

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

Unprecedented Recovery: Drug Helps Treat Spinal Cord Injuries

Researchers discovered that AZD1236, a drug developed by AstraZeneca, might reduce damage after spinal cord injury.

New hope for spinal cord injury treatment

Scientists from the [University of Birmingham](#) found that suppressing the inflammatory response in the spinal cord may minimize damage following spinal cord injury.

Their findings, recently published in *Clinical and Translational Medicine*, show that AZD1236, an AstraZeneca medicine, may considerably reduce ‘secondary damage’ produced by the body’s response to spinal cord injury (SCI).

Animal models were used by researchers led by Professor Zubair Ahmed, Professor of Neuroscience and Section Lead for the Neuroscience and Ophthalmology Section at The University’s Institute of Inflammation and Ageing, to demonstrate that AZD1236 can promote significant nerve regeneration, with a dramatic 80% preservation in nerve function following spinal cord compression injury.

Crucially, this translated into an 85% improvement in movement and sensation. These dramatic effects were observed following only three days of treatment with AZD1236, starting within 24 hours post-injury. Within three weeks, the AZD1236 treated animals showed unprecedented recovery, while controls still showed significant deficits at six weeks post-injury.

One of the key drivers of SCI secondary damage is the breakdown of the blood-spinal cord barrier (BSCB). This results in oedema (excess fluid build-up around the spinal cord) and triggers an inflammatory response that can ultimately hinder the healing process, and lead to nerve cell death.

AZD1236 is a potent and selective inhibitor of two enzymes,

MMP-9 and MMP-12, which are implicated in the inflammatory process.

The researchers demonstrated that AZD1236 halts SCI-induced oedema, and reduces BSCB breakdown and scarring at the site of the injury. They also examined the effect of AZD1236 dosing on MMP-9 and MMP-12 activity in both the bloodstream and cerebrospinal fluid, which surrounds the spinal cord.

Here they demonstrated significant suppression of enzyme activity after both oral dosing, and intrathecal dosing (injection into the spinal canal). Oral dosing reduced enzyme activity by 90% in serum, and 69-74% in the cerebrospinal fluid. Unsurprisingly, intrathecal injection delivered higher levels (88-90%) of suppression in the cerebrospinal fluid.

Further studies showed that AZD1236 suppressed the formation of pro-inflammatory cytokines (molecules that are known to contribute to the development of long-lasting neuropathic pain, which often follows SCI) by 85-95%. AZD1236 was also found to be 82% more effective at alleviating SCI-induced neuropathic pain sensitivity to cold, heat, and touch when compared to currently used pain medications such as pregabalin (Lyrica) and gabapentin.

Professor Ahmed commented: “There is currently no reparative drug available for SCI patients, treatments only provide symptomatic relief and do not tackle the underlying molecular mechanisms that cause or contribute to oedema and blood-spinal cord barrier breakdown. This drug has the potential to be a first-in-class treatment against some of the key pathological drivers of SCI and could revolutionize the prospects for recovery of SCI patients”.

Hitesh Sanganee, Executive Director, Discovery Sciences, AstraZeneca said: “The work by Professor Ahmed and his team has been supported through our Open Innovation Programme and represents a very successful collaboration between academia and industry to bring about the possibility of real benefits to patients

affected by SCI, an area of great medical need. Exploring the potential of AZD1236 for this new indication represents a great outcome for our Open Innovations program and aligns with our ethos of “sharing ideas and enabling scientific innovation to cross boundaries between academia and industry will help to translate innovative ideas into scientific breakthroughs and potential new medicines more quickly.”

The University of Birmingham Enterprise has filed a patent application covering selective combined inhibition activity or expression of both matrix metalloproteinase MMP-9 (gelatinase B) and MMP-12 (macrophage metalloelastase) after SCI or related injury to neurological tissue.

The University of Birmingham Enterprise is now seeking investors and partners to take this promising therapeutic to clinical trials.

Reference: “Clinic-ready inhibitor of MMP-9/-12 restores sensory and functional decline in rodent models of spinal cord injury” by Zubair Ahmed, Sharif Alhajlah, Adam M. Thompson and Rebecca J. Fairclough, 20 May 2022, Clinical and Translational Medicine. DOI: 10.1002/ctm2.884

<https://bit.ly/3R4btxf>

Does warfare make societies more complex?

Controversial study says yes

Archaeological analysis suggests an arms race in ironworking and cavalry spurred bureaucracy and bigger populations

By [Michael Price](#)

War is hell. It breaks apart families, destroys natural resources, and drives humans to commit unspeakable acts of violence. Yet according to a new analysis of human history, war may also prod the evolution of certain kinds of complex societies. The twin developments of agriculture and military technology—especially cavalries and iron weapons—have predicted the rise of empires.

“I think they make a convincing case,” says Robert Drennan, an archaeologist at the University of Pittsburgh who wasn’t involved in the work. Yet he and others argue the study offers a rather

limited look into how exactly these factors might have shaped societies.

Scholars largely agree that agriculture was one of the major drivers of increasingly complex societies by allowing for bigger, more sedentary populations and divisions of labor. More contentious has been the role of strife.

“The majority of archaeologists are against the warfare theory,” says Peter Turchin, an evolutionary anthropologist at the University of Connecticut, Storrs, and the new study’s lead author. “Nobody likes this ugly idea because obviously warfare is a horrible thing, and we don’t like to think it can have any positive effects.”

The scholarship in this area hinges on how one measures and defines social complexity. For the new study, Turchin and colleagues chose three quantifiable metrics: the size of a society and its territory, the complexity of its ruling hierarchy, and how specialized its government is, from the presence of professional soldiers, priests, and bureaucrats to the intricacy of its legal codes and court systems.

Next, the scientists turned to a database known as [Seshat: Global History Databank](#). (Turchin is the chair of Seshat’s board of directors, and several other authors on the paper sit on the board or work there as staff.) The Seshat project pulls together historians, archaeologists, and other experts in more than 400 past societies around the world that date back up to 10,000 years ago. Project leaders asked these experts to break down aspects of ancient life into different variables: Did the 12th century Ayyubid Sultanate of southern Yemen have full-time bureaucrats? Yes. How many people lived in Peru’s Wari Empire between 650 and 999 C.E.? Between 100,000 and 500,000.

Turchin and colleagues grouped the hundreds of societies over time into 30 global regions and sorted the societal variables into 17 data buckets, including military innovation and how long people had

been practicing agriculture. Then, they devised an algorithm to determine how well the data from each bucket predicted growth in their chosen three dimensions of social complexity.

Two factors stood out. Unsurprisingly, the longer a region had been practicing agriculture, the more likely it was to be socially complex. But [even more predictive was military innovation](#)—specifically the introduction of mounted warfare and the emergence of iron weapons, researchers report this month in *Science Advances*.

Cavalry surfaced as a particularly dependable sign of imminent empire. In each Eurasian region Turchin and colleagues examined, megaempires emerged 300 to 400 years after the appearance of cavalry. The Achaemenid Empire, for example, which occupied much of modern-day Iran, acquired both ironworking and cavalry around 900 B.C.E.; in 500 B.C.E. its territory eclipsed 3 million square kilometers.

Once a society adopted superior iron weaponry and formed cavalries, it could protect itself from rivals or overwhelm them, Turchin says. He thinks this competition is what drives societies to become more complex, building more hierarchical armies to fight ever-more-complex wars and organizing increasingly bureaucratic governments to manage diverse resources and growing populations. Turchin acknowledges that these results concern his team's specific definition of social complexity; they say nothing about any particular society's *cultural* complexity. That's an important distinction because complex societies thrived for millennia throughout sub-Saharan Africa, the Americas, the Pacific islands, and elsewhere, but few conquered huge swaths of territory to become massive empires; their societies were often smaller and their governments less hierarchical and specialized than their counterparts in Eurasia and northern Africa beginning around 1000 B.C.E. When European colonization introduced iron and horses to these societies, the authors write, they, too, experienced a jump in

the societal traits considered complex in this study.

The Inca Empire, Turchin notes, is something of an outlier. It needed neither iron nor horses to develop a massive population and complex governance. It did, however, have llamas, and using them as transport animals would have given the empire a competitive advantage over rivals, he says.

“It’s compelling that amidst the umpteen variables that they consider here, the impact of horses really rises to the top,” says William Taylor, an anthropologist at the University of Colorado, Boulder, who studies humanity’s history with the animals. “I think the paper underscores the importance of horses as an agent of social change.”

But he quibbles with some of the historical and archaeological data used to build the new model. For example, the study presumes horse riding arose in 1000 B.C.E. on the Pontic–Caspian steppe, but Taylor says scholars are still seeking answers as to exactly where and when people began to ride horses. Also, many early horse-riding societies left behind relatively few archaeological clues and are likely underrepresented in models, such as Seshat, that rely heavily on archaeology.

Monique Borgerhoff Mulder, a human behavioral ecologist at the University of California, Davis, says the researchers should be applauded for “taking an innovative, macrolevel, quantitative approach to history.”

But she thinks the time between advances in agriculture and military technology and the development of social complexity is too long to be confident about their impact. She says a lag time of 300 to 400 years between the arrival of ironworking and horses and the rise of an empire suggests “military technology must be viewed as a very remote predictor of the outcome.”

If it is true that warfare ultimately propelled human societies into certain kinds of complexity, though, Turchin says that’s no reason

to celebrate it. The crucial ingredient in this evolution was competition, he says, not violence.

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

Forest-Living East African Chimpanzees are Digging Wells for Cleaner Water: Study

First report of habitual well-digging in a rainforest-living group of East African chimpanzees

Digging wells to access or filter drinking water is a relatively rare behavior in the animal kingdom — only a handful of species have been documented to do so.

Researchers from the United Kingdom, Switzerland and Uganda provide the first report of habitual well-digging in a rainforest-living group of [East African chimpanzees \(*Pan troglodytes schweinfurthii*\)](#); they suggest that this behavior may have been imported into the community's behavioral repertoire by an immigrant female chimpanzee.

“Water, a resource of universal relevance, is rarely considered a concealed resource; it is usually directly accessible from surfaces, cavities, or other types of containers,” said first author Hella Péter, a Ph.D. student in the School of Psychology and Neuroscience at the University of St Andrews and the School of Anthropology and Conservation at the University of Kent, and colleagues.

“However, water is also present beneath the surface, where access is only possible through the creation of wells.”

“Some species have been documented to regularly exploit concealed water. Reports include those on African elephants, warthogs and various equids, such as [feral horses and donkeys](#), khulan, mountain zebras and plains zebra.”

In their research, Péter and co-authors analyzed the behavior of East African chimpanzees in the Waibira community in Uganda.

The well-digging was first observed in Onyofi, a young immigrant female who arrived in 2015 and was immediately very proficient,

suggesting she perhaps grew up in a well-digging community.

