

<https://bit.ly/3zxp1Zv>

Why Scientists Tweak Lab Viruses to Make Them More Contagious

Some “gain of function” studies explore how a dangerous pathogen might cross species barriers to start an outbreak. They are not without controversy

By [Emily Willingham](#)

The microbiology toolbox includes techniques to induce mutations in viruses that give the microbes new powers. Scientists perform these manipulations for many reasons, including wanting to understand how the microbes evade detection by our immune systems.

But adding capability to a pathogen carries obvious risks, especially if this “gain of function” involves enhanced virulence or infectiousness. Escape from a lab, by accident or design, is a possibility. So why do it? Some researchers argue the work can offer a peek at what a virus can do before it goes into the natural world and poses a threat to people.

Controversy over gain-of-function research has generated academic papers, conferences and even a moratorium in 2014, when the U.S. government paused funding for three years until steps could be taken to ensure the safety of the procedure.

Debate about gain-of-function experiments continues in the latter phases of the pandemic as thoughts turn to the “next one” or a possible second act for COVID-19. Science policy makers must wrestle with defining the rare instances in which the benefits of experiments that enhance a virus’s capacity to survive and flourish in human hosts outweigh any risks.

Densely technical discussions often bog down over the very definition of gain of function. Recently, semantics were front and center in the debate over whether National Institutes of Health–funded work at the Wuhan Institute of Virology (WIV) in China

constituted gain-of-function research, a contention denied by the U.S. agency. The WIV has also been the focus of a revived dispute over whether SARS-CoV-2, the virus that causes COVID-19, escaped from its facility.

Here are a few basic answers to questions about why an obscure technical term now receives so much attention.

What is gain of function research?

Techniques to enhance some aspect of an organism’s functioning are commonplace in research and applied to everything from mice to [measles](#). One typical application of this approach is tweaking mouse genes to generate more of a protein that [limits fat deposition](#).

But that is not the kind of [gain-of-function study that raises fears](#) among scientists and regulators. The high-risk practices are those that create mutations to examine whether a pathogen becomes more contagious or lethal as a means of estimating future threats.

Some experts acknowledge the critical differences between the two types of studies. One proposed term to represent the more threatening subset of this research is “potential pandemic pathogens,” says Marc Lipsitch, a professor of epidemiology at the Harvard T. H. Chan School of Public Health. That phrase “singles out the name and reason for being concerned,” he adds. It has not caught on in common usage, however, returning only about 8,500 results in a Google search, compared with 13.4 million for “gain of function.”

Making this distinction is important for a few reasons, Lipsitch says. When the U.S. government placed the 2014 moratorium on “gain of function research,” some of the studies that were [affected](#) carried no obvious risk of setting off a pandemic.

What is the purpose of this research?

Knowing what makes a microbe more dangerous enables preparation of countermeasures, says Lipsitch, who is one of 18 signatories to a May 14 letter, published in *Science*, that [calls for](#)

[the investigation of a SARS-CoV-2 lab spillover](#) as one of several possible explanations for the origins of the COVID-19 pandemic. He points to the difficulties of studying viruses for the development of vaccines and treatments without doing experiments in a mouse or in other nonhuman animals. There is, Lipsitch says, a “direct path from doing that research to gaining public health benefits,” enabling a balancing of risks and potential benefits.

The riskier version of gain-of-function research creates viruses with abilities they do not have in nature. In two separate studies in 2011, scientists famously and controversially did just that with the H5N1 influenza virus, or “bird flu,” resulting in a version capable of airborne transmission among ferrets. The naturally occurring virus does not have this ability. Making mammal-to-mammal transmission easier set off alarm bells and triggered discussion of a U.S. moratorium.

In 2015 researchers engineered a hybrid pathogen that combined features of the original SARS virus (SARS-CoV) that infected humans in the early 2000s with that of a bat coronavirus. Most bat coronaviruses cannot infect the cells lining the human respiratory tract.

This experiment was intended to mimic what would happen if a third species served as a mixing vat for the bat and human viruses to exchange genetic material. The result was a pathogen that could enter human cells and also cause disease in mice. Reactions to this work were polarized, as demonstrated by experts quoted in a 2015 article in *Nature*: one said that all the research did was create a “new, non-natural risk” among the multitude that already exist, while another contended that it showed the potential for this bat virus to become a “[clear and present danger](#).”

Experts in the latter camp argue that gain-of-function virus studies can presage what will eventually happen in nature. Speeding things up in the lab gives researchers firsthand evidence about how a virus

might evolve. Such insights could drive [predictions about future viral behaviors](#) in order to stay a step ahead of these pathogens.

That calculation must be made on a case-by-case basis, Lipsitch says. “There is not one-answer-fits-all,” he adds. But the key question to address in this complex computation is “Is this work so valuable for public health that it outshines the risk to public health in doing it?”

Lipsitch was “very outspoken,” as he puts it, about the influenza-ferret study, and he led the effort for the 2014 moratorium on similar gain-of-function work. “I did that because I thought that we need to have a real accounting of the benefits and risks,” he says. “I had a view that the benefits were very small, and I still have that view.”

The moratorium was lifted in 2017. A U.S. government review panel later approved a resumption of funding for more lab studies involving [gain-of-function modifications of bird flu viruses](#) in ferrets. Conditions of the approvals, according to reports, included enhanced safety measures and reporting requirements.

As for SARS-CoV-2, the virus of most urgent interest right now, the NIH released a statement on May 19 that neither the agency nor its National Institute of Allergy and Infectious Diseases has “ever approved any grant that would have supported ‘gain-of-function’ research on coronaviruses that would have increased their transmissibility or lethality for humans.”

What are the risks?

Predictions based on gain-of-function studies may be hypothetical, but lab breaches in the U.S. are not. Serious violations are uncommon and have almost never resulted in a [pathogen being released into the community](#). But 2014 showed why human error may prove to be the biggest wild card in planning these experiments.

Several lab accidents that year endangered researchers and set off

waves of uneasiness. These incidents were not gain-of-function mishaps, but they demonstrated the potential threats posed by a biosafety lab—whether from negligence or malfeasance.

In 2014 about 75 Atlanta-based employees at the U.S. Centers for Disease Control and Prevention learned about their [potential exposure to anthrax](#) after safety practices were ignored. Also, several long-forgotten vials of [freeze-dried smallpox](#)—a pathogen long thought to be stored in only two places, one in Russia and one in the U.S.—turned up during a cold-storage cleanup at the NIH that year. And the CDC made news again a month later, after it sent out vials of a relatively benign influenza virus [contaminated with the much more deadly H5N1 avian flu virus](#). The possible reason, as reported in *Science*, was that a researcher was “overworked and rushing to make a lab meeting.”

Michael Imperiale, a professor of microbiology and immunology and associate vice president for research and compliance at the University of Michigan, co-authored a 2020 [editorial about gain-of-function studies](#) that said that the key to planning them is to have proper mechanisms to ward off the threats of accidental or intentional harm.

“If proper biosafety procedures are in place and proper containment is used, the risks can be mitigated substantially,” he says. Biosafety level 4 (BSL-4) labs have the highest containment precautions in place, and the U.S. currently has [13 or more such facilities planned or in operation](#). Research on the novel coronavirus is handled in labs one notch down: [BSL-3](#).

In their editorial, Imperiale and his co-author Arturo Casadevall, editor in chief of *mBIO*, wrote that even predicting the threat level of an accidental release is difficult. After publication of the studies of ferret-to-ferret transmission of engineered H5N1, two groups tried to predict what would have happened if this virus had escaped into the human population. One team, Imperiale and Casadevall

wrote, predicted an “extremely high level” of transmission. The other, from one of the labs involved in the ferret-influenza work, concluded otherwise.

In the context of the COVID-19 pandemic, the authors of the editorial wrote, the source of a pathogen—whether from nature or a lab—does not change how the world should prepare to respond to it. But gain-of-function experiments should be governed by transparency in planning the research, a “rededication” to biosafety and a strong surveillance program to capture breaches.

What alternative techniques are available to test a potential viral threat?

If a virus has already moved from an animal host to humans, gain-of-function research may be unnecessary, Imperiale says. “In these cases, there may be animal models that serve as useful surrogates for humans” in testing the virus’s effects, he says.

Researchers can also test the capacity of virus proteins to engage with different kinds of cells. Software can predict how these proteins might interact with various cell types or how their genetic sequences could be associated with specific virus features. Also, if the researchers use cells in a lab dish, the viruses might be designed not to replicate.

Another option is [loss-of-function research](#). Using versions of a virus with less pathogenic potential is another way to unlock that microbe’s secrets. Still, highly pathogenic forms can be quite different from their less threatening counterparts—for example, they may differ in how often they replicate—possibly limiting the usefulness of such studies.

ABOUT THE AUTHOR(S)

Emily Willingham is a science writer with a Ph.D. in biology. She is author of *Phallacy: Life Lessons from the Animal Penis* (Avery, an 2020) and *The Tailored Brain: From Ketamine, to Keto, to Companionship, a User's Guide to Feeling Better and Thinking Smarter*, which will be published by Basic Books in December 2021.

<https://bit.ly/3xM0WMX>

Scientists unravel mystery of echidnas' bizarre 4-headed penis

It is one of nature's weirdest wangs.

By [Harry Baker - Staff Writer](#)

Scientists in Australia have uncovered the mystery behind the bizarre four-headed [echidna](#) penis by creating an advanced 3D model of the peculiar organ.



A short-beaked echidna in Australia. (Image credit: Shutterstock)

There are four species of echidnas that, along with [platypuses](#), make up a unique group known as monotremes — the smallest of the three mammal groups — whose members lay eggs like birds and fish, but also produce milk like other mammals. Much about this group remains a mystery, the study researchers said.

One of the biggest monotreme mysteries is the echidna penis, which has four separate heads, or glans, at the end of the shaft. If that wasn't weird enough, only two of the heads are used during each erection, and echidnas can alternate between which two they use.

"Exactly how echidnas do this has always been a mystery," the study researchers [said in a statement](#). "But for the first time we have untangled what is going on anatomically."



A close up of the distinctive four-headed penis emerging from the cloaca of a short beaked echidna. (Image credit: Jane Fenelon)

Weirdness abounds

In addition to their distinctive shape, echidna penises are also unusual because, unlike those of most other mammals, they are used only for sexual reproduction and not urination. Instead, echidnas use a cloaca — a multipurpose opening for urinating,

defecating and, in females, egg laying. When not in use, echidnas' penises are retracted inside their bodies and emerge through the cloacal opening when erect; their testes, which unusually have no scrotum, remain inside their bodies all the time.

In addition to their unconventional genitalia, echidnas' sperm are also unconventional and have the astonishing ability of being able to work as a team.

"Ejaculated semen samples contained bundles of up to 100 sperm that are joined at the tip of their heads so they form a sphere-like shape," Jane Fenelon, lead author of the study and a reproductive biologist at the University of Melbourne, told Live Science. "These bundles have been observed to swim progressively forward in a vigorous and coordinated pattern, and bigger bundles seem to swim better than individual sperm or smaller bundles."

