear that Scott died of scurvy,” said Sancton. “Ultimately, he died of cold,

exhaustion and hunger. But his body was certainly weakened by it.” Unlike Scott, Amundsen and his team successfully avoided contracting scurvy. They did this by regularly eating not only seals and penguins but also the weaker dogs that pulled their sled.

The book reveals for the first time that Amundsen, Cook and the captain of the Belgica, Georges Lecointe, first came up with this extraordinary strategy while they were all stuck in the ice together. Sancton discovered a letter Lecointe wrote on board the Belgica tucked away in the archive of the Royal Institute of Natural Sciences in Belgium. “The plan was for Lecointe to make a dash for the south magnetic pole with Cook and Amundsen and to go there by dog sled, and to eat the dogs as a matter of strategy to save on weight and on food,” he said. In the end, they did not attempt it. “It was a ruthless strategy but it turned out to inspire Amundsen’s own sledging strategy in his race to the south pole against Scott.”

Scott, meanwhile, dismissed the idea of eating dogs as cruel and unsportsmanlike. He wrote: “One cannot calmly contemplate the murder of animals which possess such intelligence and individuality, which have frequently such endearing qualities, and which very possibly one has learnt to regard as friends and companions.” Instead, he used Manchurian ponies, “which all died”. Scott and his men then famously suffered the same fate, while Amundsen returned home from the south pole a hero. But he never forgot who had first taught him how to survive in the Antarctic. “He later described Cook as a genius and the finest traveller he ever saw,” said Sancton. “And he credited him with saving his life.”

<https://bit.ly/3eSeWhl>

A Dead Man Was Cremated in Arizona Without Anyone Knowing He Was Radioactive

His mortal remains were incinerated, with a radioactive and potentially dangerous dose of [lutetium Lu 177 dotatate](#)

[Peter Dockrill](#)

In 2017, a 69-year-old man with pancreatic [cancer](#) went to hospital with abnormally low blood pressure. Sadly, he died only two days later, and his remains were cremated.

What nobody at the hospital or the crematorium knew, was that this hadn't been the man's only recent trip to hospital.

Just one day earlier, in fact, he had been injected with a radioactive compound at another hospital to treat his tumor – and when his mortal remains were incinerated, this radioactive and potentially dangerous dose of [lutetium Lu 177 dotatate](#) was still inside his body. This case, reported in a [research letter](#) published in 2019, illustrates the collateral risks potentially posed by on average [18.6 million](#) nuclear medicine procedures involving radiopharmaceuticals performed in the US every year.

While rules regulate how these drugs are administered to living patients, the picture can become less clear when those patients die, thanks to a patchwork of different laws and standards in each state – not to mention situations like the 69-year-old man, whose radioactive status simply slipped through the cracks.

"Radiopharmaceuticals present a unique and often overlooked postmortem safety challenge," researchers from the Mayo Clinic [explained in a case note](#). "Cremating an exposed patient volatilizes the radiopharmaceutical, which can then be inhaled by workers (or released into the adjacent community) and result in greater exposure than from a living patient."

In this patient's case, once the treating physicians and the radiation safety department at the initial hospital became aware of the man's death, they got in touch with the crematorium.

Almost a month after the cremation took place, they used a Geiger counter to detect radiation levels inside the cremation chamber and on equipment, including the oven, vacuum filter, and bone crusher.

What they found were low but nonetheless elevated levels of radiation, while a spectroscopic personal radiation detector

identified the primary radionuclide culprit – lutetium Lu 177, the same radioactive compound used to treat the man.

"This wasn't like the second-coming of [Chernobyl](#) or Fukushima, but it was higher than you would anticipate," case co-author and radiation safety officer Kevin Nelson [told The Verge](#) in 2019.

While there's no definitive proof specifically linking the patient's radiopharmaceutical dosage to the radiation levels detected in the crematorium, it's certainly the most likely explanation for how those trace levels of lutetium Lu 177 could be there.

It's also the first time radioactive contamination of crematory facilities [has been documented](#) like this.

But that's not the most concerning part of the story.

When the researchers analysed the crematorium operator's urine to see if the employee had also been contaminated by radiation exposure, they couldn't find any traces of lutetium Lu 177.

They did find something, though: a different radioactive isotope, called technetium Tc 99m. The worker said they had never been exposed to the compound as part of a nuclear medicine procedure.

Because of this, the researchers say it's plausible the operator could have been exposed to volatilized technetium Tc 99m while cremating *other* human remains – and if they're right, we could be looking at a broader issue here, as opposed to an isolated, unfortunate one-off.

Still, the amount of radiation we're talking about is very low, so even while the problem of accidental volatilization could be widespread in the cremation industry, it may not actually be as dangerous as it sounds.