Since then several other young Waibira chimpanzees and adult females have been seen digging wells.

No adult males were observed digging, however, they regularly use the wells dug by others.

Onyofi's well-digging attracted a lot of attention from the other chimpanzees in the group, and she was carefully watched both by young chimps and other adults, suggesting that when she arrived the behavior was novel to the Waibira community.

Her wells seem popular, with other chimpanzees drinking from them directly, or using chewed up leaves or moss, demonstrating that there seems to be some added benefit to well-water.

The presence of the behavior also highlights the importance of water as a resource, even for rainforest living populations.

With increasing change in the climate, behavioral adaptations to changes in rainfall may allow groups like Waibira to continue to thrive even when their local habitat starts to change.

“Well digging is usually done to access water in very dry habitats — in chimpanzees, we only know about three savannah living groups who do so,” Péter said.

“What we've seen in Waibira is a bit different from those groups. First, they live in a rainforest, so most people assume getting water shouldn't be a challenge — but it looks like the yearly few months of dry season is enough to cause some trouble for them!”

“What's also interesting is that the wells all appear next to open water, so the purpose of them is likely filtering, not reaching the water — the chimpanzees might get cleaner or differently flavored water from a well, which is fascinating.”

“One of the most interesting things was seeing the other chimpanzees' responses to Onyofi's digging — even large dominant males would politely wait for her to finish digging and drinking, and only then go and borrow her well, which is pretty

unusual around such a valuable resource,” said senior author Dr. Catherine Hobaiter, a researcher in the School of Psychology and Neuroscience at the University of St Andrews and the Budongo Conservation Field Station.

“We’re curious to see what happens once some of the young males who can dig grow older — maybe they will be acceptable teachers for the big males, and they’ll stop relying on others to dig wells for them.” The [study](#) was published in the journal *Primates*.

H. Péter et al. Well-digging in a community of forest-living wild East African chimpanzees (Pan troglodytes schweinfurthii). Primates, published online June 6, 2022; doi: 10.1007/s10329-022-00992-4

<https://bit.ly/3AnITC8>

A Dying Star’s Last Act was to Destroy all Its Planets *Expansive buffet makes this stellar cannibalism act one of the most widespread ever seen*

By [Carolyn Collins Petersen](#)

When white dwarfs go wild, their planets suffer through the resulting chaos. The evidence shows up later in and around the dying star’s atmosphere after it gobbles up planetary and cometary debris. That’s the conclusion a team of UCLA astronomers came to after studying the nearby white dwarf G238-44 in great detail. They found a case of cosmic cannibalism at this dying star, which lies about 86 light-years from Earth.

If that star were in the place of our Sun, it would ingest the remains of planets, asteroids, and comets out to the Kuiper Belt. That expansive buffet makes this stellar cannibalism act one of the most widespread ever seen.

“We have never seen both of these kinds of objects accreting onto a white dwarf at the same time,” said lead researcher Ted Johnson, a physics and astronomy graduate of UCLA. “By studying these white dwarfs, we hope to gain a better understanding of planetary systems that are still intact.”

Finding Evidence of Chaos at a Dying Star

Johnson was part of a team from UCLA, UC San Diego, and the University of Kiel in Germany working to study chemical elements detected in and around the white dwarf atmosphere.

They used data from NASA’s retired Far Ultraviolet Spectroscopic Explorer, the Keck Observatory’s High-Resolution Echelle Spectrometer in Hawaii, and the Hubble Space Telescope’s Cosmic Origins Spectrograph and Space Telescope Imaging Spectrograph. The team found and measured the presence of nitrogen, oxygen, magnesium, silicon, and iron, as well as other elements.

The iron is particularly interesting since it makes up the cores of rocky planets like Earth or Mars. Its presence is a clue that terrestrial-type worlds once orbited G238-44. The presence of high amounts of nitrogen implies the system had a pool of icy bodies as well.

When White Dwarfs Strike

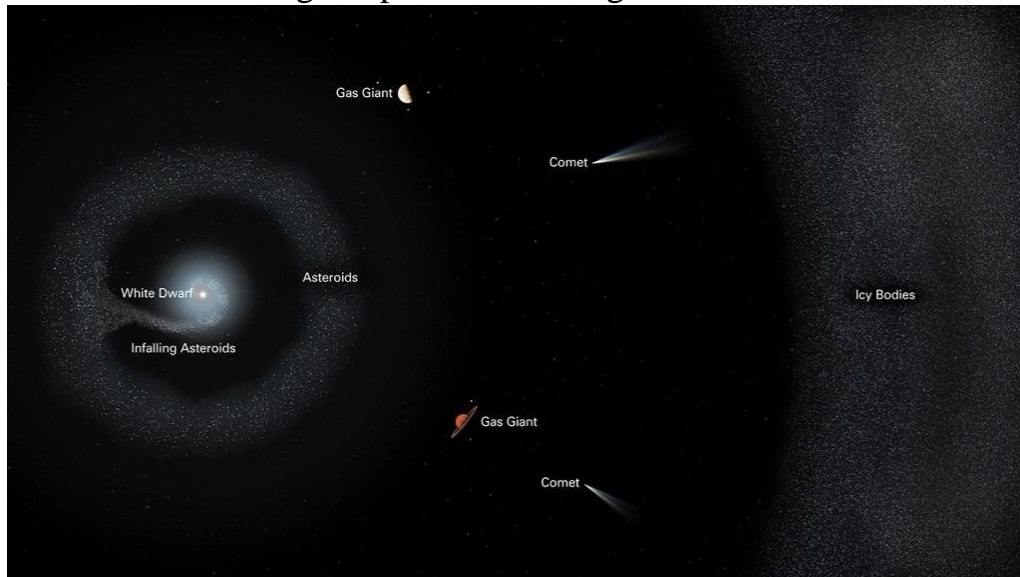
As stars like the Sun enter very old age, they leave behind burned-out cores called [white dwarfs](#). Over billions of years, these remnants of dying stars slowly cool down. Before they get to that point, however, the actual death throes can be quite violent and messy. That’s when they cannibalize the worlds around them. The discovery of the “leftovers” of those planets, comets, and asteroids, in the atmosphere of G238-44 paints an ominous picture of our solar system’s future.

We can expect our Sun to go through the process starting in about five billion years. First, it will balloon out to become a red giant, swallowing up planets possibly out to the orbit of Earth. Then, it will lose its outer layers, forming what we call a “planetary nebula”. Once all that’s dissipated to space, what’s left is the massive, but tiny white dwarf.

The whole process will tear apart the solar system, ripping planets to shreds and scattering comets and asteroids. Any of those objects that come too close to the white dwarf Sun will get sucked in and

destroyed. The scale of the destruction occurs fairly quickly if G238-44's example is any clue.

This study shows the shocking scale of the chaos. Within 100 million years after it entered its white dwarf phase, the dying star was able to capture and consume material from its nearby asteroid belt and its far-flung Kuiper belt-like regions.



The slow destruction of G238-44's planetary system, with the tiny white dwarf at the center, surrounded by a faint accretion disk made up of pieces of shattered bodies falling onto the dead star. Any remaining asteroids form a thin stream of material surrounding the dying star. Larger gas giant planets may still exist in the system, and much farther out is a belt of icy bodies such as comets. The process of gobbling up the leftovers of its worlds commenced shortly after the star entered its white dwarf phase. Courtesy:

NASA, ESA, Joseph Olmsted (STScI)

What Else This White Dwarf Reveals

Not only does this finding show what's in our future, but it also supplies interesting insight into how other systems form. It offers clues to what they contain, and a peek at our own solar system's past.

For example, astronomers think that icy objects crashed into dry, rocky planets in our own infant solar system. That's in addition to the rocky materials that helped create our planet. For G238-44, that means an interesting amalgamation of stuff from a variety of regions and the evidence shows it.

"The best fit for our data was a nearly two-to-one mix of Mercury-like material and comet-like material, which is made up of ice and dust," Johnson said. "Iron metal and nitrogen ice each suggest wildly different conditions of planetary formation. There is no known solar system object with so much of both."

A Dying Star Gives Other Clues

The death of this sun-like star and its penchant for gobbling up debris has another interesting twist. Billions of years ago, comets and asteroids likely delivered water to our planet, sparking the conditions necessary for life.

According to Benjamin Zuckerman, UCLA professor of physics and astronomy, the combo of icy and rocky material detected raining onto G238-44 shows that other planetary systems may have icy reservoirs (like the Kuiper Belt and Oort Cloud). That's in addition to rocky bodies such as Earth and the asteroids.

"Life as we know it requires a rocky planet covered with a variety of volatile elements like carbon, nitrogen, and oxygen," Zuckerman said. "The abundances of the elements we see on this white dwarf appear to have come from both a rocky parent body and a volatile-rich parent body—the first example we've found among studies of hundreds of white dwarfs."

It's intriguing to think that our own Sun could be doing the same thing in a few billion years. Perhaps some future astronomer on a planet a few dozen light-years away will do the same study that Johnson and his team did—and spot the remains of Earth in the white dwarf Sun's dying glow.

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

Ancient wolves give clues to origins of dogs

Study helps narrow down where our canine pals came from

By [Michael Price](#)

Where and when dogs arose is one of the [biggest mysteries of domestication](#). To solve it, researchers have tried everything from analyzing ancient dog bones to sequencing modern dog DNA—all with inconclusive results. Now, researchers have tried a new tack: figuring out where the ancient wolves that gave rise to dogs lived. The new study doesn't close the case, but it does point to a broad geographic region—eastern Eurasia—while also suggesting our canine pals may have been domesticated more than once.

That region “certainly jibes with what I've been thinking,” says Adam Boyko, a canine geneticist at Cornell University who wasn't involved in the work. He remains skeptical, however, about the possibility of separate domestication events.

At least 15,000 years ago—and perhaps closer to [23,000 years ago](#)—humans and wolves began their fateful dance toward domestication. This was during the last ice age, when high-latitude regions experienced a bitterly cold, dry climate. According to the most prominent theory, less timid gray wolves inched closer and closer to human campsites to get scraps. Over time, they passed along genes for increasingly docile behaviors and traits. Humans found these newfound friends useful for hunting and guarding campsites.

Exactly where this happened is hotly contested. Some genetic analyses of modern dogs suggest they arose in East Asia, whereas other genetic and archaeological evidence indicates our pups came from [Siberia](#), the Middle East, Western Europe, or perhaps [multiple places](#). “There's been a lot of pins put in the map,” says Pontus Skoglund, a geneticist at the Francis Crick Institute and senior author of the new study.

Skoglund and a vast cast of collaborators from 16 countries decided to try something new: build a massive map of wolf ancestry around the time of domestication. “If you imagine wolf ancestry as a big jigsaw puzzle, we placed the dog puzzle piece within that map,” he says.