Very few animals' sperm are known to do this, and the reason behind it is unknown, Fenelon said.

Scanning the shaft

To understand more about how echidna penises work, Fenelon's team turned to short-beaked echidnas (*Tachyglossus aculeatus*) at a wildlife sanctuary in Australia. Unfortunately, rescued echidnas tend to have injuries, usually inflicted by road collisions, that are so severe the animals are often euthanized. But luckily for the researchers, the euthanized echidnas' penises are still in good enough shape to study, Fenelon said.

Researchers took the euthanized echidnas and created 3D models of their penises using specialized [CT scans](#). Normal CT scans only detect hard tissue like bones, so the researchers stained the penises with [iodine](#) to enable the soft tissues to be mapped out.

"This meant we could create a 3D model of the whole echidna penis and its important internal structures in order to see how it operates," the researchers wrote.

Erectile evolution

The 3D computer model revealed that the urethral tube, which the sperm moves through, splits below the heads into two separate tubes, which each split again to allow for sperm to be delivered to each of the four heads. This makes sense, but the finding did not explain why only two of the heads are used during sex.

"Initially, we thought we'd find some sort of valve mechanism" that would "control the one-sided action seen in echidna," the researchers wrote. But instead of a valve, they found that it was actually the type of tissue within the penis that was responsible.

Mammalian penises consist of two main types of erectile tissue — the corpus cavernosum and the corpus spongiosum. Both tissues fill with blood during an erection, but the role of the corpus cavernosum is predominantly to provide a rigid structure to the penis, whereas the corpus spongiosum keeps the urethral tube open to allow sperm to pass through.

Each tissue starts off as two different structures at the base of the penis. In most mammals, the two corpus spongiosum structures merge into one. While the corpus cavernosum remains separated. But in short-beaked echidnas, the cavernosum was merged while the spongiosum remained separate. This separate spongiosum tissue is what allows echidnas to erect each half, or pair of heads, independently from the other, the researchers said.

"We're not really sure" why this is beneficial to the echidna males, Felon said, "but we think it could be an advantage for male-male competition for females."

During a separate experiment on a living but anesthetized echidna, the researchers found that by alternating pairs of heads the individual could ejaculate 10 times in a row without significant pause. This may allow some males to gain an advantage over others, but more experiments are needed to confirm this idea.

The study was published online April 29 in the journal [Sexual Development](#).

<https://go.nature.com/3vGppl5>

Amphibious fish get smart — by working out on land *Fish navigate mazes more quickly and efficiently after a regimen of jumping about on a solid surface.*

Experiments on amphibious fish have shown that those that dwell in both air and water become smarter than those that reside only in water. Fish that exercise on land experience a similar brain boost.



The mangrove killifish is a quicker study after spending bouts of time in air, experiments show. Credit: Pally/Alamy

Giulia Rossi and Patricia Wright at the University of Guelph in Canada placed mangrove killifish (*Kryptolebias marmoratus*), a species that thrives both on land and in water, in small containers. The authors exposed some of the fish to periodic drops in water levels, and so to the air, over a period of eight weeks. Other fish were placed in a terrarium every few days and spurred to jump for three minutes. Control fish were left to swim about undisturbed.

The trained jumpers and fish that had been exposed to air navigated a maze and found the meal at the end more quickly, and covered a shorter distance to do so, than did control fish. They also had more cell proliferation in a brain area that is linked to spatial learning.

The authors say the work is a step towards showing how ancient fish evolved and adapted while making the move from water onto land. [Proc. R. Soc. B \(2021\)](#)

<https://nyti.ms/3xBeVVo>

‘Flying Treats’: Can Dogs and Cats Snack Safely on Cicadas?

Jittery pet owners are asking vets, animal poison control centers and Twitter. Read on for answers.

By [Jan Hoffman](#)

Of course you're anxious.

Your sweet, admittedly not overbright, four-legged pandemic pal is enamored with the horror movie of the season: relentless hordes of fat and sassy cicadas.

Clattering and slow-moving, the 2021 Brood X swarmageddon taunts cats and dogs, who seem incapable of affecting diffidence. In recent weeks, many pets have obsessively been lunging and swatting. Then, gulping.

Fearful owners are rushing to veterinarians and animal poison control centers, to say nothing of Dr. Google. Can cicada exoskeletons pierce intestinal linings? Is cicada fungus toxic to dogs?

The answers are no and no.

[Christine Klippen](#), an emergency veterinarian at Friendship Hospital for Animals in Washington, a city currently held captive by cicadas, sounded a tad weary.

“No, eating a cicada won’t make a dog or cat sick,” Dr. Klippen said.

Large areas in 15 states, mostly from the Mid-Atlantic, stretching west to Ohio, are now thrumming with [billions of Brood Xers](#), which have burst forth after a 17-year gestation, full of so much pent-up reproductive energy that last week [they invaded a White House press corps charter plane, delaying a flight for hours](#). And in a pandemic year during which, according to a [survey](#) by the American Society for the Prevention of Cruelty to Animals, one in five American households acquired dogs and cats, rookie pet owners are primed to swallow cicada myths whole.

After all, they have not had years of exposure to the God-awful things that pets routinely snarf down.

More good news: If you haven’t seen or heard [Brood X cicadas](#) yet, you’re unlikely to. [John Cooley](#), a cicada researcher and expert in ecology and evolutionary biology at the University of Connecticut, said that by now, [they had all emerged](#) and that by the Fourth of

July, their newborns would have hatched and burrowed.

“If it’s cold and miserable like it’s been in Maryland, that prolongs things,” Dr. Cooley, who maps sightings, said. “Sunny, hot weather burns them out.”

To dogs and cats, cicadas look like “big flying treats,” as Dr. Klippen says. But, she adds, unless an animal has a rare allergy to chitin, the exoskeleton material, the bugs are not toxic. That includes a fungus that has been seen on these periodical cicadas, which can affect the bugs but not the snackers.

“Most pets who ingest a few cicadas will only develop mild stomach upset,” said Tina Wismer, a veterinarian who is a senior director at the [ASPCA Animal Poison Control Center](#) in Urbana, Ill. Some cats and dogs have bellies so sensitive, she added, that they can even have a reaction to a new kibble. Most cicada-related calls to the poison center, she said, involve dogs vomiting up the exoskeletons.

The wings are crunchy “but no more than dry dog food,” observed [Ann Hohenhaus](#), a veterinary oncologist at the [Animal Medical Center in New York](#).

She and others dismissed the chatter about cicada shells slicing through intestinal walls. “Dogs will eat bones and feel sick but even shards don’t poke through the intestines,” she said. “But cicada shells are unknown to us, so we have decided we should worry about them.”

Because dogs spend more time outdoors than cats, calls about feline cicada ingestion are rare. But cats do enjoy the occasional cicada amuse-bouche.

“Outdoor cats don’t like static food,” Dr. Hohenhaus said. “If something is alive and moving, they will go for it. People worry that because cats have small digestive tracts, the cicada will get stuck, but a cat can eat a whole mouse. It will digest the cicada just fine.”

The operative word here is “few.” Consuming too much of anything, including cicadas, can lead to lethargy, diarrhea and vomiting, say veterinarians as well as basic common sense.

“Dogs eat lots of stuff — they will paw open a pantry and eat five pounds of dog food before owners catch them,” Dr. Hohenhaus said. “One dog puked up a shark toy. So if you have a dog who goes to the country for the weekend and eats horse poop, he’ll have diarrhea on Monday morning.”

As for those pets who have hoovered up cicadas and landed in the vet E.R., she said, cause and effect are not necessarily obvious. “I don’t know if the cicada shells made the dog sick or it was the Kleenexes and trash the dog ate out of the bathroom basket.”

Cicadas can, however, incite some cats and especially dogs to binge. (Think potato chips: Can you eat just one?)

“Because cicadas are so easy to catch, some animals are going to town eating them,” said Dr. Klippen, who sees perhaps a handful of dogs a week for this reason. The risks are not from the bugs, she said, but from dehydration related to vomiting and diarrhea, or from having absorbed pesticide sprayed on the cicadas.

For dogs who can’t quit cicadas, “consider a basket muzzle,” Dr. Klippen said. “It’s beneficial and doesn’t prevent dogs from panting and drinking.” Also try walking your dog at dawn and dusk, Dr. Wismer advised, when cicadas are least active. Since cicadas are found in and around mature trees, avoid routes that include them.

The heebie-jeebies over pets and cicadas springs mostly from the alignment of several factors. There’s the once-in-nearly-two-decades emergence of the bugs. And the heightened attachment and overprotectiveness that owners developed toward their pets in the past year during lockdown. Moreover, veterinarians said, people’s concerns are being revved by the internet and, er, the news media.

“But basically, it’s something for us to talk about other than the coronavirus,” Dr. Klippen said.

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

The COVID-19 lab-leak hypothesis is plausible because accidents happen. I should know

It’s not the first time a pathogen was accidentally released from a research laboratory

Allen Rodrigo*

At the conclusion of the G7 summit, leaders called for a [fresh and transparent investigation](#) to determine how the COVID-19 pandemic began.

I welcome the renewed interest in the potential “lab-leak” origins of SARS-CoV-2, the virus that causes COVID-19. It wouldn’t be the first time an infectious pathogen was accidentally released from a research laboratory.

I know from personal experience. Back in 1994, on my first day of a fellowship at Stanford University, I picked up a damp courier parcel at reception and took it back to the lab. My professor put on latex gloves immediately. The parcel contained a vial with an HIV-infected lymph node.

The dry ice used to pack the sample had evaporated, soaking the cardboard. There I was, someone who had not worked with HIV before, with hands damp from handling a box containing live virus.

Support non-profit news with a tax-deductible donation.

I didn’t get infected. But the experience left me acutely aware of how easily accidents happen. A 2018 [review](#) found 27 cases of laboratory-acquired infections between 1982 and 2016 in the Asia-Pacific region alone. The list of pathogens included everything from the virus that causes dengue fever to the SARS coronavirus.

The American Biological Safety Association ([ABSA](#)) maintains a searchable database of [reported laboratory-acquired infections](#). It documents “leakage from the plastic bag in the negative-pressure transport chamber” and exposure to “droplets when cleaning a spill”, among many other examples.

From a scientific perspective alone, it is important to investigate the lab-leak hypothesis because, if true, we have to tighten safety procedures to prevent future leaks.

Two lab-leak hypotheses

When the virus was first reported from Wuhan almost 18 months ago, people have raised the possibility that it emerged from the Wuhan Institute of Virology, where research on SARS coronaviruses was underway.

This lab-leak hypothesis comes in two flavours. First, the virus could have jumped from an animal (or animal tissue) infected with a SARS coronavirus as part of the research. The infected person subsequently infected others in the community.