"I don't think this is an issue that may entail any risk of cancer or other radiation-induced illnesses," cancer researcher Paolo Boffetta from the Icahn School of Medicine at Mount Sinai [told UPI](#) at the time. "Having said that, it's clear it's a possible source of exposure, and if someone is exposed regularly, every week or every few days,

then it may become a source of concern."

Given [more than half of all Americans](#) eventually get cremated, postmortem management of individuals who receive radioactive drugs is an area the US health system needs to work on, [the researchers say](#).

This includes better ways of evaluating radioactivity in deceased patients (prior to them being cremated), and also standardizing ways of notifying crematoriums about their clients.

After all, nobody really has any idea how often this is happening.

As nuclear scientist Marco Kaltofen from the Worcester Polytechnic Institute in Massachusetts, who wasn't involved with the research, [told BuzzFeed News](#): "They only happened to catch this one case because normally they don't look."

The findings were reported in [JAMA](#).

<https://bit.ly/3fgLHne>

Whale Bone Weapons Hint at World's Earliest Coastal Economy

Thousands of years before the Neolithic Agricultural Revolution, a widespread trade network carried large whale bone spears from Spain to France.

by [Richard Kemeny](#)

Stone Age humans in Europe made, swapped, and carried whale bone weapons along long-distance networks from Spain through to France, say researchers who have tracked down dozens of such tools. The exchanges around the Bay of Biscay may have contributed to one of the world's first coastal economies, they argue. "This innovation was good enough to rapidly spread across this territory," says Alexandre Lefebvre, an archaeologist at the University of Toulouse-Jean Jaurès and lead author of [a new study documenting the find](#).

Around 15,000 years ago, Western Europe was home to the Magdalenians, a nomadic hunter-gatherer culture that made hunting

tools, cave art, and maybe even [music](#). Previous research had shown whale bone weapons were used just north of the Pyrenees mountains, in France. Yet, surprisingly, almost no evidence had been found for the same technology in prehistoric sites along the northern coast of Spain, where whale bones might reasonably have come from.

Lefebvre and his team decided to try to fill that gap by re-examining existing collections of bones taken from 64 sites across the Spanish coast. Many of these bones—found mostly in limestone caves or rock shelters—had been classified simply as bone or antler; Lefebvre suspected some were actually whale bone, scavenged from stranded whales.

Cetacean bones are extremely porous; they are lighter than the bones of terrestrial animals of the same size and have no cavity for bone marrow. Using these criteria, the researchers identified 54 whale bone objects among a trove of more than 8,000 bone artifacts from 12 of the 64 sites along modern-day coastal Cantabria. The majority of them dated to 18,000 to 15,000 years ago, when the researchers think the network was most active.

Most of the newly identified whale bones were crafted projectile points about one centimeter across and up to 21 centimeters long. Some had beveled edges and grooves, likely used to [attach small flint blades](#); some were decorated with geometric designs. All of the weapons had impact fractures, and a subset had traces of resharpening and repair, suggesting the weapons were valued and maintained over time.

Adding these findings to their own previously reported data, the researchers mapped out a trade network spanning over 600 kilometers from Cantabria in Spain, along the coast and across the Pyrenees to the Ariège Valley in southern France. Since the scientists didn't find any waste from tool manufacturing, they assume that the original sites where the tools were made were on

the coast and are now underwater. Only the finished whale bone weapons, not the raw material, seem to have been transported inland, says coauthor Jean-Marc Pétillon.

The study highlights 23 key sites that stand out for hosting a large number of whale bone objects, suggesting they may have been trading hubs. Isturits, France, roughly 60 kilometers from the shoreline, had the highest concentration of whale bones (63 objects have been found), and sat strategically at the center of the network. This site most likely had a “pivotal role” in the distribution of objects far from the coast, says Pétillon. All this, the authors argue, is evidence that the Bay of Biscay was home to the first structured coastal economy in the world.

“This reveals an elaborate network for the circulation and exchange of weapons,” says Paul Pettitt, a Paleolithic archaeologist at Durham University in England who was not involved in the study. This sophisticated trading behavior is just as complex as the economies that evolved around agriculture during the Neolithic Revolution a few thousand years later, Pettitt adds.

João Zilhão, a paleoanthropologist at the University of Barcelona in Spain, who was also not involved with the new work, agrees that the whale bone network shows that the Magdalenian people were engaged in sophisticated interactions. But, he argues that the first coastal economies may have started even earlier. Fishhooks and bones found in East Timor suggest people may have been deep-sea fishing 42,000 years ago, he says, which would have required planning and technical know-how indicative of an organized economy.

Other widely exchanged goods might simply not have lasted long enough for archaeologists to find them, points out Zilhão. “Similar coastal economies involving the circulation of perishables would not be visible in the same way, but that does not mean they did not exist.”