The paper's 81 co-authors—mostly archaeologists, anthropologists, and geneticists—pooled their collective resources and sequenced 66 ancient wolf genomes and incorporated six previously published ones, from sites across Europe, Siberia, and North America. The ages of these animals spanned the past 100,000 years. Next, the team used computer software to compare the 72 ancient genomes and work out a rough family tree.

One of the first things that jumped out was how interconnected these far-flung wolf populations remained over time, Skoglund says. Over tens of thousands of years, wolves living as far apart as Alaska and Europe continued to share recent ancestry, suggesting the animals were mobile and mated at least occasionally.

Comparing the ancient wolf genomes with those from modern and ancient dogs, the researchers found that dogs are much more closely related to ancient wolves from eastern Asia than those from Europe. That [points to eastern Eurasia as their home region](#) and more or less eliminates western Eurasia as a potential origin spot, the team contends today in *Nature*. But none of the ancient wolves proved to be a close ancestor of dogs, meaning the actual site of domestication remains a mystery. The paper also resolves the mystery of whether [an 18,000-year-old pup](#) found in 2019 near the Siberian city of Yakutsk was a wolf or a dog. The answer? Wolf.

These are “exciting results,” says evolutionary biologist Yohey Terai at Japan's Graduate University for Advanced Studies, whose work previously identified an extinct Japanese wolf as the [closest relative of modern dogs yet found](#). Even though “the authors did not sample a wolf population most closely related to dogs,” he says,

“these samples help narrow down the place of origin.”

Curiously, the ancient wolves from Europe do appear to share some genes with modern dogs from western Eurasia and Africa, such as basenjis and various village dogs. That suggests that at some point, European wolves either interbred with a western population of dogs or, more intriguingly, underwent a separate domestication event.

Boyko isn't convinced, noting that the later interbreeding scenario is the simplest. “I think their evidence makes the case even stronger that we're looking at a single domestication event,” he says, though one that may have been complicated by interbreeding and other factors.

The ancient wolf genomes also provide a lengthy look at which genes proliferated through the species over the course of approximately 30,000 generations. One gene known to be involved in craniofacial development swept through wolves beginning about 40,000 years ago. Within the span of 10,000 years, it went from being incredibly rare to present in 100% of ancient wolves. It's still found in modern wolves and dogs today. Another cluster of genes related to olfaction experienced a similar sweep between 45,000 and 25,000 years ago.

Together, Skoglund notes, these events suggest wolves evolved adaptations—perhaps stronger jaws and more sensitive noses—that allowed them to survive the harsh conditions of the ice age. “The better to eat you with,” he says, “the better to smell you with.”

<https://bit.ly/3bN00SE>

A new look at the ‘mineral kingdom’ may transform how we search for life

Research also shows Earth may have been ready for life to form earlier than typically thought

By [Asa Stahl](#)

If every mineral tells a story, then geologists now have their equivalent of *The Arabian Nights*. For the first time, scientists have

cataloged every different way that every known mineral can form and put all of that information in one place. This collection of mineral origin stories hints that Earth could have harbored life earlier than previously thought, quantifies the importance of water as the most transformative ingredient in geology, and may change how researchers look for signs of life and water on other planets.

“This is just going to be an explosion,” says Robert Hazen, a mineralogist and astrobiologist at the Carnegie Institution for Science in Washington, D.C. “You can ask a thousand questions now that we couldn't have answered before.”



Diamonds have the same carbon structure, but they can form in different ways. This particular gem originated deep within the Earth. Rob Lavinsky/ARKENSTONE

For over 100 years, scientists have defined minerals in terms of “what,” focusing on their structure and chemical makeup. But that can make for an incomplete picture. For example, though all diamonds are a kind of crystalline carbon, three different diamonds might tell three different stories, Hazen says. One could have formed 5 billion years ago in a distant star, another may have been born in a meteorite impact, and a third could have been baked deep below the Earth's crust.

So Hazen and his colleagues set out to define a different approach to mineral classification. This new angle focuses on the “how” by thinking about minerals as things that evolve out of the history of life, Earth and the solar system, he and his team report July 1 in a pair of studies in *American Mineralogist*. The researchers [defined 57 main ways](#) that the “mineral kingdom” forms, with options ranging from condensation out of the space between stars to formation in the excrement of bats.

The information in the catalog isn't new, but it was previously

scattered throughout thousands of scientific papers. The “audacity” of their work, Hazen says, was to go through and compile it all together for the more than [5,600 known types of minerals](#). That makes the catalog a one-stop shop for those who want to use minerals to understand the past.

The compilation also allowed the team to take a step back and think about mineral evolution from a broader perspective. Patterns immediately popped out. One of the new studies shows that over half of all known mineral kinds form in ways that ought to have been possible on the newborn Earth. The implication: Of all the geologic environments that scientists have considered as potential [crucibles for the beginning of life on Earth](#), most could have existed as early as 4.3 billion years ago (*SN*: 9/24/20). Life, therefore, may have formed almost as soon as Earth did, or at the very least, had more time to arise than scientists have thought. Rocks with traces of life [date to only 3.4 billion years ago](#) (*SN*: 7/26/21).

“That would be a very, very profound implication — that the potential for life is baked in at the very beginning of a planet,” says Zachary Adam, a paleobiologist at the University of Wisconsin–Madison who was not involved in the new studies.



Calcite can form in 17 different ways, more than almost any other mineral. This calcite, which formed in a cave, got its distinctive shape from changing water levels. Rob Lavinsky/ARKENSTONE

The exact timing of when conditions ripe for life arose is based on “iffy” models, though, says Frances Westall, a geobiologist at the Center for Molecular Biophysics in Orléans, France, who was also not part of Hazen’s team. She thinks that scientists need more data

before they can be sure. But, she says, “the principle is fantastic.” The new results also show how essential water has been to making most of the minerals on Earth. Roughly 80 percent of known mineral types need H₂O to form, the team reports. “Water is just incredibly important,” Hazen says, adding that the estimate is conservative. “It may be closer to 90 percent.”



Some minerals would not form in certain ways without the influence of life. Photosynthesizing bacteria helped bring about the oxygen-rich conditions needed for this azurite (left), while the opalized ammonite (right) was created by the mineral opal filling the space where an ammonite shell used to be.

Rob Lavinsky/ARKENSTONE

Taken one way, this means that if researchers [see water](#) on a planet like Mars, they can guess that it has a rich mineral ecosystem (*SN*: 3/16/21). But flipping this idea may be more useful: Scientists could identify what minerals are on the Red Planet and then use the new catalog to work backward and figure out what its environment was like in the past. A group of minerals, for example, might be explainable only if there had been water, or even life. Right now, scientists [do this sort of detective work](#) on just a few minerals at a time (*SN*: 5/11/20). But if researchers want to make the most of the samples collected on other planets, something more comprehensive is needed, Adam says, like the new study’s framework.

And that’s just the beginning. “The value of this [catalog] is that it’s ongoing and potentially multigenerational,” Adam says. “We can go back to it again and again and again for different kinds of questions.” “I think we have a lot more we can do,” agrees Shauna Morrison, a mineralogist at the Carnegie Institution and coauthor of the new studies. “We’re just scratching the surface.”

Citations

R.M. Hazen and S.M. Morrison. [On the paragenetic modes of minerals: a mineral evolution perspective](#). *American Mineralogist*. Published online July 1, 2022. doi: 10.2138/am-2022-8099.

R.M. Hazen et al. [Lumping and splitting: toward a classification of mineral natural kinds](#). *American Mineralogist*. Published online July 1, 2022. doi: 10.2138/am-2022-8105.

<https://bit.ly/3Ia9fZ4>

How Eating Eggs Can Protect Against Heart Disease and Improve Heart Health

According to new research, eating eggs may increase the quantity of heart-healthy metabolites in the blood, which may help explain why moderate egg consumption is protective against cardiovascular disease

Researchers recently published findings in the journal *eLife* that demonstrate how eating eggs can boost the number of heart-healthy metabolites in the blood. According to the research, consuming up to one egg daily may help reduce the risk of cardiovascular disease. Despite the fact that eggs are a rich source of dietary cholesterol, they also provide a variety of important nutrients. There is contradictory evidence about whether eating eggs is good or bad for your heart. According to a 2018 study in the journal *Heart*, those who ate eggs regularly (about one egg per day) had a much reduced risk of heart disease and stroke than people who ate eggs less often. This study involved roughly 500,000 individuals in China. The authors of this research have now conducted a population-based study to further understand this association by looking at how egg intake impacts indicators of cardiovascular health in the blood.

“Few studies have looked at the role that plasma cholesterol metabolism plays in the association between egg consumption and the risk of cardiovascular diseases, so we wanted to help address this gap,” explains first author Lang Pan, MSc at the Department of Epidemiology and Biostatistics, Peking University, Beijing, China. Pan and the team selected 4,778 participants from the China

Kadoorie Biobank, of whom 3,401 had a cardiovascular disease and 1,377 did not. They used a technique called targeted nuclear magnetic resonance to measure 225 metabolites in plasma samples taken from the participants’ blood. Of these metabolites, they identified 24 that were associated with self-reported levels of egg consumption.

Their analyses showed that individuals who ate a moderate amount of eggs had higher levels of a protein in their blood called apolipoprotein A1— a building-block of high-density lipoprotein (HDL), also known as ‘good lipoprotein’. These individuals especially had more large HDL molecules in their blood, which help clear cholesterol from the blood vessels and thereby protect against blockages that can lead to heart attacks and stroke.

The researchers further identified 14 metabolites that are linked to heart disease. They found that participants who ate fewer eggs had lower levels of beneficial metabolites and higher levels of harmful ones in their blood, compared to those who ate eggs more regularly. “Together, our results provide a potential explanation for how eating a moderate amount of eggs can help protect against heart disease,” says author Canqing Yu, Associate Professor at the Department of Epidemiology and Biostatistics, Peking University. “More studies are needed to verify the causal roles that lipid metabolites play in the association between egg consumption and the risk of cardiovascular disease.”

“This study may also have implications for Chinese national dietary guidelines,” adds senior author Liming Li, Boya Distinguished Professor at the Department of Epidemiology and Biostatistics, Peking University. “Current health guidelines in China suggest eating one egg a day, but data indicate that the average consumption is lower than this. Our work highlights the need for more strategies to encourage moderate egg consumption among the population, to help lower the overall risk of cardiovascular disease.”

The study was funded by the National Natural Science Foundation of China, The Kadoorie Charitable Foundation in Hong Kong, the Chinese Ministry of Science and Technology and the National Key Research and Development Program of China.