The transfer of a pathogen from an animal to people is called a zoonotic transmission. This process also [occurs outside of laboratories](#), perhaps when there is close contact with infected animals or they are eaten.

The second hypothesis suggests a purposeful genetic modification of a coronavirus that gave rise to a more infectious and human-transmissible variant, which then leaked into the community. This type of genetic modification is called gain-of-function, because the engineered virus acquires new biological traits.

It is unfortunate these hypotheses have been miscast as somehow equivalent, and often portrayed as alternative to the “natural origins” hypothesis.

When I and other computational biologists think of origins, we think about evolutionary ancestors: a virus’ evolutionary line of descent. If SARS-CoV-2 had evolved without human intervention from an ancestral variant found in one or more hosts, it is quite possible that such a host animal, or a sample from an infected host animal, was the subject of study in a lab.

Through some unfortunate misadventure, it is plausible that someone in that lab became infected.

Why an investigation is important

Arguments for or against these hypotheses are often couched in terms of likelihoods. In February, the World Health Organisation (WHO) listed four scenarios in its [global study of SARS-CoV-2 origins](#): direct zoonotic transmission, indirect zoonotic transmission through an intermediate host, transmission through cold/food-chain products and accidental laboratory release.

Indirect zoonotic transmission through an intermediate host was deemed “likely to very likely” and accidental lab release “extremely unlikely”. The WHO panel rejected deliberate gain-of-function manipulation because it “has been ruled out by other scientists following analyses of the genome”.

But that wasn’t the last word, because the exact origin of the COVID-19 virus remains a mystery.

Genome sequencing of SARS-CoV-2 has shown the virus is related (about 96%) to a [strain found in horseshoe bats](#). Although this seems like a high level of similarity, it implies that SARS-CoV-2 [diverged from this strain](#) several decades ago. Therefore, it remains unclear if the spillover was directly to humans or through an intermediate species.

In any case, such evolutionary analysis cannot distinguish between transmission in or outside a laboratory.

The WHO panel considered a lab-acquired infection as extremely unlikely because of the Wuhan laboratories’ strict biosafety protocols. But the ABSA database lists accidental infections happening even in labs with the highest biosafety accreditation, and these include SARS-coronavirus infections.

In its arguments for and against accidental lab release, the WHO report noted the Wuhan laboratories moved to a new location near the Huanan market in early December 2019, but “reported no disruptions or incidents caused by the move”. There is no reason to distrust the WHO panel’s conclusions, but it is nonetheless true that

lab relocations present opportunities for error.

The lab-leak hypothesis is at least plausible and it's therefore important to investigate it. If it were related to the operations of the lab, or its relocation, we need to re-examine safety protocols. For relocations, we may want to require independent monitoring and pre- and post-move quarantine of essential personnel.

**Professor and Head, The School of Biological Sciences, University of Auckland
Disclosure statement*

Allen Rodrigo does not work for, consult, own shares in or receive funding from any company or organisation that would benefit from this article, and has disclosed no relevant affiliations beyond their academic appointment.

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

Evolution of the dad

Most male mammals have little or nothing to do with their kids.

Why is our own species different?

By [Elizabeth Preston](#)

Lee Gettler is hard to get on the phone, for the very ordinary reason that he's busy caring for his two young children. Among mammals, though, that makes him extraordinary.

"Human fathers engage in really costly forms of care," says Gettler, an anthropologist at the University of Notre Dame. In that way, humans stand out from almost all other mammals. Fathers, and parents in general, are Gettler's field of study. He and others have found that the role of dads varies widely between cultures — and that some other animal dads may give helpful glimpses of our

Many mysteries remain, though, about how human fathers evolved their peculiar, highly invested role, including the hormonal changes that accompany fatherhood (see sidebar). A deeper understanding of where dads came from, and why fatherhood matters for both fathers and children, could benefit families of all kinds.

"If you look at other mammalian species, fathers tend to do nothing but provide sperm," says Rebecca Sear, an evolutionary demographer and anthropologist at the London School of Hygiene

and Tropical Medicine. Moms carry the burden in most other animals that care for their kids, too. (Fish are an exception — most don't tend their young at all, but the caring parents are usually dads. And bird couples are famous for co-parenting.)

Even among the other apes, our closest relatives, most dads don't do much. That means moms are stuck with all the work and need to space out their babies to make sure they can care for them. Wild chimps give birth every four to six years, for example; orangutans wait as long as six to eight years between young.

The ancestors of humans, though, committed to a different strategy. Mothers got help from their community and their kin, including fathers. This freed them up enough to have more babies, closer together — about every three years, on average, in today's nonindustrial societies. That strategy "is part of the evolutionary success story of humans," Gettler says.

New fathers show reduced testosterone, which may help them be more nurturing to their newborn children. Scientists sampled testosterone levels of more than 450 men in the Philippines in 2005 and again in 2009. All the men showed a slight decrease in testosterone levels (morning testosterone levels shown here), which is to be expected as they age. Men with newborn infants showed a much greater drop, however. Their testosterone returned to expected levels as their children grew up.

Fatherhood in the blood

Some clues to the evolutionary history of fatherhood are written in the molecules of men's bodies.

Anthropologist Lee Gettler worked on a [long-term study](#) of men in the Philippines, gathering biological data from them in their early 20s and following up five years later. He and his colleagues found that men with higher testosterone in their early 20s were more likely to have partners and children later on, when researchers followed up. But those new dads no longer had high testosterone —

it had dropped dramatically, especially if they had a newborn at home. Once a man's youngest child was a toddler, his testosterone began to creep back upward.

Testosterone is linked to mating and competitive behavior in male animals. Suppressing it might be nature's way of preparing fathers to cooperate with their partners and care for children, the researchers say. Although caring fathers are rare among mammals and most other animals, many can be found among birds — and those bird fathers [also experience testosterone dips](#).

Prolactin is another hormone linked to paternal behavior in birds — this time, doting bird dads have more of it — and some studies have hinted at a similar effect in humans. Although we're only distantly related to birds, evolution may have used the same mechanisms to encourage fatherly behavior in both animals. Understanding those mechanisms better might help us learn how fatherhood evolved.

“If we understand the physiological pathways that underpin care in those other species, we can look to see if the same signatures occur in human fathers,” Gettler says. — *Elizabeth Preston*

Doting gorilla dads

Some clues about the origin of doting fatherhood come from our close primate relatives. Stacy Rosenbaum, a biological anthropologist at the University of Michigan, studies wild mountain gorillas in Rwanda. These gorillas provide intriguing hints about the [origins of ape dads](#), as Gettler and coauthors Rosenbaum and Adam Boyette argue in the 2020 *Annual Review of Anthropology*.

Mountain gorillas are a type of eastern gorilla. They differ from western gorillas — a separate species, more often seen in zoos — in their habitat and diet. Rosenbaum is more interested in another thing that sets mountain gorillas apart: “Kids spend a ton of time Those males may or may not be their dads. Male mountain gorillas don't seem to know or care which young are theirs. But nearly all males tolerate the company of kids. Unlike any other great ape

that's been studied in the wild, these males — bruisers twice the size of females, with huge muscles and teeth — are essentially babysitters. Some pick up the kids, play with them and even sleep cuddled together.

This male company can protect very young gorillas against predators, and it keeps the young from being killed by intruding males. Another important benefit might be social, Rosenbaum speculates. The young gorillas mingling around an adult male might pick up social skills like human toddlers do from their peers at daycare. Additionally, research has shown that the relationships between young gorillas and adult males persist as those kids grow up.

Another tantalizing hint about how male gorillas benefit the young in their group comes from a recent paper on young mountain gorillas whose mothers died. Losing their mothers didn't make these orphans more likely to die themselves, the researchers found. Nor did they experience other costs, such as a longer wait before having their own young. The orphans' relationships with others in their group, especially dominant males, seemed to [protect them from ill effects](#).

Mountain gorilla males aren't the only primates to ally with kids. Adult male macaques also spend time with young. And baboon males form “friendships” with females and their young, which are often (but not always) their own offspring. These behaviors cost the male primates almost nothing. So while the males may give their own kids a survival boost, it's not a big deal if they spend time with some unrelated kids too.

Are dads sexy?

But babysitting may benefit male gorillas in another way, too: by making them more attractive. “One of our speculations is that females actually prefer mating with males who do a lot of interacting with kids,” Rosenbaum says. She's found that male

gorillas who do more babysitting earlier in life go on to father [many more children](#) when they're older. Macaques, too, seem to be [more attractive to females](#) if they've spent more time hanging out with kids.

Anthropologists used to assume that fatherly behavior could evolve only in monogamous animals, Rosenbaum says. Species like the mountain gorillas undermine that assumption. They also show that, despite what scientists have long thought, male animals don't have to choose between spending their energy on mating or parenting. It seems taking care of kids can be a way of getting mates.

Studies of human dads and stepdads have hinted at the same idea. "A lot of guys will willingly enter into relationships with kids they know aren't theirs," says Kermyt Anderson, a biological anthropologist at the University of Oklahoma. That investment might seem paradoxical from an evolutionary perspective. But Anderson's research suggests that men invest in stepkids and even biological kids partly as an investment in their relationship with the mother. When that relationship ends, fathers tend to [become less involved](#).

A human dad who cares for his children or stepchildren is different, of course, from an ape or monkey who just lets kids hang around. But Gettler and Rosenbaum wonder whether our own ancestors had similar habits to a mountain gorilla or macaque. Under the evolutionary pressures they faced, these friendly tendencies toward kids could have ratcheted up into devoted fatherhood.

Many kinds of fatherhood

It's clear human fathers are unusual in their attention to their children. "However, it's also clear that fatherhood in humans is quite variable," Sear says. Not all dads are doting, or even present.

But that doesn't necessarily affect basic survival. In a [2008 paper](#), Sear and coauthor Ruth Mace asked whether children with absent fathers are likelier to die. They reviewed data on child survival

from 43 studies of populations around the world, mostly those without access to modern medical care. They found that in a third of the studies looking at fathers, kids were more likely to survive childhood when their dad was around. But in the other two-thirds, fatherless kids did just as well. (By contrast, every study of children without mothers found they were less likely to survive.)

"That is not what you would expect to see if fathers are really vital for children to thrive," Sear says. Rather, she suspects that what's vital are the jobs fathers perform. When a father is missing, others in the family or community can fill in. "It may be that the fathering role is important, but it's substitutable by other social group members," she says.

What is that role? Historically, Gettler says, anthropologists have viewed fatherhood as all about "provisioning" — bringing home the bacon, literally. In some foraging communities, more successful hunters also father more kids. But Gettler hopes to help expand the definition of a dad. Research has shown that fathers can have important roles in directly caring for their children, for example, and teaching children [language](#) and social skills. Fathers may also help their children by cultivating relationships in their communities, Gettler says. When it comes to survival, "Networking can be everything."