Reference: “Association of egg consumption, metabolic markers, and risk of cardiovascular diseases: A nested case-control study” by Lang Pan, Lu Chen, Jun Lv, Yuanjie Pang, Yu Guo, Pei Pei, Huaidong Du, Ling Yang, Iona Y Millwood, Robin G Walters, Yiping Chen, Weiwei Gong, Junshi Chen, Canqing Yu Is a corresponding author, Zhengming Chen and Liming Li, on behalf of China Kadoorie Biobank Collaborative Group, 24 May 2022, *eLife*. DOI: [10.7554/eLife.72909](https://doi.org/10.7554/eLife.72909)

<https://bit.ly/3ul36Uo>

South African Hominin Fossils Predate Lucy, Analysis Suggests

A newer dating technique using cosmogenic isotopes finds Australopithecus remains from the Sterkfontein caves to be about 1 million years older than previous estimates, potentially changing scientists’ understanding of humanity’s origins.

Andy Carstens

Remains of ancient *Australopithecus* hominins from the Sterkfontein caves in South Africa—including the well-known “Mrs. Ples”—were originally dated to between 2.1 and 2.6 million years ago, but they are actually between 3.4 and 3.6 million years old, a study estimates. The revised dates, published in *PNAS* on Monday (June 27), would mean they’re older than the famous *Lucy* fossil unearthed in Ethiopia, which is dated to around 3.2 million years ago, reports *The Washington Post*.

“This important new dating work pushes the age of some of the most interesting fossils in human evolution research, and one of South Africa’s most iconic fossils, Mrs. Ples, back a million years to a time when, in East Africa, we find other iconic early hominins like Lucy,” study coauthor Dominic Stratford tells the *Post*.

The archeological community has widely accepted the hypothesis that the early hominin species *Australopithecus africanus* (e.g. Mrs. Ples) descended from *A. afarensis* (e.g. Lucy). However, “[t]he contemporaneity of the two species now suggests that a more

complex family tree prevailed early in the human evolutionary process,” the study authors write.



Four different Australopithecus crania that were found in the Sterkfontein caves, South Africa Jason Heaton and Ronald Clarke, in cooperation with the Ditsong Museum of Natural History

Hundreds of *Australopithecus* fossils have been found at the Sterkfontein caves since the first was discovered in 1936, reports the *Post*. “But it’s hard to get a good date on them,” study coauthor Darryl Granger tells the outlet.

In East Africa, volcanic ash surrounding fossils can be used for accurate dating, according to [Purdue’s news release](#), but it’s more complicated in South Africa. There, researchers have had to use surrounding animal fossils, which can shift over time, or calcite flowstone deposits, which can settle in areas older than them, leading to underestimates of age. The current analysis employed a newer technique instead, one that directly ages the surrounding sediment. Using mass spectrometry, the researchers measured cosmogenic isotopes in quartz excavated from around the fossils; the relative decay of these elements reveals how old the rocks are.

“South Africa was largely ignored because it was so difficult to date the fossils. They were largely dismissed as not being relevant to the story of human evolution,” study coauthor Ronald Clarke

tells [The Sydney Morning Herald](#). “It’s a big deal, this does confirm that these primitive ancestors were all over Africa.

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

Scientists Have Measured a Perceptual Ability Called 'O'. How Good Is Yours?

Research suggests some people are better than others at learning to discriminate things perceptually, whatever the objects may be

Isabel Gauthier and Jason Chow, *The Conversation*

Like snowflakes, no two people are exactly the same. You're probably used to the idea that people differ substantially in personality and in cognitive abilities – skills like problem-solving or remembering information.

In contrast, there's [a widely held intuition](#) that people vary far less in their ability to recognize, match or categorize objects. Many everyday tasks, hobbies and even critical jobs – like interpreting satellite imagery, matching fingerprints or diagnosing medical conditions – rely on these perceptual skills.

The common expectation is that smart and motivated people who receive the appropriate training should eventually be able to excel at occupations that require hundreds of perceptual decisions every day.

[We are](#) psychologists who measure how people compare on challenging perceptual tasks. Our research has found that this intuition that everyone has the same capacity for perceptual skills is not supported by the evidence.

It's not a problem if you choose to spend every weekend bird-watching without ever getting very good at it – you may still get some fresh air and have fun. But when perceptual decisions influence safety, health or legal outcomes, there's a case for seeking people who can achieve the best possible performance. Our research suggests some people are just better than others at learning to discriminate things perceptually, whatever the objects may be.

A general ability to recognize things

[Classic psychological studies](#) at the turn of the 20th century discovered that performance across a range of cognitive tasks designed to test memory, math and verbal skills is correlated. In real life, this means someone who is great at sudoku is also likely to be good at memorizing their shopping list.

This finding led to the modern notion of general intelligence, describing a collection of faculties that together predict a wide range of outcomes, from [income](#) to [health and longevity](#).

In a similar way, our studies reveal that those who are the [best at bird recognition may also excel at plane identification](#), and they may also be the best at learning to spot tumors in [chest X-rays](#). In other research, the same ability predicted better performance in [reading musical notation](#) or [recognizing images of prepared food](#).

Of course, people vary in their experience with birds or medical images. The more familiar you are with them, the [better you are at recognizing them](#). Experience and training have an important role in how people make decisions based on visual information. But does everyone start on the same footing when they begin training?

Does everyone start at square one?

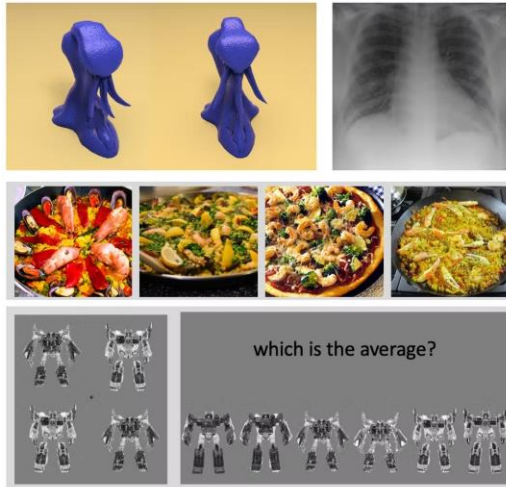
We were interested in whether everyone starts at about the same baseline of perceptual talent. To investigate this question, we measured people's abilities with artificial objects they had never seen, to prevent any advantage due to different levels of experience. In [one large study](#), we assessed 246 people for 13 hours each, testing them on several tasks with six categories of computer-generated artificial objects. We asked people to remember and recognize objects, to match them, or to make judgments about some of their parts.

Our results across tasks like these repeatedly reveal that people vary as much in perceptual abilities as they do in cognitive skills. Using [statistical methods](#) historically applied to intelligence and

personality tests, we found that over 89 percent of the differences between people in their performance with these different tasks and categories could be explained by a general ability.

We called this ability "o" for object recognition and in honor of the "g" factor, which stands for similar statistical evidence for general intelligence.

In [follow-up studies](#), we've found that o applies in the same way to artificial and real objects, and that people with high o are better at computing summary statistics for groups of objects (such as estimating the "average" of several objects) and also better at [recognizing objects by touch](#). You can compare yourself to others in [this short demo](#).



Above: Examples of tasks that tap into o, from top left: 1) Are these two objects identical despite the change in viewpoint? 2) Which lung has a tumor? 3) Which of these dishes is the oddball? 4) Which option is the average of the four robots on the right? Answers: 1) no 2) left 3) third 4) fourth. Isabel Gauthier, CC BY-ND)

o is a distinct ability

Since it is so general, is o just another name for general intelligence? We don't think so.

In one study, we found that [neither IQ nor SAT scores predict recognition](#) of novel objects. [In other work](#), we found that o was distinct from g, but also from the personality trait of conscientiousness. This means that book smarts may not be enough to excel in domains that rely heavily on perceptual abilities.

We tested this idea by measuring how good people with or without expertise in radiology were at detecting lung nodules in chest X-

rays. Those with the highest o were better at this task, even after controlling for intelligence and experience in radiology.

This finding demonstrates the added value of measuring o. Even when medical students are selected to be smart and provided with training, it may not guarantee the highest levels of performance in specializations that rely on perceptual skills.

Many doors open when you demonstrate that you're cognitively talented, which seems only fair. But it is fair only to the extent that general intelligence is the best way – or even a sufficient way – to predict success in a given domain. Many have raised warnings that intelligence testing can lead to inequities in hiring or career placement tied to race, gender or socioeconomic status.

Over the years, many thinkers have downplayed innate talents to emphasize environmental influences. They argued that success can be shaped through years of [deliberate practice](#), programs to change one's [attitudes about learning](#), or even [hours of playing video games](#). But the evidence in favor of the influence of innate talents remains strong, and denying them or overpromising on the efficacy of environmental factors [may sometimes be harmful](#). People can waste time and resources that could be better invested, and may run the risk of experiencing stigma if their efforts do not succeed because of factors they cannot control.

One answer to this problem is to learn more about talents beyond those related to intelligence and then to make better use of them. Classical notions of intelligence may be just one factor of many that determine overall ability.

An increased focus on perceptual abilities, specifically those that are general, could help reduce inequities. For instance, while differences in experience can drive [sex differences in the recognition of objects in some familiar categories](#), we've found [no such differences in the general ability o](#).

Isabel Gauthier, David K. Wilson Professor of Psychology, [Vanderbilt](#)

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

Study of Ancient Mass Extinction Reveals Dinosaurs Took Over Earth Amid Ice, Not Warmth

Thriving in a Series of Sudden Global Chills That Killed Competitors

Many of us are familiar with the popular theory of how the dinosaurs died 66 million years ago: in Earth's violent collision with a meteorite, followed by a global winter caused by dust and debris choking the atmosphere. But there was a far more mysterious and less discussed previous extinction: the one 202 million years ago, which wiped out the big reptiles who up until then ruled the planet, and apparently cleared the way for dinosaurs to take over. What caused the so-called Triassic-Jurassic Extinction, and why did dinosaurs thrive when other creatures perished?



With a lava flow in the distance, a primitively feathered theropod dinosaur carries off a mammalian victim during a snowy volcanic winter caused by massive eruptions during the Triassic-Jurassic Extinction. A new study says dinosaurs survived because they were already adapted to freezing conditions at high latitudes. Credit: Painting by Larry Felder

We know that the world was generally hot and steamy during the Triassic Period, which preceded the extinction, and there were similar conditions during the following Jurassic, which kicked off the age of dinosaurs. However, new research turns the idea of heat-loving dinosaurs on its head: It presents the first physical evidence that Triassic dinosaur species, which were a minor group largely

relegated to the polar regions at the time, regularly endured freezing conditions there.

The telltale indicators are dinosaur footprints along with odd rock fragments that only could have been deposited by ice. The authors of the study explain that during the extinction, cold snaps already happening at the poles spread to lower latitudes, killing off the cold-blooded reptiles. Dinosaurs, which had already adapted, survived the evolutionary bottleneck and spread out. The rest is ancient history.

“Dinosaurs were there during the Triassic under the radar all the time,” said Paul Olsen, a geologist at Columbia University’s Lamont-Doherty Earth Observatory, and lead author of the study. “The key to their eventual dominance was very simple. They were fundamentally cold-adapted animals. When it got cold everywhere, they were ready, and other animals weren’t.”

The study, based on recent excavations in the remote desert of northwest China’s Junggar Basin, was published today (July 1, 2022) in the journal *Science Advances*.

Dinosaurs are thought to have first appeared during the Triassic Period in temperate southerly latitudes about 231 million years ago, when most of the planet’s land was joined together in one giant continent geologists call Pangaea. They [made it to the far north](#) by about 214 million years ago. Until the mass extinction at 202 million years, the more expansive tropical and subtropical regions in between were dominated by reptiles including relatives of crocodiles and other fearsome creatures.

During the Triassic, and for most of the Jurassic, atmospheric concentrations of carbon dioxide ranged at or above 2,000 parts per million—five times today’s levels—so temperatures must have been intense. There is no evidence of polar ice caps then, and excavations have shown that deciduous forests grew in polar regions. However, [some climate models](#) suggest that the high

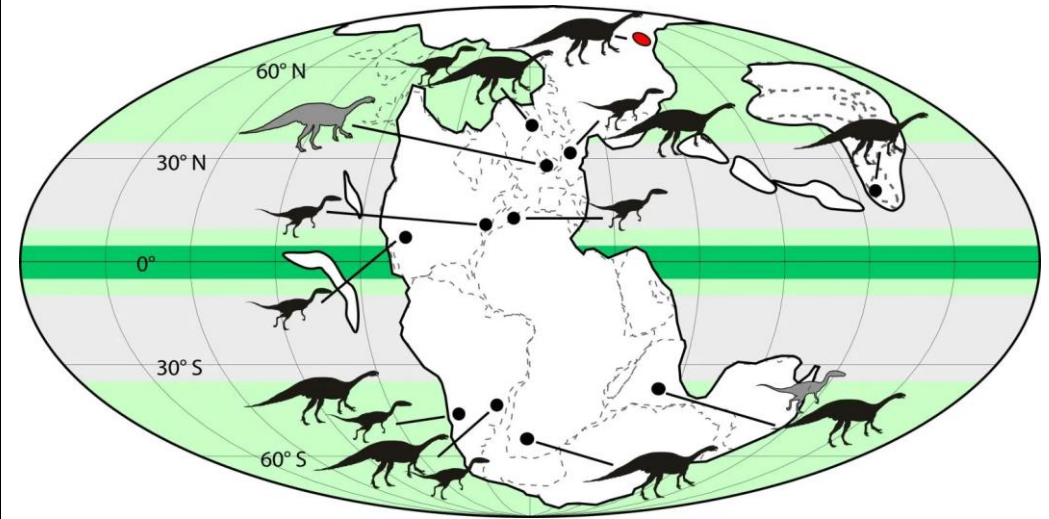
latitudes were chilly some of the time; even with all that CO₂, they would have received little sunlight much of the year, and temperatures would decline at least seasonally. But until now, no one has produced any physical evidence that they froze.

At the end of the Triassic, a geologically brief period of perhaps a million years saw the extinction of more than three-quarters of all terrestrial and marine species on the planet, including shelled creatures, corals and all sizable reptiles. Some animals living in burrows, such as turtles, made it through, as did a few early mammals. It is unclear exactly what happened, but many scientists connect it to a series of [massive volcanic eruptions](#) that could have lasted hundreds of years at a stretch. At this time, Pangaea started to split apart, opening what is now the Atlantic Ocean, and separating what are now the Americas from Europe, Africa and Asia. Among other things, the eruptions would have caused atmospheric carbon dioxide to skyrocket beyond its already high levels, causing deadly temperatures spikes on land, and turning ocean waters too acid for many creatures to survive.

The authors of the new study cite a third factor: During the eruptions' fiercest phases, they would have belched sulfur aerosols that deflected so much sunlight, they caused repeated global volcanic winters that overpowered high greenhouse-gas levels. These winters might have lasted a decade or more; even the tropics may have seen sustained freezing conditions. This killed uninsulated reptiles, but cold-adapted, insulated dinosaurs were able to hang on, say the scientists.

The researchers' evidence: fine-grained sandstone and siltstone formations left by sediments in shallow ancient lake bottoms in the Junggar Basin. The sediments formed 206 million years ago during the Late Triassic, through the mass extinction and beyond. At that time, before landmasses rearranged themselves, the basin lay at about 71 degrees north, well above the Arctic Circle. Footprints

found by the authors and others show that dinosaurs were present along shorelines. Meanwhile, in the lakes themselves, the researchers found abundant pebbles up to about 1.5 centimeters across within the normally fine sediments. Far from any apparent shoreline, the pebbles had no business being there. The only plausible explanation for their presence: they were ice-rafted debris



(IRD).

The supercontinent of Pangaea 202 million years ago, shortly before the Triassic-Jurassic Extinction. Evidence of early dinosaurs has been found in the indicated areas; most species were confined to the high latitudes, and those few nearer the tropics tended to be smaller. Red area at the top is the Junggar Basin, now in northwest China. Credit: Olsen et al., Science Advances, 2022

Briefly, IRD is created when ice forms against a coastal landmass and incorporates bits of underlying rock. At some point, the ice becomes unmoored and drifts away into the adjoining water body. When it melts, the rocks drop to the bottom, mixing with normal fine sediments. Geologists have extensively studied ancient IRD in the oceans, where it is delivered by glacial icebergs, but rarely in lake beds; the Junggar Basin discovery adds to the scant record.

The authors say the pebbles were likely picked up during winter, when lake waters froze along pebbly shorelines. When warm weather returned, chunks of that ice floated off with samples of the pebbles in tow, and later dropped them.

“This shows that these areas froze regularly, and the dinosaurs did just fine,” said study co-author Dennis Kent, a geologist at Lamont-Doherty.

How did they do it? Evidence has been building since the 1990s that many if not all non-avian dinosaurs including tyrannosaurs had primitive feathers. If not for flight, some coverings could have used for mating display purposes, but the researchers say their [main purpose was insulation](#). There is also good evidence that, unlike the cold-blooded reptiles, many dinosaurs possessed [warm-blooded, high-metabolism systems](#). Both qualities would have helped dinosaurs in chilly conditions.

“Severe wintery episodes during volcanic eruptions may have brought freezing temperatures to the tropics, which is where many of the extinctions of big, naked, unfeathered vertebrates seem to have occurred,” said Kent. “Whereas our fine feathered friends acclimated to colder temperatures in higher latitudes did OK.”

The findings defy the conventional imagery of dinosaurs, but some prominent specialists say they are convinced. “There is a stereotype that dinosaurs always lived in lush tropical jungles, but this new research shows that the higher latitudes would have been freezing and even covered in ice during parts of the year,” said Stephen Brusatte, a professor of paleontology and evolution at the University of Edinburgh. “Dinosaurs living at high latitudes just so happened to already have winter coats [while] many of their Triassic competitors died out.”

Randall Irmis, curator of paleontology at the Natural History Museum of Utah, and specialist in early dinosaurs, agrees. “This is the first detailed evidence from the high paleolatitudes, the first

evidence for the last 10 million years of the Triassic Period, and the first evidence of truly icy conditions,” he said. “People are used to thinking of this as being a time when the entire globe was hot and humid, but that just wasn’t the case.”

Olsen says the next step to better understand this period is for more researchers to look for fossils in former polar areas like the Junggar Basin. “The fossil record is very bad, and no one is prospecting,” he said. “These rocks are gray and black, and it is much harder to prospect [for fossils] in these strata. Most paleontologists are attracted to the late Jurassic, where it’s known there are many big skeletons to be had. The paleo-Arctic is basically ignored.”

Reference: “Arctic ice and the ecological rise of the dinosaurs” by Paul Olsen, Jingeng Sha, Yanan Fang, Clara Chang, Jessica H. Whiteside, Sean Kinney, Hans-Dieter Sues, Dennis Kent, Morgan Schaller and Vivi Vajda, 1 July 2022, Science Advances.

DOI: [10.1126/sciadv.abo6342](https://doi.org/10.1126/sciadv.abo6342)

The study was co-authored Jingeng Sha and Yanan Fang of Nanjing Institute of Geology and Paleontology; Clara Chang and Sean Kinney of Lamont-Doherty Earth Observatory; Jessica Whiteside of the University of Southampton; Hans-Dieter Sues of the Smithsonian Institution; Morgan Schaller of Rensselaer Polytechnic Institute; and Vivi Vajda of the Swedish Museum of Natural History.

<https://bit.ly/3a8eFYg>

‘Zombie papers’ just won’t die. Retracted papers by notorious fraudster still cited years later

Authors who cited flawed work often fail to warn readers, study finds

By [Jeffrey Brainard](#)

Alison Avenell spent years collecting evidence that Yoshihiro Sato, a now-deceased nutritional researcher in Japan, was among the most prolific fraudsters known to science. After journals investigated the findings by Avenell, a clinical nutritionist at the University of Aberdeen, and her colleagues, [they retracted more than two dozen papers Sato had co-authored](#). Many had reported findings from clinical trials that could have led physicians to incorrectly treat patients suffering from osteoporosis and other

disorders.

But the retractions, which began in 2015, didn't mean the papers were gone for good, or that their influence waned.

Avenell noticed many journal articles that cited one or more of the 27 retracted papers did not warn readers that they referenced tainted work. Worse, she and colleagues [reported recently](#), Sato's flawed findings were cited in 88 articles, published from 2003 to 2020, that are systematic reviews and clinical guidelines—potentially influential publications that often help guide medical treatments. Avenell wondered: Would the authors and editors of these papers take action if alerted to the retractions of Sato's work?

For the most part, she found, the answer was no.

Her team contacted the authors of 86 of the citing papers—and sometimes the editors, too. After a year, however, journals had posted notices or letters for just eight of those papers informing readers that they cited retracted work, the researchers reported in late May in *Accountability in Research*. In five of those cases the announcement wasn't linked to the paper, leaving readers in the dark. (A ninth review was itself retracted.)

The saga provides an unusually methodical case study of what some call “zombie papers.” Even after they are retracted—publishing's death sentence—these papers live on thanks to citations. And that could have real-world consequences, the study suggests. It found 39 of the 88 citing papers had drawn conclusions that, if the retracted papers were left out of the analysis, were likely to be substantially weaker. Journals flagged just four of the weakened studies for citing retracted papers.