A dad's job also varies culturally. For example, in the Republic of the Congo, Gettler works with two neighboring communities. The Bondongo are fishers and farmers; they value fathers who take risks to gain food for their own families. Their neighbors, the BaYaka, are foragers who value fathers who share their resources outside their families.

"In the West we have this idealization of the nuclear family," says Sear: a self-reliant, heterosexual couple in which Dad does all the provisioning and Mom all the childcare. But worldwide, she says, families like this are very rare. A child's biological parents may not

live together exclusively, for life or at all, Sear [writes](#) in a recent paper. Childcare and food can come from either parent — or neither. Among the Himba of Namibia, for instance, children [are often fostered](#) by extended family.

“Possibly the key defining feature of our species is our behavioral flexibility,” Sear says. Assuming that certain roles are “natural” for fathers or mothers can make parents feel isolated and stressed, Sear writes. She hopes research can broaden our understanding of what fathers are for, and what a human family is. That might help societies to better support families of all kinds — whether they have dads like Gettler who are busy chasing the children around, or dads who are away fishing, or no dads at all.

“I think we need to take a much more nonjudgmental view of the human family, and the kinds of family structures in which children can thrive,” Sear says, “to improve the health of mothers, fathers and children.”

Editor's note: This story was updated on June 16, 2021, to correct the name of the country where the Bondongo and BaYaka live. It is the Republic of the Congo, not the Democratic Republic of the Congo, as was originally stated.

<https://wb.md/3gOe7G0>

Comatose TBI Patients Often Recover Consciousness During Rehab

Following moderate to severe [traumatic brain injury](#), patients often regain consciousness and even functional independence during rehabilitation

Steve Cimino

Patients with a disorder of consciousness (DoC) following a moderate to severe [traumatic brain injury](#) (TBI) often regain consciousness and even functional independence during rehabilitation, according to a study of 3 decades of TBI survivors.

"Caution is warranted in consideration of withdrawing or withholding life-sustaining therapies in patients with severe TBI

and DoC," wrote [Robert G. Kowalski, MBBCh, MS](#), of the department of neurology at the University of Colorado at Denver, Aurora, and colleagues. The study was published in [JAMA Neurology](#).

To determine the likelihood of returning to consciousness in the weeks that follow a serious brain injury, along with any notable contributing factors, the researchers launched a retrospective analysis of 17,470 patients with moderate to severe TBI. All participants had been enrolled in the Traumatic Brain Injury Model Systems database from January 1989 to June 2019 after being admitted to any 1 of 23 inpatient rehabilitation centers. The cohort had a median age of 39 (interquartile range, 25-56), with 74% being male and 66% being white. Their median duration of acute hospital care was 16 days (IQR, 9-26).

Unconsciousness was defined by the researchers as not being able to follow commands or having a [Glasgow Coma Scale](#) motor score in the ED of lower than 6 or a Disability Rating Scale motor score greater than 0. Of the overall cohort, 7,547 (57%) patients initially lost consciousness and 2,058 (12%) remained unconscious as they were admitted to rehab.

Of that subgroup, 1,674 (82%) recovered consciousness during rehab. The 414 patients who still had a DoC at completion of rehab had a longer median stay (37 days; IQR, 22-65), compared with the patients who recovered consciousness (19 days; IQR, 12-30; $P < .001$).

After multivariable analysis, the factors most associated with recovery of consciousness were the absence of [intraventricular hemorrhage](#) (adjusted odds ratio, 0.678; 95% confidence interval, 0.532-0.863; $P = .002$) and the absence of intracranial mass effect (aOR, 0.759; 95% CI, 0.595-0.968; $P = .03$).

Though all patients experienced an improvement in functional status during rehabilitation, patients with DoC had an increase in

median Functional Independence Measure total score from 19 to 71 while patients without DoC increased from 54 to 96 (change in total score, +43 versus +37; $P = .002$). After multivariate analysis, younger age and male sex were both associated with better functional outcomes during rehab and at discharge.

When It Comes to TBI Patients, Don't Give Up Hope

The choice to withdraw care in TBI patients is a complicated and daunting one, and this study is further evidence that physicians should delay that decision in many scenarios, wrote [Jennifer A. Kim, MD, PhD](#), and [Kevin N. Sheth, MD](#), of Yale University, New Haven, Conn., in an [accompanying editorial](#).

"By showing that a large proportion of patients with persistent DoC recover during acute rehabilitation, this article further challenges our potential toward overly nihilistic notions of who may or may not ultimately recover consciousness long term," they added.

That said, they also recognized the questions that still persist: What are the reasons for late-stage withdrawal of lifesaving therapy? What is the recovery rate of all hospitalized patients with TBI, not just those in rehabilitation facilities? And is it possible to detect covert consciousness using MRI and electroencephalography, which this study did not include?

"Defining both good and poor prognostic risk factors is critical to portending recovery," they wrote, emphasizing the need for physicians to rely on scientifically based predictions when making such important assessments.

Patience Is a Virtue for TBI Specialists

"A lot of people write notes on hospital charts, 'poor prognosis.' You don't know, that early in the game, in the acute care setting, how TBI patients are going to do," said [Jamie S. Ullman, MD](#), of the department of neurosurgery at Hofstra University, Hempstead, N.Y., in an interview. "It's over the long term that we really have to judge that."

"Of course, there may be some characteristics that patients might have that may portend for a worse outcome, like brain stem damage," she added. "But in general, there is plenty of literature to suggest that not only can even the worst-looking patients have some kind of functional outcome but that it takes 18 months or more to actually realize an outcome from a traumatic brain injury."

She emphasized that each patient with TBI is unique; beyond their current status, you have to consider the significance of their injury, the thoughts of their families or partner, and their own previously stated wishes and willingness to tolerate disability. Nonetheless, this study is another step toward distilling the "nihilistic thinking" that can lead physicians to expect the worst regarding patients who may still have a path toward a functional life.

"As traumatic brain injury specialists," she said, "we need to see what we can do to give patients as good a chance as possible at a recovery."

The authors acknowledged their study's limitations, including an inability to account for 3 decades of variations in treatment regimens and its limited generalizability because of the cohort being composed of only TBI survivors admitted to inpatient rehab. In addition, they noted a possible referential bias for the study's mostly young TBI patients in rehab facilities, another reason why these findings "may not be directly applicable to the overall population of patients with moderate or severe TBI."

The study was funded by grants from the National Institute on Disability, Independent Living, and Rehabilitation Research; the Department of Health & Human Services; and the Veterans Health Administration Central Office VA TBI Model Systems Program of Research. The authors reported several potential conflicts of interest, including receiving grants and support from various government agencies and pharmaceutical companies.

<https://bit.ly/2S9GHcE>

COVID-19 was spreading in the US by December 2019, mounting evidence suggests

The virus was already lurking here at least a month before the country's first reported case, according to a new study.

By [Rachael Rettner - Senior Writer](#)

The novel [coronavirus](#) may have already arrived in the U.S. by late December 2019, adding to the evidence that the virus was already lurking here at least a month before the country's first reported case, according to a new study.

The study researchers analyzed more than 24,000 blood samples collected in the U.S. from Jan. 2 to March 18, 2020, as part of the National Institutes of Health's All of Us program, a project that aims to gather health data from diverse populations.

The researchers identified seven participants from five states (Illinois, Massachusetts, Wisconsin, Pennsylvania and Mississippi) who tested positive for [antibodies](#) against the novel coronavirus, SARS-CoV-2, prior to the first reported cases of COVID-19 in those states. The earliest detection came from a sample collected Jan. 7 in Illinois. Because it takes about two weeks for a person to develop these antibodies, the new findings suggest the virus may have been circulating in Illinois as early as Dec. 24, 2019, according to the study, published Tuesday (June 15) in the journal [Clinical Infectious Diseases](#).

"This study allows us to uncover more information about the beginning of the U.S. epidemic" of COVID-19, Dr. Josh Denny, CEO of All of Us and co-author of the study, [said in a statement](#).

The first confirmed case of COVID-19 in the U.S. was reported on Jan. 20, 2020, in a resident of Washington state who had recently traveled to China. But researchers have suspected that the virus arrived in the U.S. earlier than this, and a previous study from the Centers for Disease Control and Prevention also found evidence

that the virus was in the U.S. in December 2019, [Live Science previously reported](#).

Still, the new study has limitations. Although positive antibody tests suggest a prior infection with SARS-CoV-2, they cannot prove that a person had the virus. For example, even very accurate antibody tests still produce a small number of false positive results.

But the researchers did take steps to rule out false positives. They used two different antibody tests, and the samples had to test positive on both to be counted as positive results. The first test identified 147 samples that were positive for SARS-CoV-2 antibodies, but of these, only nine also tested positive on the second test. (Two of these samples were collected after the first cases of COVID-19 were identified in the participants' respective states.)

There's also a chance that the samples had antibodies against other, similar coronaviruses that "cross-react" in this test to give positive results, but this is uncommon. In 1,000 blood samples collected in the U.S. from January to March 2019, which was used as a control group for comparison, none tested positive for antibodies against SARS-CoV-2.

"It is unlikely all nine of these [positive] individuals are false positive," the authors wrote.

It's important to note that the authors did not have information on whether the people who tested positive had traveled recently, which would suggest whether they became infected within their communities or elsewhere. The researchers plan to follow up with the people who tested positive to ask about their travel history, [according to The New York Times](#). They are also planning further research to pinpoint exactly when the novel coronavirus first appeared in the U.S.

"The exact month at which it probably came into the U.S. is still unknown," study lead author Keri Althoff, an epidemiologist at the Johns Hopkins Bloomberg School of Public Health, told the Times.

<https://bit.ly/3zG6XMA>

Deadly Facial Tumors Spur Tasmanian Devil

Evolution: Study

The largest study to date of the animals' genetics provides robust evidence that they are adapting to survive a highly lethal, contagious cancer scientists feared would cause their extinction.

[Christie Wilcox](#)

On the whole, the 20th century was pretty rough for Tasmanian devils (*Sarcophilus harrisii*). Just when their numbers seemed to finally be recovering after more than a century of poisoning and trapping, a strange, deadly disease emerged: the [contagious cancer](#) known as devil facial tumor disease (DFTD).

Infected devils grow large, disfiguring tumors, especially on their faces—hence the name—and the vast majority die. In fact, within five years of DFTD's first appearance in 1996, populations hit by the disease had declined by around 80 percent, and [scientists feared](#) the cancer would wipe the devils out in a matter of decades.



Menna Jones holding an adult Tasmanian devil Courtesy of Menna Jones

These days, the disease continues to kill the world's largest marsupial carnivore, and populations remain concerningly small. But, according to experts such as Menna Jones, a vertebrate ecologist at the University of Tasmania who has worked with devils for more than 30 years, DFTD hasn't doomed the animals. According to a May 26 paper by Jones and her colleagues in [Proceedings of the Royal Society B](#), devils are evolving resistance to the disease—and that evolution is happening “very, very fast,” she says.