The study's findings are “unfortunately very consistent” with others going back to the 1990s, says Ivan Oransky, co-editor of [Retraction Watch](#), which reports on retracted papers and tracks them in a [public database](#). A 1998 investigation in *JAMA*, for example, found that 94% of 299 citations to retracted articles still listed in the

MEDLINE database [did not note the work had been retracted](#). And “most editors do not seem to make correcting the record a priority,” Oransky says.

Avenell took a very rigorous approach to documenting the problem, Oransky says. For example, her team emailed queries to authors and journals using a randomized, controlled trial design. For some papers, the researchers only contacted the corresponding authors of the evidence syntheses. For others, they contacted an additional two co-authors and sometimes also the journal's editor-in-chief.

For half of the 86 papers, they got no response. (Looping in the editor didn't increase the response rate.) Some authors who did respond said they didn't plan to amend their papers because, for example, the publication was too old, or they didn't have time to do a reanalysis. Some asserted that the elimination of a single, retracted study likely would not have changed their overall findings. There is some evidence for that position. A 2021 study in *Accountability in Research* led by Daniele Fanelli of the London School of Economics and Political Science examined 50 meta-analyses of clinical treatments. The conclusions of those that cited retracted work and those that didn't [were statistically similar](#).

The studies examined by Avenell's team that were weakened by retracted work could have put patients at risk. One of those reviews, showing vitamin K helps prevent fractures, was the basis of 2011 and 2015 Japanese guidelines that recommend the supplement for people at risk. Omitting Sato's studies made the reported benefit statistically nonsignificant. The guidelines' sponsor, the Japan Osteoporosis Foundation, was among those that did not respond to the team's queries.

Even if a retracted citation doesn't change the bottom line, Avenell argues, journals and authors have an obligation to say so publicly. “You need to reassure your readers” about a paper's validity, she says.

Avenell is scheduled to discuss the study—co-authored by Mark Bolland, Greg Gamble, and Andrew Grey of the University of Auckland—in September at the International Congress on Peer Review and Scientific Publication. The work, she says, was spurred by “my frustration with the slow process of correcting the literature that has integrity issues and to demonstrate the potential adverse consequences if it is not corrected promptly.”

There are signs the research community is beginning to take such concerns more seriously. Several bibliographic databases—including EndNote, LibKey, Papers, and Zotero—now note papers that are included in Retraction Watch’s database of retractions, which debuted publicly in 2018. (The popular Google Scholar search engine does not flag retractions.) The International Committee of Medical Journal Editors recommends journal editors routinely check to see whether submitted manuscripts cite retracted papers. And in 2021, Cochrane, a nonprofit international network that promotes evidence-based medicine, began to attach a warning to any of its systematic reviews that cite retracted studies. Cochrane asks the authors of flagged reviews to reconsider their work; then the organization decides whether to withdraw the analysis or publish an updated version with revised findings.

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

Meet *Nepenthes pudica*, Carnivorous Plant that Produces Underground Traps

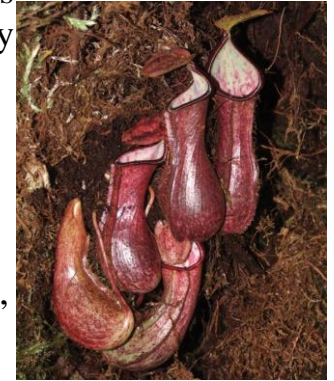
Pitcher plant produces well-developed, fully functional and effective underground traps

by [Sergio Prostak](#)

Nepenthes pudica, a new species of pitcher plant from the lower montane rainforests of North Kalimantan, Indonesia, produces well-developed, fully functional and effective underground traps — a strategy as yet unknown in any species of carnivorous plant with pitfall traps.

Nepenthes is a genus of more than 160 species of carnivorous plants in the family *Nepenthaceae*.

These plants are primarily distributed in tropical and subtropical Southeast Asia, with centers of diversity in Borneo, Sumatra, and the Philippines. A small number of species occur in outlying areas, including Madagascar, Seychelles, Sri Lanka, northeastern India, southern China, northeastern Australia, and various islands of the western Pacific Ocean.



Lower pitchers of Nepenthes pudica under a moss mat. Image credit: Dančák et al., doi: 10.3897/phytokeys.201.82872.

“We found a pitcher plant which differs markedly from all the other known species,” said Dr. Martin Dančák, a researcher at Palacký University. “In fact, this species places its up-to-11-cm-long pitchers underground, where they are formed in cavities or directly in the soil and trap animals living underground, usually ants, mites and beetles.”

Nepenthes pudica is the first carnivorous species confirmed to use pitfall traps specifically in the subterranean environment. It produces almost exclusively underground pitchers that are well developed and fully functional.

“*Nepenthes pudica* grows on relatively dry ridge tops at an elevation of 1,100-1,300 m. This might be why it evolved to move its traps underground,” said Dr. Michal Golos, a researcher at the University of Bristol.

“We hypothesize that underground cavities have more stable environmental conditions, including humidity, and there is presumably also more potential prey during dry periods.”

Nepenthes pudica is predominantly an ant specialist, as are the majority of *Nepenthes* species.

“Interestingly, we found numerous organisms living inside the pitchers, including mosquito larvae, nematodes and a species of worm which was also described as a new species,” said Dr. Václav Čermák, a researcher at the Mendel University.

Nepenthes pudica is endemic to Borneo and known only from a few adjoining localities in the western part of the Mentarang Hulu district of Indonesian province of North Kalimantan.

Due to its restricted distribution, small population size and possible habitat loss, the species qualifies to be assigned preliminary conservation status as *Critically Endangered* based on the IUCN Red List categories and criteria.

“This discovery is important for nature conservation in Indonesian Borneo, as it emphasizes its significance as a world biodiversity hotspot,” said Wewin Tjiasmanto, a researcher at the Yayasan Konservasi Biota Lahan Basah.

“We hope that the discovery of this unique carnivorous plant might help protect Bornean rainforests, especially prevent or at least slow the conversion of pristine forests into oil palm plantations.”

The discovery of *Nepenthes pudica* is reported in a [paper](#) published this month in the journal *PhytoKeys*.

M. Dančák et al. 2022. First record of functional underground traps in a pitcher plant: Nepenthes pudica (Nepenthaceae), a new species from North Kalimantan, Borneo. PhytoKeys 201: 77-97; doi: 10.3897/phytokeys.201.82872

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

Walking Can Improve Cognitive Function

For some people, walking can boost brain function

For a very long time, people have believed that when walking and a task are combined, both suffer. This isn't always the case, according to study results from the [University of Rochester's](#) Del Monte Institute for Neuroscience. Some young, healthy individuals improve cognitive function while walking by changing the use of neural resources. This does not suggest, however, that you should

start a hard task while exercising off the cake from the previous night.

“There was no predictor of who would fall into which category before we tested them, we initially thought that everyone would respond similarly,” said Eleni Patelaki, a biomedical engineering Ph.D. student at the University of Rochester School of Medicine and Dentistry in the Frederick J. and Marion A. Schindler Cognitive Neurophysiology Laboratory and first author of the study recently published in *Cerebral Cortex*. “It was surprising that for some of the subjects it was easier for them to do dual-tasking – do more than one task – compared to single-tasking – doing each task separately. This was interesting and unexpected because most studies in the field show that the more tasks that we have to do concurrently the lower our performance gets.”

Improving means changes in the brain

26 healthy adults between the ages of 18 and 30 were asked to view a series of images while either sitting in a chair or walking on a treadmill. Researchers used the Mobile Brain/Body Imaging system, or MoBI, to track the brain activity, kinematics, and behavior of the participants. When a picture changed, participants were prompted to press a button. Participants were told not to click if the same picture appeared back-to-back.

Each participant's performance on this activity while seated was regarded as their unique behavioral “baseline”. Researchers discovered that when walking was added to doing the same task, various behaviors occurred, with some individuals performing worse than their baseline when sitting – as predicted based on prior research – but others improved relative to their baseline. The electroencephalogram, or EEG, analysis revealed that there was a change in frontal brain function in the 14 participants who improved at the task while walking, but not in the 12 participants who did not. The altered brain activity shown in individuals who

performed better on the test may be a sign of enhanced brain flexibility or efficiency.

“To the naked eye, there were no differences in our participants. It wasn’t until we started analyzing their behavior and brain activity that we found the surprising difference in the group’s neural signature and what makes them handle complex dual-tasking processes differently,” Patelaki said. “These findings have the potential to be expanded and translated to populations where we know that flexibility of neural resources gets compromised.”

Edward Freedman, Ph.D., associate professor of Neuroscience at the Del Monte Institute led this research that continues to expand how the MoBI is helping neuroscientists discover the mechanisms at work when the brain takes on multiple tasks. His previous work has highlighted the flexibility of a healthy brain, showing the more difficult the task the greater the neurophysiological difference between walking and sitting. “These new findings highlight that the MoBI can show us how the brain responds to walking and how the brain responds to the task,” Freedman said. “This gives us a place to start looking in the brains of older adults, especially healthy ones.”

Impact on aging

Expanding this research to older adults could guide scientists to identify a possible marker for ‘super agers’ or people who have a minimal decline in cognitive functions. This marker would be useful in helping better understand what could be going awry in neurodegenerative diseases.

Additional authors include John Foxe, Ph.D., and Kevin Mazurek, Ph.D., of the University of Rochester Medical Center. This research was supported by the Del Monte Institute for Neuroscience Pilot Program, the University of Rochester CTSA award number KL2 TR001999 from the National Center for Advancing Translational Sciences of the National Institutes of Health, and the National Institutes of Health. Recordings were conducted at the University of Rochester Intellectual and Developmental Disabilities Research Center (UR-IDDRC).

Reference: “Young adults who improve performance during dual-task walking show more

flexible reallocation of cognitive resources: a mobile brain-body imaging (MoBI) study” by Eleni Patelaki, MSc, John J Foxe, Ph.D., Kevin A Mazurek, Ph.D. and Edward G Freedman, Ph.D., 6 June 2022, Cerebral Cortex. DOI: 10.1093/cercor/bhac227

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

A Clunky Mask May Be the Answer to Airborne Disease and N95 Waste

Experts say the U.S. government has unintentionally encouraged a dependency on imported masks by failing to promote elastomeric respirators, a reusable mask that is domestically produced.

By [Andrew Jacobs](#)

In the early 1990s, long before P.P.E., N95 and asymptomatic transmission became household terms, federal health officials issued guidelines for how medical workers should protect themselves from tuberculosis during a resurgence of the highly infectious respiratory disease.



Three years into the pandemic, elastomeric respirators — industrial-grade face masks familiar to car painters and construction workers — remain a rarity at U.S. health care facilities. Credit...Kirsten Luce for The New York Times

Their recommendation, [elastomeric respirators](#), an industrial-grade face mask familiar to car painters and construction workers, would in the decades that followed become the gold standard for infection-control specialists focused on the dangers of airborne pathogens.

The Centers for Disease Control and Prevention [promoted them](#) during the SARS outbreak of 2003 and the [swine flu pandemic](#) of 2009. A few [studies](#) since then [have suggested](#) that reusable [elastomeric respirators](#) [should](#) be [essential gear](#) for frontline medical workers during a respiratory pandemic, which experts

predicted would quickly [deplete supplies](#) of N95s, the disposable filtration masks largely made in China.

But when the coronavirus swept the globe and China cut off exports of N95s, [elastomeric respirators](#) were nowhere to be found in a vast majority of hospitals and health clinics in the United States. Although impossible to know for sure, some [experts believe](#) the dire mask shortage early on contributed to the wave of infections that killed more than [3,600](#) health workers.

The pandemic has generated a bevy of [painful lessons](#) about the importance of preparing for public health emergencies. From the Trump administration's tepid early response to the C.D.C.'s bungled coronavirus testing rollout and its mixed messaging on masking, quarantining and the reopening of schools, the federal government has been roundly criticized for mishandling a health crisis that has left one million Americans dead and dented public faith in a once-hallowed institution.

Three years into the pandemic, elastomeric respirators remain a rarity at American health care facilities. The C.D.C. has done little to promote the masks, and all but a handful of the dozen or so domestic companies that rushed to manufacture them over the past two years have stopped making the masks or have folded because demand never took off.

Most cost between \$15 and \$40 each, and the filters, which should be replaced at least once a year, run about \$5 each. Made of soft silicone, the masks are comfortable to wear, according to health care worker surveys, and they have a shelf life of a decade or more.

"It's frustrating and frightening because a mask like this can make the difference between life and death, but no one knows about them," said Claudio Dente, whose company, Dentec Safety, recently stopped making elastomeric respirators that were specifically redesigned at the request of federal regulators for health care workers.

The government's tentative approach to elastomeric respirators during the pandemic has largely escaped public scrutiny, even as American mask producers, health policy experts and nursing unions have been pressing federal officials to promote them more aggressively. The masks, they note, are an environmentally sustainable and cost-effective alternative to N95s. Worn properly, they offer [better protection](#) than N95s, which, as their name suggests, only filter out 95 percent of pathogens. Most elastomerics exceed 99 percent.

The masks have another notable attribute: Most are made in the United States.

Now that hospitals have resumed buying cheap, Chinese-made face coverings and the resurgent American mask industry has imploded, experts warn of the perils of the nation's continued dependency on foreign-made protective equipment. Many of the U.S. companies calling it quits are start-ups whose founders jumped into the P.P.E. business out of a sense of civic duty.

"It's sad to see all of this manufacturing capacity come online during a crisis, only to be shut down because hospitals and even our own government would rather save a few pennies buying from China," said Lloyd Armbrust, president of the American Mask Manufacturers Association. Its membership includes just eight companies that are still producing masks, down from 51 a year ago. He said 17 of the companies have shut down.

Some experts say the C.D.C.'s hands-off approach to elastomeric respirators is unintentionally encouraging a return to the nation's reliance on disposable masks made overseas. Dr. Eric Feigl-Ding, an epidemiologist who heads the Covid-19 task force at the World Health Network, criticized federal officials for inaction despite compelling evidence that elastomerics provide the highest level of protection against aerosolized viruses. "At a certain point, you need to act on the existing science, and the failure to do otherwise is a

dereliction of duty,” he said.

To be clear, federal health experts back the use elastomerics but say they are awaiting additional study results before offering full-throated support for their widespread adoption by medical personnel. Emily Haas, a scientist at the C.D.C.’s National Institute for Occupational Safety and Health, or NIOSH, said researchers were still grappling with the need to regularly disinfect them and complaints about muffled communication, though some newer models make it easier for wearers to be heard.

The bigger challenge, she says, is convincing hospitals and group purchasing organizations to embrace the masks given the abundance of N95s, which offer comparable protection during routine medical care and can be thrown away after each use.

“There’s been so much research in the last 10 years that has really supported elastomerics, so in some ways the issue right now is cultural,” Dr. Haas said. “No one likes change, and introducing a whole new system of respiratory protection can be a heavy lift.”

Experts say such obstacles could be overcome through more muscular federal leadership. Dr. Tom Frieden, who led an unsuccessful effort to fill the Strategic National Stockpile with elastomerics when he was C.D.C. director in 2009, said the advantages of providing them to frontline medical workers were clear, especially given the nation’s ruinous overreliance on single-use masks. He said health authorities could promote elastomerics by highlighting their cost savings for hospitals and the environmental benefits of a reusable mask to help reduce the tsunami of N95s that end up in landfills. “To me, it’s a puzzle why they haven’t become more widespread,” Dr. Frieden said.

Providing an elastomeric respirator to each of the nation’s 18 million health care workers would cost roughly \$275 million, according to Nicolas Smit, an expert on elastomerics and executive director of the American Mask Manufacturers Association. By

comparison, he noted that the federal government spent \$413 million on a [disastrous effort](#) to decontaminate N95 masks so they could be safely reused.

James C. Chang, an industrial hygienist, has long been a fan of elastomerics. In 2018, he helped to produce [a report](#) on them for the National Academies of Sciences, Engineering and Medicine, and after the short-lived swine flu pandemic of 2009, he persuaded his employer, the University of Maryland Medical Center, to purchase 1,500 masks. The decision was based in part on research that predicted a respiratory pandemic lasting more than a few weeks would lead to catastrophic supply-chain shortages.

“When you ran the numbers, it was pretty clear we’d burn through a six- or seven-digit cache of disposables pretty quickly,” he said.

“It’s just not feasible for any hospital to stock that many masks.”

Initially he had a handful of concerns — that their “Darth Vader” look would frighten patients or that disinfecting them would be burdensome. But those fears quickly faded in early 2020 as hospitals across the country scrambled to find N95s, and the C.D.C. issued [guidelines](#) saying N95s could be reused up to five times — guidance that evoked widespread skepticism among health professionals.

To deal with the need to disinfect the masks, he set up a system that allowed workers to drop them off after each shift so they could be cleaned before being made available to others.

“It was a real success story on our end because our staff had respirators to wear and they felt more reassured wearing elastomerics than wearing N95s,” Mr. Chang said.

One of the only other hospital systems in the country to adopt the masks on a large scale was Allegheny Health Network of Western Pennsylvania, which early in the pandemic, distributed more than 8,000 respirators at its 14 hospitals. The decision to do so stemmed from a coincidence of geography: Allegheny’s headquarters in

Pittsburgh was not far from the manufacturing plant of MSA Safety, a century-old company that got its start producing coal miner protective gear with help from Thomas Edison.

Prompted by an appeal from hospital administrators, MSA began sending over the industrial-grade masks but they quickly ran into a problem. The protruding filters only screened inhaled air, which meant that exhaled air from an infected wearer could pose a potential health risk to those nearby, according to Dr. Zane Frund, executive director for materials and chemicals research at MSA Safety.

The solution was not exactly rocket science: Product designers simply removed the masks' exhalation valve, and NIOSH in late 2020 [approved the new models](#). A subsequent design tweak added a mechanical voice amplifier to help ease communication.

Dr. Sricharan Chalikonda, Allegheny's chief medical operations officer, said he was surprised by just how popular they became among the 2,000 medical personnel who had been outfitted to wear them — a process aimed at ensuring air would not evade the mask's tight face seal.

According to [a paper](#) he published in the Journal of the American College of Surgeons, none of the employees went back to wearing N95s. The cost benefit of relying almost entirely on elastomerics became irrefutable: Outfitting the workers was one-tenth as expensive than supplying them with disposable N95s. A separate study found that after one year, the filters were still 99 percent effective. "Elastomerics for us really were a game changer," Dr. Chalikonda said. "When I think of all the millions of dollars wasted on N95s and then trying to reuse them makes you realize how much elastomerics are a missed opportunity."

Federal health officials say they are moving as fast as possible to produce stronger guidance on elastomerics. Maryann D'Alessandro, director of the National Personal Protective Technology Laboratory,

said scientists were reviewing feedback from a study that distributed nearly 100,000 respirators to hospitals, nursing homes and first-responders across the country. "If we can get a tool kit together to serve as a guide for organizations and educate the users, we hope it can help move the needle," she said.

Many masks entrepreneurs are not likely to last that long. Max Bock-Aronson, the co-founder of Breathe99, which makes an elastomeric respirator that Time magazine included on its 2020 list of best inventions, has been winding down operations at the company's Minnesota plant.

He blamed the slump in sales on Covid fatigue and waning public interest in protective gear. The company's fortunes, he added, were doomed early on by the C.D.C.'s mask guidance, which prompted Amazon, Google and Facebook [to limit or bar the sale](#) of medical-grade masks to consumers, even as P.P.E. imports once again began flooding the United States.

"The whole industry has been gutted," said Mr. Bock-Aronson. "Every time there's a new variant, we get a small bump in sales, but I haven't taken a nickel out of the company since last May,"

For now, he is focused on finding a buyer for his company while selling off his inventory online. The masks cost \$59 and can be sheathed in washable covers that come in eight colors, among them crimson, linen and royal blue.

All sales, the website points out apologetically, are final.

<https://bit.ly/3Anz3PD>

Ancient DNA yields surprising findings on world's earliest seafarers

Including family structure, social customs, and the ancestral populations of the people living there today

New genetic research from remote islands in the Pacific offers fresh insights into the ancestry and culture of the world's earliest seafarers, including family structure, social customs, and the

ancestral populations of the people living there today.

The work, described in the journal *Science*, reveals five previously undocumented migrations into a subregion of this area and suggests that about 2,500 to 3,500 years ago early inhabitants of these Pacific islands—including Guam in the northern region and Vanuatu in the southwest—had matrilineal population structures where women almost always remained in their communities after marriage while men more often moved out of their mothers' community to live with that of their wives'.

The practice is different from that of patrilineal societies where women are overwhelming the ones to leave their own community. These findings support the idea that the world's earliest seafarers were organized through female lineages.

The results come from a genome-wide analysis on 164 ancient individuals from 2,800 to 300 years ago as well 112 modern individuals. It was published by a team of researchers co-led by Harvard geneticists David Reich and Yue-Chen Liu, Ron Pinhasi at the University of Vienna, and Rosalind Hunter-Anderson, an independent researcher working in Albuquerque New Mexico.