The research, led by University of Idaho's Paul Hohenlohe and

then-graduate student Amanda Stahlke, is the largest genetic study of Tasmanian devils to date, and it uncovered hundreds of genomic regions changing in response to the disease—regions that do not appear to have been under selection previously in the animals' history.

Billie Lazenby, a wildlife biologist with the Department of Primary Industries, Parks, Water and Environment (DPIPWE) in Tasmania who was not involved in the work, says the findings are “encouraging news” because they build on [earlier evidence](#) from Hohenlohe and his collaborators that Tasmanian devils can evolve resistance to DFTD. “If we're getting selection on these genes . . . it's indicative that we could see some level of population recovery,” she notes. “It's also great in the sense that it gives us some context for understanding devil facial tumor disease and its impact through time.”

DFTD resistance: A novel, genome-wide adaptation

Stahlke, now a computational biologist for the US Department of Agriculture's Agricultural Research Service, says she was drawn to the Tasmanian devil project in Hohenlohe's lab because of her broader interest in using genomic approaches for conservation. Identifying the genetic basis of any emerging resistance to DFTD could bolster ongoing efforts of DPIPWE and its partners in the [Save the Tasmanian Devil Program](#), she says, as genetic assays could be used to track the spread of resistance in the wild or even screen captive-bred individuals prior to release.

“An evolutionary response to natural selection means, oftentimes, small changes in the frequencies of different genotypes or different genetic variants in a population, and so to be able to detect those changes requires having a lot of individuals,” says Hohenlohe. To get a large enough dataset in their search for resistance variants, the researchers turned to Jones and her field program in Tasmania that's been studying devils for more than two decades. “We've got

one of the best sample data sets and genetic sample sets for any emerging infectious disease in wildlife globally,” says Jones.

In all, the team sequenced roughly 16,000 single nucleotide polymorphisms (SNPs) from about 2,500 individual Tasmanian devils in six populations across Tasmania. Some of the loci were chosen because of their previous association with [DFTD](#), cancer, or immunity in general; others, which were at least 20 kilobases away from other loci, were added to ensure a greater coverage of the genome (whole genome sequencing for that many individuals would have been too expensive, Stahlke notes). The team then analyzed how the frequencies of these SNPs changed in each population over time using several different analyses to account for fluctuating population sizes and other potentially confounding effects.

Overall, they found evidence for selection in hundreds of loci scattered across the animals’ genome, which shows that “adaptation to DFTD is a really complicated, organism-wide response,” says Stahlke. Many of these loci were in immune-related genes, including ones previously associated with resistance and/or tumor remission in devils.

There were notable exceptions. Some of the genes have roles in the central nervous system, which could indicate behavioral evolution, or could have something to do with the fact that DFTD initially arose from Schwann cells in the central nervous system before becoming transmissible. The analyses also turned up selection in a gene that, in humans, is associated with ear formation, Stahlke notes; exactly how it might be involved in DFTD response is unclear, but discovering that link could provide novel insights into the animals’ disease response.

Other analyses in the paper suggested this kind of disease is new to the devils. “I was pretty convinced of this hypothesis that devils had seen transmissible cancer previously,” and therefore would have

had a remnant of past adaptation to such a disease in their genome, Stahlke says. This idea arose because devils are afflicted with two different transmissible cancers, and such diseases are considered extremely rare. To find out, the team compared the devil’s genome to those of other marsupials to identify genes that rapidly evolved since the devils’ split from their kin, which would suggest historical selection. While they did find a number of genes that fit the bill, there was “very little overlap” with the genes evolving since DFTD cropped up, she says, which suggests contagious cancers are a new challenge to the animals’ survival; presumably, the genes that rapidly evolved previously were in response to other selective pressures.

An evolving situation

Because of the dire predictions for the species early on, a large network of Tasmanian devil captive breeding programs was established in the early 2000s. In theory, this captive population could supplement losses to genetic diversity that occurred because of the epidemic, or could even be used to reintroduce the animals if the disease wiped out their wild kin completely. Now, Jones says, those captive animals could end up harming wild populations.

“They’re getting increasingly out of step with the natural evolution occurring in the wild,” she explains, and because of that, adding them to the wild gene pool could “water down” the emerging disease resistance and ultimately end up fueling a new epidemic of DFTD.

Lazenby notes that DPIPWE currently has four sites where captive animals are being released to augment local genetic diversity. The Save the Tasmanian Devil team is closely observing the released animals and the populations as a whole to determine exactly what effects the releases might have on those populations, and “this paper really highlights the importance of making sure that we do that,” she says. “It’s really important that, in our efforts to ensure

that we maintain as much genetic diversity as we can, we don't dilute this potential for evolution of tolerance or resistance."

A bountiful genetic resource

Although compiled to examine selection and provide a means for tracking resistance in devils, the data set the authors compiled could prove useful in many ways, such as investigating whether the disease prompts an increase in inbreeding, notes Anna Brüniche-Olsen, a conservation geneticist at the University of Copenhagen who investigated [selection in Tasmanian devils](#) during her doctoral training (Jones was one of her PhD advisors).

And DFTD isn't the only contagious cancer the animals face. The second transmissible tumor, [DFT2](#), was first spotted in 2014. It's currently limited in range, but is expected to spread much like DFTD did. "It will be interesting, in the future, to try to compare [what happens genomically after] DFTD and this DFT2," Brüniche-Olsen says, something "this data set could be excellent for."

Brüniche-Olsen says she'd love to see the sequencing expanded to whole genomes. The 16,000 loci used represent a small portion of the animal's genome, she says, and she "wouldn't be surprised" if there are genomic regions under selection that were missed by the study. She'd also like to see comparisons with other species that have contagious cancers to see if any of the same genes show evidence for selection, as it's possible other changing aspects of the devils' environment are confounding the results. "That would be more like an independent validation" of the genes' importance in resistance to DFTD.

Lazenby notes that the findings could aid research into potential [therapeutics](#), from helping determine which [human cancer drugs](#) have the greatest potential for treating devils to guiding [vaccine development efforts](#)—but researchers will need to connect the selected-for genes to functional changes first. Also, linking genes to physiology more directly could reveal any potential downsides or

tradeoffs involved. "By having this strong selection, does that make devils susceptible to anything else moving into the future?" asks Lazenby. "I think it's something which would be good to consider." In the meantime, Jones says, the results indicate that the devil will recover all on its own. "It's got enough standing genetic variation to adapt, so we don't need to wait for new mutations" she says. "The devil is going to live with [DFTD]. It's not going to become extinct."

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

Giving Flu and COVID Shots at Same Time Appears Safe, Effective: Study

Giving a COVID-19 vaccine at the same time as a [seasonal flu vaccine](#) appears safe and effective in the first study to test how people react to getting both shots at the same time.

Damian McNamara

Overall, the NVX-CoV2373 vaccine (Novavax) is showing 89.8% efficacy in an ongoing, placebo-controlled phase 3 study. When the researchers gave a smaller group of 431 volunteers from the same study an [influenza](#) shot at the same time, efficacy dropped slightly to 87.5%.

"These results demonstrate the promising opportunity for concomitant vaccination, which may lead to higher vaccination rates and further protection against both viruses," said study co-author Raja Rajaram, MD, medical affairs lead, Europe, Middle East, and Africa at Seqirus, the company that supplied the influenza vaccines for the research.

The [research](#) was published online June 13 as a *medRxiv* preprint.

"With these COVID-19 vaccines, there are essentially no concurrent use studies," Paul A. Offit, MD, told *Medscape Medical News* when asked to comment.

Traditionally, how a new vaccine might interact with existing vaccines is studied before the product is cleared for use. That was

not the case, however, with the COVID-19 vaccines made available through expedited emergency use authorization.

The researchers found no major safety concerns associated with concomitant vaccination, Rajaram said. In addition to safety, the current study aimed to see if either vaccine changes the immunogenicity or effectiveness of the other.

"It's a small study, but it's certainly encouraging to know that there didn't seem to be a big decrease in immunogenicity either way and the safety profile was similar. Not identical, but similar," added Offit, director of the Vaccine Education Center at Children's Hospital of Philadelphia, Pennsylvania.

Some adverse events were more common in the co-administration group. For example, injection-site tenderness was reported by 70% vs 58% for those who got the COVID-19 shot alone. The same was true for pain at the injection site, 40% vs 29%; fatigue, 28% vs 19%; and muscle pain, 28% vs 21%.

Rates of unsolicited adverse events, adverse events that required medical attention, and serious adverse events were low and well balanced between groups.

Fewer Antibodies Important?

Interestingly, although co-administering the two vaccines did not change the immune response for the influenza vaccine, the spike protein antibody response to the COVID-19 vaccine was less robust. Antibody titer levels at day 35 were 46,678 among people in the Novavax vaccine alone group, compared with 31,236 titers in the participants who received both vaccines.

"This impact did not seem to be clinically meaningful as vaccine efficacy appeared to be preserved," the researchers note.

Gregory A. Poland, MD, an internist and part of the Vaccine Research Group at Mayo Clinic in Rochester, Minnesota, agreed. "I highly doubt that is significant," he told *Medscape Medical News*.

Rajaram said the antibody findings are "slightly surprising but not

completely unexpected" because the same observation has been made in other combination vaccine studies. He added that the antibody levels "remain very high, although we do not yet know what antibody levels are required to achieve protection against COVID-19."

The decrease could become more concerning if people start with fewer antibodies and they drop over time with normal waning of protection, Poland said. This group could include people over age 65 or people who are [immunocompromised](#). More data would be needed to confirm this, he added.

A Boost for Booster Vaccines?

The research could carry implications for future COVID-19 booster shots, Poland said. "Overall, the study results are reassuring and of potential practical importance if we have to give booster doses. It will make it easier to give them both in one visit," said Poland, who was not affiliated with the research.

Although Novavax could be positioning itself as a logical choice for a COVID-19 booster based on the findings, Offit believes it is more important to focus on having more COVID-19 vaccine options available. "There may be, as we say at the track, 'courses for horses,'" he said, meaning that different vaccines may be better suited for different situations.

"It's likely we're going to find these vaccines have different safety profiles, they may have different populations for whom they work best, and they may have differences in terms of their long-term durability," he added. Also, some may prove more effective against certain variants of concern.

The Novavax vaccine would add a new class of COVID-19 vaccine to the mRNA and adenovirus vaccines. NVX-CoV2373 is a recombinant spike protein vaccine.

"I think the more vaccines that are available here, the better," Offit said.

Study Limitations

Poland shared some caveats. The study was primarily conducted in adults 18 to 64 years old, so there is less certainty on what could happen in people over 65. Furthermore, co-administration was evaluated after the first dose of the Novavax vaccine. "The reason I bring that up is most of the COVID-19 vaccine reactogenicity occurs with dose two, not dose one."

"All in all, it's an important first step — but it's only a first step," Poland said. "We need more data, including in elderly people who are primarily at risk for morbidity and mortality from the flu."

He suggested expanding the research to study co-administration of COVID-19 vaccines with different formulations of influenza vaccines.

The study was supported by Novavax. Offit had no relevant financial disclosures. Poland serves as a consultant to all of the COVID-19 vaccine companies.

MedRxiv. Published online June 13, 2021. [Full text](#)

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

Nutrition researchers urge update to lab animal diets

Nutrition scientists met to discuss revisions to the 30-year-old formulation of the diet consumed by lab rats and mice

By [Mennatalla Ibrahim](#)

The pile of beige food pellets in a lab mouse's cage might not be the most exciting part of an experiment, but it's a detail researchers can't afford to ignore. Nutrition scientists met last week to discuss possible revisions to the almost 30-year-old formulation of the diet consumed by laboratory rats and mice—the most commonly used animals in biomedical research. At [a session of the online American Society for Nutrition \(ASN\) meeting](#), researchers described how making rodent feed more nutritious and consistent would improve the animals' health and limit possible confounding variables in experiments.

"Having animals at their healthiest and then modifying the diet" gives researchers "a better base" to explore the effects of specific

nutrients—and to understand how and when animals develop diseases, says Michael Pellizzon, a senior nutrition scientist at the lab animal diet manufacturer Research Diets, Inc., and a panelist at the ASN session.

Last year, Pellizzon co-authored a paper describing ways that [diet choice can influence the results of experiments](#). For example, grain-based rodent diets often contain unspecified amounts of a class of hormonelike compounds called phytoestrogens. These can affect the onset of puberty in rodents and their risk of developing cancer, potentially obscuring the impacts of a drug, toxin, or nutrient being studied.

Prior to the 1960s, there was no standard formulation for rodent food, and researchers had little information about their vitamin and mineral content. In the 1970s, a committee of the American Institute of Nutrition developed AIN-76A, the first widely accepted, publicly available diet formula for rats and mice. It described pellets comprised mostly of sugar and milk protein, enriched with specific concentrations of vitamins, minerals, and amino acids to meet all the rodent nutritional requirements known at the time. Since the early 1990s, researchers have used a slightly modified formula called AIN-93.

But researchers have identified shortcomings with the formula. Purified, nonnatural diets such as AIN-93, which contain refined, easy-to-digest ingredients, can lead to various abnormalities in lab mice that could affect experimental results, including a buildup of fat, a loss of normal intestinal bacteria, and a reduction in the size of the intestines.

"It's almost 30 years later and AIN-93 hasn't been revised. And of course, today we know a lot more about nutrition now and how nutrients work," says Marta Fiorotto, a nutrition scientist at Baylor College of Medicine and a panelist at the ASN session. "There have been a lot of [people] in the nutrition community saying, 'Well yes,

we see why we use this diet, but it's got problems.””

Fiorotto doesn't think the rodent diet needs a complete overhaul. She and other panelists urged nutrition researchers to share “well-documented, scientifically correct” observations about how their animals' diet influenced their study results. Several meeting attendees agreed that AIN-93 was due for an upgrade, and some suggested potential improvements, such as modifying the amount of fiber, chromium, calcium, and protein in the pellet.

But updating rodent diets will be an uphill battle. The prospect of reformulation has been studied and discussed before, Fiorotto says, but “sometimes it's very difficult to get a bunch of people together to agree on something.” If nutrition scientists can reach a consensus that reformulation is necessary, she says, the next step is to compile available research on the issue and identify a group of experts to make recommendations that feed manufacturers could follow.

There's another challenge: Even though these manufacturers already offer carefully standardized rodent diets, many researchers still rely on less expensive alternatives made from nonpurified natural ingredients, such as ground corn, dried beef, pork, and fish. The amounts of specific ingredients in this chow are rarely disclosed and can change from batch to batch, which makes it hard to control individual nutrient levels in an experiment. It would be very difficult for a researcher to conduct—or replicate—a study on how different levels of copper affects the health of lab rodents, for example, because this essential nutrient can appear in chow at varying concentrations without being labeled.

Some scientists opt for this less transparent diet instead of the standardized one because they doubt a careful formulation matters much for the questions they are studying, Fiorotto says. But, “In order to do good nutrition research with mice and rats,” she says, “it's important to use diets where you know exactly what's in them.”

<https://bit.ly/3zFd6Je>

This 'ancient' monster fish may live for 100 years

These fish may be part of the centenarian club.

By [Laura Geggel - Editor](#)

Coelacanths, a group of human-size fish once thought to be extinct, may live as long as 100 years — five times longer than previous estimates suggested, a new study finds.

Researchers made the discovery by analyzing calcified growth structures, known as circuli, on the coelacanths' scales.

Like tree rings, circuli act as a record of the fish's age. The circuli analysis also showed that coelacanths likely don't reach sexual maturity until age 55 and then gestate their offspring for a remarkably long time — five years in total.



Coelacanths, which grow very slowly, may live to be 100 years old. (Image credit: Marc Herbin/MNHN)

"All told, the work reveals that the coelacanth is one of the slowest-growing and slowest-reproducing animals in the world," study lead researcher Kélig Mahé, of the Channel and North Sea Fisheries Research Unit at the National Institute for Ocean Science (IFREMER) in Boulogne-sur-mer, France, told Live Science in an email.

Lobe-finned coelacanths have been around since the [Devonian period](#), about [400 million years ago](#). But researchers, who began finding coelacanth fossils in the 19th century, thought this ancient lineage had gone extinct about 66 million years ago at the end of the [Cretaceous period](#), when an asteroid struck [Earth](#) and killed the nonavian [dinosaurs](#). That perception changed in 1938, when an angler caught a living coelacanth off the coast of South Africa.

But these deep-sea fish have remained something of a mystery to scientists. For instance, the African coelacanth (*Latimeria chalumnae*) can grow to be 6.5 feet (2 meters) long and weigh up to 231 pounds (105 kilograms). Strangely, [previous studies](#) suggested that these fish grew to their huge sizes in just 20 years — a growth rate that placed coelacanths among the fastest-growing marine fish, comparable to tunas, the new study's researchers said. But coelacanths have a low metabolism and low fecundity, two factors usually not seen in species with fast growth rates, the researchers said.

Moreover, the two earlier studies had included the same 12 coelacanth specimens. In the new study, the researchers more than doubled that count, looking at 27 coelacanths captured near the Comoros, a group of islands roughly between Mozambique and Madagascar. These fish — which included 13 females, 11 males, one juvenile and two embryos — were captured between 1953 and 1991, and are now part of a collection at the National Museum of Natural History in Paris.

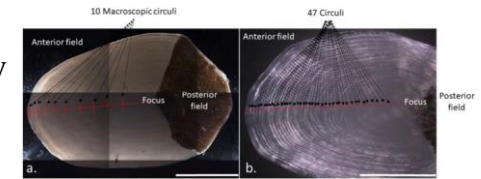
While the previous studies relied on regular microscopes to look at circuli on the coelacanths' scales, the new team used polarized-light microscopes that "made it much easier to see contrast," Mahé said. "The technique revealed calcified structures on the scales so thin that they were very nearly imperceptible."

This method revealed that, of the 27 coelacanths, six were in their 60s and one was 84 years old. Contrary to the previous claims that these fish grew quickly, "all looked to have been growing very slowly," Mahé said.

To validate their numbers, the researchers double-checked that the circuli were laid down annually, and found that was the case, Mahé said. The team did this by documenting the last incremental circuli growth on each individual and comparing that with the month each fish was captured. By observing the monthly fluctuations of

incremental growth throughout the year, they found that there was "only one scale growth peak during the year, which validates an annual periodicity," Mahé said.

The same coelacanth scale, of a female caught in 1954, analyzed with different microscopes. On the left (a) the scale is shown with transmitted light microscopy, which only shows some circuli. On the right (b), the scale is analyzed with polarized light microscopy, which shows more detail. (Image credit: R. Elleboode/IFREMER)



Next, the researchers looked at the scales on the two embryos. Coelacanths are ovoviviparous, meaning their offspring develop inside eggs within the mother and then hatch as live young. Both embryos were 5 years old, the team found. This age jibes with the nearly 14-inch (35 centimeters) length of newly hatched coelacanths, suggesting that the fish gestate their young for half a decade, "contrary to the one to two years [of gestation] suggested by earlier studies," the researchers wrote in the study.

This finding makes the coelacanth one of the longest-gestating vertebrates — even longer than the deep-sea frilled shark (*Chlamydoselachus anguineus*), which has a three-year gestation, the researchers said.

Based on the known length of coelacanths at sexual maturity, the researchers "estimated the age of sexual maturity around 55 years old," Mahé added.

The team's growth model, as well as the discovery of the 84-year-old individual, suggests that these fish can hit the century mark, Mahé said.

The study was published online Thursday (June 17) in the journal [Current Biology](#).

<https://bit.ly/2U15Fqn>

Darwin Made an Error About Sexual Selection, New Research Reveals

Findings suggest Darwin got things the wrong way round

Tamas Szekely, The Conversation

Charles Darwin was a careful scientist. In the middle of the 19th century, while he was collecting evidence for his theory that species evolve by [natural selection](#), he noticed it didn't explain the fancy tails of male peacocks, the antlers paraded by male deer, or why some the males of some species are far larger than their female counterparts.

For these [quirks](#), Darwin proposed a secondary theory: the [sexual selection](#) of traits that increase an animal's chance of securing a mate and reproducing. He carefully distinguished between weapons such as horns, spurs, fangs and sheer size that are used to subdue competing rivals, and ornaments that are aimed at charming the opposite sex.

Darwin thought that sexually selected traits could be explained by uneven sex ratios – when there are more males than females in a population, or vice versa. [He reasoned](#) that a male with fewer available females would have to work harder to secure one of them as a mate, and that this competition would drive sexual selection.

In a [new study](#), my colleagues and I have confirmed a link between sexual selection and sex ratios, as Darwin suspected. But surprisingly, our findings suggest Darwin got things the wrong way round. We found that sexual selection is most pronounced not when potential mates are scarce, but when they're abundant – and this means looking again at the selection pressures at play in animal populations that feature uneven sex ratios.

Since Darwin's time, we've learned a lot about uneven sex ratios, which are common in wild animal populations. For instance, in many [butterflies](#) and [mammals](#), including humans, the number of

adult females exceeds the number of adult males.

This skew is most extreme [among marsupials](#). In Australian antechinus, for instance, all males [abruptly die](#) after the mating season, so there are times when no adult males are alive and the entire adult population is made up of pregnant females.

In contrast, many birds parade more males than females in their populations. In some plovers, for example, the males [outnumber females](#) by six to one.

So why do many birds species have more males, while mammals often have more females? The short answer is that we don't know. But there are smoking guns.

Explaining uneven sex ratios

Some uneven sex ratios can be partially explained by [lifespan differences](#). [Female mammals](#), including humans, usually outlive their male counterparts by a wide margin. In humans, females live on average about [5 percent longer](#) than males. In [African lions](#) and [killer whales](#), the female lifespan is longer by up to 50 percent.