Ms. Alyssa Taitano talks about her experience as a young scientist and Chamorro woman participating in the Micronesian ancient DNA project published July 1, 2022. Credit: Rosalind Hunter-Anderson, Ph.D., National Geographic Society grantee

"It's an unexpected gift to be able to learn about cultural patterns from [genetic data](#)," said David Reich, a professor in the Department of Human Evolutionary Biology and a professor of genetics at Harvard Medical School. "Today, traditional communities in the Pacific have both patrilineal and matrilineal population structures and there was a debate about what the common practice was in the ancestral populations. These results suggest that in the earliest seafarers, matrilineality was the rule.

The genetic analysis compared early seafarers from Guam, Vanuatu,

and Tonga—living about 2500 to 3,000 years ago—revealing that their mitochondrial DNA sequences, which humans only inherit from their biological mother, differed almost completely while sharing much more of the rest of their DNA. The only way this can happen is if migrants who left their communities to marry into new ones were almost always males.

"Females certainly moved to new islands, but when they did so they were part of joint movements of both females and males" explains Reich. "This pattern of leaving the community must have been nearly unique to males in order to explain why genetic differentiation is so much higher in mitochondrial DNA than in the rest of the genome."

The new study from an interdisciplinary team of geneticists and archeologists quintuples the body of ancient DNA data from the vast Pacific region called Remote Oceania, the last habitable place on earth to be peopled. It also provides surprising insights into the extraordinarily complex peopling of one of Remote Oceania's major subregions.

Humans arrived and spread through Australia, New Guinea, the Bismarck Archipelago, and the Solomon Islands beginning 50,000 years ago, but it wasn't until after 3,500 years ago that humans began living in Remote Oceania for the first time after developing the technology to cross [open water](#) in unique long-distance canoes.

This expansion included the region called Micronesia: about two thousand small islands north of the Equator including Guam, the Marshall Islands, the Caroline Islands, Palau, and the Northern Mariana Islands.

It's long been a mystery what the routes people took to arrive in the region. The revealing of five streams of migration into Micronesia helps bring clarity to this mystery and the origins of the people there today. "These migrations we document with ancient DNA are the key events shaping this region's unique history," said Liu, a

post-doctoral fellow in Reich's lab and the study's lead author. "Some of the findings were very surprising."

Of the five detected migrations, three were from East Asia, one from Polynesia, and a Papuan ancestry coming from the northern fringes of mainland New Guinea. The indigenous ancestry from New Guinea was a major surprise as a different stream of this migration—one from New Britain, an island chain to the east of New Guinea—was the source of the Papuan ancestry in the southwest Pacific and in Central Micronesia.

The researchers also found that present-day Indigenous people of the Mariana Islands in Micronesia, including Guam and Saipan, derive nearly all their pre-European-contact ancestry from two of the East Asian-associated migrations the researchers detected. It makes them the "only people of the open Pacific who lack ancestry from the New Guinea region," Liu said.

The researchers consulted with several Indigenous communities in Micronesia for the study. This is the fourth publication of original ancient DNA data from remote Pacific islands by Reich's group.

"It's important that when we do ancient DNA work, we don't just write a paper about the population history of a region and then move on," Reich said. "Each paper raises as many new questions as it answers, and this requires long term commitment to follow up the initial findings. In the Pacific islands there are so many open questions, so many surprises still to be discovered."

More information: Yue-Chen Liu et al, Ancient DNA reveals five streams of migration into Micronesia and matrilocality in early Pacific seafarers, *Science* (2022). DOI: [10.1126/science.abm6536](https://doi.org/10.1126/science.abm6536). www.science.org/doi/10.1126/science.abm6536

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

The Rhyme-as-Reason Effect: Why We Find Reason in Rhyme, Time After Time

The rhyme-as-reason effect refers to our tendency to perceive rhyming statements as more truthful than those that don't rhyme

Over the years, marketers, campaigners, and politicians have successfully used rhyming slogans as a tool to persuade people that their product, idea, or candidate is the right choice for them; "A Mars a day helps you work, rest and play," "Lead the scene and keep it green," "I like Ike." Why is this tactic so effective?

What is the rhyme-as-reason effect?

The rhyme-as-reason effect refers to our tendency to perceive rhyming statements as more truthful than those that don't rhyme; "What sobriety conceals, alcohol reveals" seems somehow more accurate than "What sobriety conceals, alcohol unmasks."

(The bias is sometimes referred to as the "Eaton-Rosen phenomenon," although this term seems to originate from a random entry made by an anonymous Wikipedia user in 2013.)

The seminal study

The Rhyme-as-Reason Effect was identified in 1999 by psychologists Matthew McGlone and Jessica Tofiqbakhsh, who set out to show how poetic structure can influence our perception of truth. They gathered a group of pithy aphorisms and created new ones, losing the rhyme but keeping the meaning; "Woes unite foes" became "Woes unite enemies," and "Life is mostly strife" became "Life is mostly struggle." They then asked a group of volunteers to judge the validity of the statements. On average, the rhyming aphorisms were judged to be 22% more accurate than the non-rhyming ones.^[1]

Other experiments have had similar results, including one that showed that rhyming slogans were more likable, trustworthy, persuasive, and original than their non-rhyming counterparts, as well as easier to remember and more suitable for ad campaigns.^[2]

The effect was found to be more effective for advertising products—like Coke or cars—than it was for advertising on social issues such as human rights issues or environmental activism. This is possibly because people tend to have strong opinions on social

issues and are less likely to be persuaded to change their opinion by a slogan.

But perhaps the most high-profile and infamous example of the bias comes from the 1995 trial of former NFL star O. J. Simpson. Simpson had been accused of murdering his ex-wife Nicole Brown and her friend Ron Goldman, and one of the pieces of evidence presented in the case was a leather glove that had been found at the scene of the crime.

The glove contained DNA evidence from Brown, Simpson, and Goldman, and it had been bought by Brown for Simpson. But when Simpson was asked to put it on, he was unable to squeeze his hand into it. This prompted his defense lawyer, Johnnie Cochran, to famously declare to the jury, “if it doesn’t fit, you must acquit.” It didn’t, so they did, and in the ensuing controversy, the rhyming remark was accused of having helped to bring about the questionable acquittal.

How does it work

The rhyme-as-reason effect has been attributed to several interrelated cognitive mechanisms, including improved aesthetics, increased fluency, and increased familiarity.

Rhyming makes statements sound more beautiful to people, and that, in turn, makes the statements seem more truthful or accurate, something the authors of the original paper called “the Keats heuristic,” after the famous poet who once asserted that “Beauty is truth, truth beauty.” Because of our natural tendency to find rhymes aesthetically pleasing, we tend to overlook the distinction between the form and content of the phrases. As a result, we treat rhyme as reason.

A similar phonetic appeal has recently been shown to extend to antimetabolic statements — those in which the words in the first half of a sentence are inverted in the second half, like “All for one and one for all.” In this experiment,^[3] “Success is getting what you

want. Happiness is wanting what you get” was judged more accurate than “Success is getting what you wish. Happiness is wanting what you receive.”

Rhyming — and antimetabolic — statements also benefit from increased fluency. Fluency makes statements easier for our brains to process, and this makes us feel good. However, because this happens subconsciously, we have a tendency to conflate the ease with which we understand a statement with its accuracy. The faster and smoother we can process a statement, the more likely we are to assign value to the information that it contains and to believe that it’s true.^[4]

Finally, two different features of memory — recollection and familiarity — also profoundly impact our perception of a statement’s value.^[5] We are more likely to rely on information that is easy for us to bring to mind, and rhyming statements are easier to recall than statements that don’t rhyme because they are more easily encoded by our brains. This is thanks in large part to the way visual and acoustic encoding works. During these processes, each word is broken down into its phonemes, and since rhymes end each line with a similar sound, they are quicker to encode and easier to recall. In fact, people are twice as likely to remember rhyming statements as they are statements that don’t rhyme.^[6]

Rhyming aphorisms also benefit from being catchy and appealing, making them more likely to be repeated. Most of us seem to work on the assumption that the more something is repeated, the more likely it is to be true, possibly because, all things being equal, speakers generally try to be informative and helpful, and true statements are more likely to be repeated than are false ones.^[7]

Ultimately, because our memory’s function is to store important information for later use, our recollection of and familiarity with rhyming phrases leads us to attribute more credibility and accuracy to their content.

How to avoid it

Happily, though the rhyme-as-reason effect is insidious, it is also quite easy to neutralize. In a follow-up to their original study, McGlone and Tofiqbakhsh pitted new aphorisms like “Caution and measure will bring you treasure” against non-melodic counterparts like “Caution and measure will bring you riches.” Unlike in their previous study, however, they specifically told the participants to base their judgments on the accuracy of the claim itself and not the poetic form of the phrase; this time, the accuracy ratings of the rhyming aphorisms were markedly lower.^[8]

The key to defending yourself against this bias is to understand what it is and to be wary of rhetorical rhyming statements. You can eliminate a rhyming statement’s power by re-phrasing the original information in your own words and judging its content in order to see if it holds true or not. So, while you might hope that drinking liquor before beer puts you in the clear, past experience or a quick search on the internet should be enough to tell you that, if you want to avoid feeling sick, your best bet is to avoid drinking too much of anything, in any order. Sadly, just because something sounds catchy doesn’t mean that it’s true.

References:

1. McGlone, M. S., & Tofiqbakhsh, J. (1999). *The Keats heuristic: Rhyme as reason in aphorism interpretation*. *Poetics*, 26(4), 235-244.
2. Filkuková, P., & Klempe, S. H. (2013). *Rhyme as reason in commercial and social advertising*. *Scandinavian journal of psychology*, 54(5), 423-431.
3. Kara-Yakoubian, M., Walker, A. C., Sharpinskyi, K., Assadourian, G., Fugelsang, J. A., & Harris, R. A. (2022). *Beauty and truth, truth and beauty: Chiastic structure increases the subjective accuracy of statements*. *Canadian Journal of Experimental Psychology/Revue canadienne de psychologie expérimentale*. Advance online publication.
4. Reber, R., & Schwarz, N. (1999). *Effects of perceptual fluency on judgments of truth*. *Consciousness and Cognition: An International Journal*, 8(3), 338-342.
5. Begg, I. M., Anas, A., & Farinacci, S. (1992). *Dissociation of processes in belief: Source recollection, statement familiarity, and the illusion of truth*. *Journal of Experimental Psychology: General*, 121(4), 446-458.
6. Shotton, R. (2017, October 9). *The power of rhyme*. *The Media Leader*. the-media-leader.com/the-power-of-rhyme/

7. Arkes, H. R., Hackett, C., & Boehm, L. (1989). *The generality of the relation between familiarity and judged validity*. *Journal of Behavioral Decision Making*, 2(2), 81-94.
8. McGlone, M. S., & Tofiqbakhsh, J. (2000). *Birds of a Feather Flock Conjointly (?): Rhyme as Reason in Aphorisms*. *Psychological Science*, 11(5), 424-428.