Predator preferences could also play a part. African lions kill approximately [seven times more](#) male than female buffalo, because male buffalo tend to roam alone, whereas females are protected within herds. In contrast, cheetahs kill [many more female](#) Thompson's gazelles than males, presumably because they can outrun female gazelles easier – especially the pregnant ones.

Finally, males and females often [suffer differently](#) from parasites and diseases. The [COVID-19 pandemic](#) is a striking example of this: the number of infected men and women is similar in most countries, but male patients have [higher odds of death](#) compared to female ones.

Sex ratios and sexual selection

Despite our growing knowledge of uneven sex ratios, Darwin's insight linking sex ratios with sexual selection has received little attention from scientists. Our study sought to address this, pulling

together these two strands of evolutionary theory in order to revisit Darwin's argument.

We looked in particular at the evolution of [large males](#) in different species, which are often several times larger than their female counterparts. We see this in [male baboons](#), [elephant seals](#) and [migratory birds](#), for example.

Sometimes, females are larger than males – as with some species of [bird](#), such as the African jacana. The scientific term for when one sex in a species is larger than the other is "[sexual size dimorphism](#)". It's clear how [sexual selection](#) can sometimes create size dimorphism. Knocking out an enemy requires muscular power, while fight endurance requires stamina. So being bigger often means dominating rivals, thereby winning the evolutionary lottery of reproduction.

Analyzing 462 different species of reptiles, mammals and birds, our study found a tight association between sexual size dimorphism and sex ratios, vindicating Darwin's conjectures.

But the trend was the opposite to the one Darwin predicted with his limited evidence. It turns out the most intense sexual selection – indicated by larger males relative to females – occurred in species where there were plenty of females for males to choose from, rather than a scarcity of females as Darwin suggested.

Implications for sexual selection

This in no way invalidates Darwin's theories of natural selection and sexual selection. Our finding simply shows that a different mechanism to the one Darwin proposed is driving mating competition for animals living in sex-skewed populations.

Darwin's assumption was based on the idea that the most intense competition for mates should occur when there's a shortage of mating partners. But [more recent theories](#) suggest this logic may not be correct, and that sexual selection is actually a system in which the winner takes all.

That means that when there are many potential partners in the population, a top male – in our study, the largest and heaviest – enjoys a disproportionately high payout, fertilizing a large number of females at the expense of smaller males, who may not reproduce at all.

We need further studies to help us understand how males and females seek out new partners in male-skewed and female-skewed populations, and in what circumstances ornaments, armaments and sheer size are particularly useful. Such studies could provide us with unprecedented new insights into how nature works, building on Darwin's original theory of sexual selection.

<https://wb.md/2SL0tvi>

Hundreds of Vaccinated Medical Workers in Indonesia Hospitalized

More than 350 doctors and medical workers in Indonesia who received a Chinese-made COVID vaccine have tested positive for the virus, Reuters reported.

Ralph Ellis

Most are asymptomatic but dozens have been hospitalized with a high fever and other symptoms, Badai Ismoyo, head of the health office in the district of Kudus in central Java, [told Reuters](#).

Health care workers in Indonesia were among the first to be vaccinated. Almost all of them were given the vaccine developed by Chinese biopharmaceutical company Sinovac, the Indonesian Medical Association (IDI) told Reuters.

The number of infected medical workers raises questions about how well that vaccine works against the Delta variant, which is thought to be causing the recent surge in cases in Indonesia.

"The data shows they have the Delta variant (in Kudus) so it is no surprise that the breakthrough infection is higher than before, because, as we know, the majority of healthcare workers in Indonesia got Sinovac, and we still don't know yet how effective it

is in the real world against the Delta variant," Dicky Budiman, an epidemiologist at Australia's Griffith University, told Reuters.

The World Health Organization said the Sinovac vaccine prevented symptomatic disease in 51% of recipients and prevented severe COVID-19 and hospital stays, Reuters said.

Last month, the WHO gave emergency authorization for the Sinovac vaccine, meaning it could be used in COVAX, the global vaccination program for low-income nations, [Reuters said](#).

The pandemic has hit Indonesia hard. [The WHO says](#) the nation of about 270 million people recorded more than 1.9 million infections and 53,000 deaths. Reuters said around 950 doctors and nurses have died in the pandemic. Reuters, citing health ministry data, reported that Indonesia recorded [12,624 new COVID infections](#) on Thursday, the most since Jan. 30.

Sources

Reuters. "Hundreds of vaccinated Indonesian health workers get COVID-19, dozens in hospital." "WHO approves Sinovac COVID shot in second Chinese milestone." "Indonesia reports 12,624 new COVID-19 cases, highest rise since January."

<https://bit.ly/35EKwtC>

This Weird Straw Claims to Cure Hiccups Better Than Any Remedy You Know

Getting rid of hiccups is no easy feat. Once your diaphragm starts involuntarily spasming, there's little you can do to stop the ensuing "hupps" and "hics" other than wait it out.

[Carly Cassella](#)

If you want to speed up the process, you can always try holding your breath, drinking upside down, sucking on a lemon, or eating a spoonful of sugar, but as popular as these traditional hiccup 'cures' are, the advice is notoriously unreliable.



[\(HiccAway\)](#)

Although hiccups are nothing more than a minor inconvenience to

most of us, for those that suffer hiccups regularly, hope could come in the form of a specialized straw recently invented by a neurologist. The device is creatively named [HiccAway](#), and if it looks like a Kickstarter product, [that's because it is](#). However, in a newly published research letter in *JAMA Network Open*, survey results from 249 volunteers around the world indicate that 90 percent of the users think this thing works better than traditional remedies.

The straw has a mouthpiece at one end and a pressure valve at the other, which requires you to suck harder than you would through a normal straw. This pressure causes your diaphragm to contract, stopping the uncontrollable influxes of air which rhythmically slam your vocal cords shut and cause the classic sound of a hiccup.

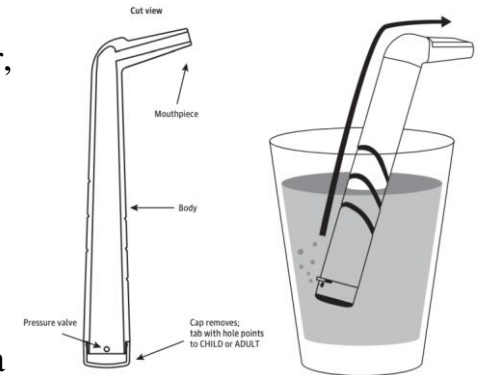


Diagram of HiccAway, aka 'the forced inspiratory suction and swallow tool'.
(Alvarez, JAMA Network Open, 2021)

All that's required to stop these 'burps of the throat' is to submerge HiccAway in half a glass of water and begin sucking. Those who have used the device say it takes as few as one or two attempts for the hiccups to fade.

According to the inventor, the valve at the bottom of the straw can be adjusted for the sipping capabilities of both children and adults.

The first trials on this special straw are based on subjective reports and do not include a placebo, so there's reason to remain skeptical. To determine if HiccAway really is the *best* remedy on offer, one would need randomized, placebo-controlled studies.

While drinking upside down or eating a spoonful of sugar might not sound very scientific, these traditional cures are [based on stimulating the vagus nerve and the phrenic nerve](#), which help to

regulate your swallowing and breathing.

If you can reboot the messages these nerves are sending by voluntarily swallowing, then it could help your diaphragm catch its breath during a spasm event. Logically, the theory is sound, but there are [few randomized placebo-controlled trials](#) to determine whether vagus-based remedies actually work. In fact, a [systematic review](#) in 2015 found there was not enough evidence to make any strong recommendations for hiccup cures at all.

HiccAway is yet another solution based on stimulating the vagus and phrenic nerve, but it too hasn't yet been tested thoroughly. Still, it was [invented by a neurologist](#) who has seen his share of patients suffering from hiccups due to brain injuries.

Ali Seifi reportedly spent years trying to find a simple solution for his patients - one that [simultaneously stimulates the phrenic and vagus nerve](#). HiccAway is the fruit of his labor.

Not all [the reviews on the product's website](#) so far describe the device as useful, but many report positive results.

Given how uncomfortable and annoying hiccups can be, especially for those with persistent cases, it's worth investigating Seifi's straws more. The study was published in [JAMA Network Open](#).

<https://wb.md/3vJazu0>

Man Refusing COVID Vaccine Later Needs Lung Transplant

Now he's speaking up and encouraging others to learn from his experience by getting vaccinated

Carolyn Crist

A Texas man who declined the COVID-19 vaccine earlier this year contracted the coronavirus and needed a double lung transplant to survive. Now he's speaking up and encouraging others to learn from his experience by getting vaccinated, according to [ABC News](#).

Joshua Garza, 43, of Sugarland, decided not to get vaccinated in January because he didn't think he needed it. Later that month, he

tested positive and became severely ill.

"COVID ended up attacking my lungs," he told ABC News. "It was quick, it was within three weeks, the lungs were already shot."

In early February, Garza fell down while trying to walk in his house, and his wife called for an ambulance to take him to the hospital. He was transferred to Houston Methodist and placed on an extracorporeal membrane oxygenation (ECMO) machine to pump his blood.

"They're telling you your lungs are failing, so you don't know if you're going to go to bed tonight and wake up tomorrow," he said.

Garza was put on the lung transplant list and was able to undergo surgery in mid-April. He spent several weeks in recovery and was released from the hospital on May 27.

Lung transplants are rare for COVID-19 patients but sometimes necessary for those who don't have any other options, ABC News reported. Houston Methodist has performed eight double lung transplants on COVID-19 patients and has several patients who are waiting for a transplant right now while on life support.

"These people are still fighting for their lives," Howard Huang, MD, Houston Methodist's medical director of [lung transplantation](#) and one of the doctors who treated Garza, told the news outlet.

Huang said it was "almost miraculous" that Garza was able to match with a donor during the peak of COVID-19 hospitalizations in the U.S. this winter. Houston Methodist continues to treat severe COVID-19 patients, including many who haven't yet been vaccinated, he said.

"The data that's now coming out suggests that the vaccines are very good at preventing severe illness," Huang said. "Even if [Garza] had ended up in a hospital, maybe it wouldn't have progressed all the way to complete lung failure that couldn't be salvaged without a lung transplant."

Garza told ABC News that he's sharing his story to help others and

prevent them from experiencing what he did.

"If I knew what I know now, I would have definitely went through with the vaccination," he said.

Source ABC News: "Texas man who declined COVID-19 vaccine speaks out after undergoing double lung transplant."

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

Skin Rash May Point to SARS-CoV-2 Infection

Skin symptoms are often the first, or only, symptom of COVID-19.

Roni Dengler, PhD

Angry red pinpricks, itchy hives, and purplish bruise-like spots on the skin often result from allergens or stress. Now, it appears that skin rashes may also signal COVID-19. Researchers discovered that skin rashes cluster with other symptoms of SARS-CoV-2 infection and predict a positive test result.

"Our results suggest that skin manifestations should be included in the list of symptoms to look for when suspecting infection," Veronique Bataille, a dermatologist at King's College London, who conducted the new research, wrote in an email.

Over the course of the pandemic, it became clear that infection with SARS-CoV-2 affected more than the lungs. Within the first few months, healthcare workers around the world noticed that patients had itchy, red welts, swelling of the face or lips, and red or purple sores or blisters on their feet or toes. During the first lockdown when people were at home with no testing and little support, there was a rising incidence of new skin rashes.

"We were concerned that this was not picked up as a sign of COVID infection," Alessia Visconti, a genetic epidemiologist at King's College London, who authored the new research with Bataille, wrote in an email.

There was no indication whether skin symptoms could be used to predict infection, and at the time, no resources for general practitioners or other healthcare professionals to distinguish

between SARS-CoV-2-related skin symptoms and unrelated skin conditions, such as eczema exacerbated by frequent handwashing.

To figure out whether skin symptoms could help diagnose COVID-19, Bataille, Visconti, and colleagues used social media to recruit more than 336,000 volunteers to use an app that collected user data on everything from sex, age, and ethnicity to chronic conditions and medication use. Participants provided daily updates on COVID-related symptoms, including rashes and sores or blisters on the feet. The app also prompted users to report whether they had had a SARS-CoV-2 test. In addition, nearly 12,000 participants completed an online questionnaire about skin symptoms.

Data collected from the app showed that the odds of testing positive for SARS-CoV-2 infection was 1.7 times higher with a skin manifestation compared with a lack of skin symptoms. The finding indicates that skin symptoms are better predictors of infection than fever.

Results from the survey revealed that skin rashes are often the first or only symptom of SARS-CoV-2 infection. Skin symptoms appeared before any other symptoms in 17 percent of SARS-CoV-2 positive cases. In 21 percent of cases, it was the only symptom, the researchers reported in the [*British Journal of Dermatology*](#).¹

"That is one of the most important things that's coming out of this paper," said Esther Freeman, director of Global Health Dermatology at Massachusetts General Hospital in Boston and principal investigator of the COVID-19 Dermatology Registry, who was not involved in the research. "These patients would not have necessarily met U.S. Centers for Disease Control and Prevention or United Kingdom National Health System criteria for COVID testing."

"For anybody who has not had a skin condition before, any new skin rash should be regarded as a possible sign of COVID, and should request a test," Visconti said.

Reference: I. A. Visconti et al., "Diagnostic value of cutaneous manifestation of SARS-CoV-2 infection." *Br J Dermatol*, 184(5):880-87, 2021.

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

UN Report Warns There's a Different Type of 'Pandemic' Coming For The World

Thousands of years of history tell us drought is nothing new.

Sometimes we prevail. Often we don't.

Mike McRae

A bleak look into the future tells us we've seen nothing yet, with a mix of shifting climates, poor water management practices, and growing population densities promising a '[pandemic](#)' of catastrophic droughts awaits.

The UN's [Special Report on Drought 2021](#) details the risks we face in coming years as a result of reduced rainfall in key spots around the world, exploring the drivers behind drought and the variety of measures we all take to cope with water shortage.

The fact global warming [is redistributing our water](#) is already a grim reality many around the world are forced to deal with.

"With human-induced [climate change](#), drought frequency and severity have already increased in some – often already water-scarce – regions of the globe," the authors [write in the report](#).

"As the world moves seemingly inexorably towards global average temperatures 2°C warmer than pre-industrial levels, drought impacts are intensifying and are predicted to worsen in many regions, particularly within business-as-usual scenarios."

At least 1.5 billion people around the world have been affected by drought over the past two decades, costing economies more than \$124 billion.

As the authors point out, there's usually a gap between reported losses and actual impacts, meaning figures like these should be taken as conservative at best. Not to mention the fact estimates don't even take into account the economies of developing nations.

Somewhat ironically, it's developing nations and remote regions that first come to mind when we think about severe drought.

Yet [nearly a fifth of the world's population](#) live in an area potentially at risk of water scarcity. By the end of the century, we can expect most countries to be touched by drought in some way.

[Reports](#) predicting the extent of increasing risks of [water shortages](#) in a [future ravaged](#) by a climate crisis have become commonplace.

Omens of drought barely qualify as news these days.

But given we know all this – given we know how devastating drought can be, and that so many of us face a future of dry spells – why aren't we better at managing it?

In an attempt to come up with an answer, the UN report assembled a number of case studies detailing 'lived experiences' of drought to highlight who in the community will be most affected by frequent periods of water stress.

Empowering those involved with agriculture is an obvious first step. But anybody with a need for a healthy aquatic environment, whether operating in tourism, transport, hydroelectricity, or fishing, has a stake in efficient water management.

Based on experiences gathered in these cases, it's clear that the politics on water aren't so much an issue with poor awareness, but a problem with bad memory.

"Current risk management and governance mechanisms and approaches addressing drought are being overwhelmed by the increasingly systemic nature of drought risk," the [report states](#).

"The case studies describe action in policy development, review and restructure when droughts are severe, and inaction when droughts are no longer evident."

Nobody wants to think about the next drought when the rains come, so it's hardly surprising that most political approaches are reactive, as opposed to proactive.

The UN secretary general's special representative for disaster risk

reduction, Mami Mizutori, is quick to compare future water shortages with a global disaster we don't need to imagine.

"Drought is on the verge of becoming the next pandemic and there is no vaccine to cure it," [quotes](#) *The Guardian's* Fiona Harvey.

Mizutori's analogy with [COVID-19](#) should resonate. Social inequality, lack of preparation, and difficulty adapting to novel risks have only compounded what is effectively a challenge we've faced [frequently in the past](#).

But just as a healthy immune system benefits from a long-term memory of past illness, our global community can't afford to forget the communities that faded from history for want of reliable access to fresh water. Read the Global Assessment Report on Disaster Risk Reduction: Special Report on Drought 2021 [here](#).

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

Geologic Activity on Earth Follows 27.5-Million-Year Cycle, New Study Says

Study provides statistical evidence for a common cycle

In a [new study](#) published in the journal *Geoscience Frontiers*, a team of U.S. researchers analyzed the ages of 89 well-dated geological events of the last 260 million years — such as marine and non-marine extinctions, major ocean-anoxic events, sea-level fluctuations — from the recent geologic literature.

"Many geologists believe that geological events are random over time," said Professor Michael Rampino, a geologist in the Department of Biology at New York University.

"But our study provides statistical evidence for a common cycle, suggesting that these geologic events are correlated and not random."

Using the age-dating data, Professor Rampino and colleagues performed moving-window and spectral analyses on the record of 89 major geologic events of the last 260 million years, including marine and non-marine extinctions, ocean-anoxic events, sea-level

oscillations, continental flood-basalt eruptions, pulses of intra-plate magmatism, and changes in seafloor spreading rates.

The scientists found that these geologic events are generally clustered at 10 different timepoints over the 260 million years, grouped in peaks or pulses of roughly 27.5 million years apart.

The most recent cluster of geological events was approximately 7 million years ago, suggesting that the next pulse of major geological activity is more than 20 million years in the future.

The authors posit that these pulses may be a function of cycles of activity in the Earth's interior–geophysical processes related to the dynamics of plate tectonics and climate. However, similar cycles in the Earth's orbit in space might also be pacing these events.

"The correlations and cyclicity seen in the geologic episodes may be entirely a function of global internal Earth dynamics affecting global tectonics and climate, but similar cycles in the Earth's orbit in the Solar System and in the Milky Way Galaxy might be pacing these events," they said.

"Whatever the origins of these cyclical episodes, their occurrences support the case for a largely periodic, coordinated, and intermittently catastrophic geologic record, which is quite different from the views held by most geologists."

Michael R. Rampino et al. 2021. A pulse of the Earth: A 27.5-Myr underlying cycle in coordinated geological events over the last 260 Myr. Geoscience Frontiers 12 (6): 101245; doi: 10.1016/j.gsf.2021.101245

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

Ocean Microbes May Actually Help Moderate Earth's Temperature, Scientists Say

Microbes in carbonate rocks act like a methane biofilter consuming it all before it leaves the ocean

[David Nield](#)

One of the key steps to mitigating [climate change](#) is to better understand the multitude of factors that affect our planet's

temperature – and a new study reveals the important role that ocean microbes play in the process.

Microbes are responsible for most of Earth's naturally produced methane, a key greenhouse gas that contributes to the warming of the atmosphere. But as well as producing it, microbes also consume it, keeping it trapped in the ocean.

The new research highlights how microbes in [carbonate rocks](#) such as limestone and dolomite play a crucial role in helping to regulate Earth's temperature by consuming methane and stopping it from escaping into the open air – a type of methane sink that has so far not been extensively studied.

"The microbes in these carbonate rocks are acting like a methane biofilter consuming it all before it leaves the ocean," [says evolutionary biologist Peter Girguis](#) from Harvard University.

In lab tests, chimney-like carbonates collected off the coast of Southern California were shown to capture methane at some of the highest rates ever recorded, emphasizing how important these rocks are at keeping methane in check.

While carbonate rocks are common on the seafloor, the chimney-like structures studied here are quite unusual. The stacks resemble groups of underwater trees and can reach around 150 centimeters (59 inches) in height.

The channels formed by these rocks allow microbes to clump together in high densities, and researchers found that the chimney rock microbes eat up methane 50 times faster than seafloor sediment microbes. That's a big jump, and it seems that the structure of the rock plays a part.

These rocks are porous, which – again – isn't typical, and that may increase methane guzzling speed because it enables fresh supplies of the gas to be delivered all the time. The mineral pyrite may also play a role, acting as an electrical conduit and increasing the metabolic rate of the microbes.

"These chimneys exist because some methane in fluid flowing out from the subsurface is transformed by the microbes into bicarbonate, which can then precipitate out of the seawater as carbonate rock," [says biologist Jeffrey Marlow](#) from Boston University.

"We're still trying to figure out where that fluid – and its methane – is coming from."

In lab tests, the team put carbonate chimney rocks into high-pressure reactors to recreate the conditions on the sea floor. The methane consumption was compared with data from another three geological settings, ranging from the Gulf of Mexico to the coast of New England.

One of the more exciting parts of the research is that if we can figure out what the microbes are doing here, we might be able to recreate it in other locations – using natural methane sinks to soak up the gas when it escapes from landfills, for example.

While different rates in microbe methane capture have been noticed before – from volcanoes, for example – these peculiarly shaped carbonate stacks are the new winners. Now scientists want to find out more about how it works.

"Next we plan to disentangle how each of these different parts of the carbonates – the structure, electrical conductivity, fluid flow, and dense microbial community – make this possible," [says Girguis](#).

"As of now, we don't know the exact contribution of each."

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