https://bit.ly/3tVurLY

Mammalian offspring derived from a single unfertilized egg

Team of researchers has successfully derived offspring from a single unfertilized mammalian egg

by Bob Yirka , Phys.org

A team of researchers affiliated with several institutions in China and one in the U.S. has successfully derived offspring from a single unfertilized mammalian egg—in a mouse. In their paper published in *Proceedings of the National Academy of Sciences*, the group describes their technique when tested in mice.

The parthenogenetic mouse and the offspring. The parthenogenetic mouse was generated by targeted epigenetic rewriting of multiple imprinting control regions. The parthenogenetic mouse exhibited normal reproductive performance as an adult. **Credit: Yanchang Wei.**

Parthenogenesis is the development of embryos from a single unfertilized egg. In nature, it occurs in aphids, fish, reptiles, scorpions, mites and some bees—but not in mammals. In mammals, sexual reproduction involves a fusion of male DNA with female DNA, with the resulting offspring having genetic material from both parents. Prior research has shown that most of the cells in mammals express copies of genes from both parents—but a few do not, instead expressing genes from only the mother or the father. In their work, the researchers took advantage of such exceptions.

Prior research efforts aimed at forcing parthenogenesis in mammals have failed, the researchers note, due to genomic imprinting. They overcame this problem by taking a different approach. Their work involved removing an egg from a mouse and then using CRISPR to edit its genes to mimic the genes a male parent would have contributed during normal fertilization. They then injected an enzyme into the egg to switch on some genes and switch others off to make the genes in the egg resemble those of an egg that has been fertilized by a father. The egg was then implanted into the female's uterus, where it was allowed to grow into a fetus. The researchers repeated this process with several eggs, implanting them all together into a single mouse uterus—mice typically give birth to between eight and 12 pups at a time. All of the pups survived the birth, but only one of them survived to adulthood—and it did well enough to produce offspring as well.

The researchers suggest that parthenogenesis in mammals is achievable, though they acknowledge much more work is required before it can be used in real-world applications. They further suggest refinement of the process could lead to applications in agriculture or medicine development.

More information: *Yanchang Wei et al, Viable offspring derived from single unfertilized mammalian oocytes, Proceedings of the National Academy of Sciences (2022).* *DOI: 10.1073/pnas.2115248119*

https://bit.ly/3HXGAVn

New class of killer T cells may prevent autoimmune diseases

Study identifies human counterparts to mouse cells that quell rogue immune response

By Mitch Leslie

The price for a vigilant immune system that can pounce on tumor cells or pathogens is occasional friendly fire—an autoimmune attack. Scientists have now identified a new type of human T cell that quells assaults on healthy tissues, a finding that could suggest treatments for conditions as diverse as lupus and cancer. “It’s a major step forward in understanding how the immune response and autoimmunity are regulated,” says immunologist Harvey Cantor of the Dana-Farber Cancer Institute, who wasn’t involved in the work.

Immunologists already knew mice and people deploy one type of regulatory T cell—a subset called Tregs that sports the protein CD4—and suppresses autoimmune attacks. The newer enforcers belong to a category of T cells distinguished by a different surface protein, CD8. CD8 T cells are best known for killing infected or cancerous cells, but in mice some of them also kill T cells that orchestrate autoimmune reactions. Although researchers have long suspected humans have similar cells, nobody had confirmed their existence.

One obstacle was that humans don't make the distinctive receptors that mark the subset of CD8 cells in mice. However, some human CD8 T cells flaunt comparable receptors, the KIR proteins. To determine whether these human cells are immune inhibitors, Jing Li, a postdoc in the lab of immunologist Mark Davis at Stanford University's School of Medicine, and colleagues measured their abundance in patients with autoimmune diseases such as multiple sclerosis, lupus, and celiac disease. The cells were more common in blood from patients than in blood from healthy people, the team reports online today in *Science*. Tissue samples revealed they congregated in parts of the body damaged by the autoimmune attack, such as the joints in people with rheumatoid arthritis and the small intestine in people with celiac disease.

The researchers detected similar surges of the KIR-producing T cells in people fighting infections, especially the pandemic coronavirus. In 56 COVID-19 patients, "We saw the KIR-positive cells going through the roof," Davis says. And the sicker COVID-19 patients were, the more of the cells they harbored. The cells' numbers also shot up in patients with influenza, the team found.

To investigate the cells' role in autoimmunity, the scientists homed in on celiac disease, which is triggered by the gluten proteins in bread and other grain-based foods. In patients with the condition, so called helper T cells recognize gluten proteins such as gliadin and then spill molecules that promote inflammation. But in cell culture studies, Li and colleagues found, human CD8 T cells carrying KIR proteins killed the gliadin-detecting helper T cells. "That really opened up a window for us to understand the biology of these [KIR+] cells," Li says.

To find out how much protection the cells provide against autoimmunity, Li and her colleagues analyzed genetically altered mice that have 50% to 75% fewer of the suppressive CD8 cells than normal. After exposure to certain viruses that can trigger autoimmune disease, the rodents developed signs of damage such as kidney inflammation. In contrast, control mice with a full complement of suppressive CD8 T cells didn't show evidence of autoimmune diseases after infections.

Cantor and other scientists are convinced the team has fingered the long-sought human counterparts to the rodent immune regulators. "The paper provides really solid data that these cells exist in humans," says immunologist Nu Zhang of the University of Texas Health Science Center, San Antonio. They may have remained obscure because they "are rare and are easily missed," accounting for only about 5% of CD8-positive T cells, Davis says.

Immunologist Stephen Jameson of the University of Minnesota Medical School says approaches that increase the cells' numbers abundance might help soothe difficult-to-treat autoimmune illnesses such as celiac disease. It's also possible, he adds, that the cells are "sitting in tumors" and shielding them from immune attacks, in which case reducing the cells' could unleash a person's immune system to fight cancer. Researchers have attempted to harness the traditional, CD4-carrying Tregs for therapies, but no treatments have been approved, Cantor notes. "The hope is that with this new set of regulatory cells, we can use them more efficiently."

A key question is why the immune system needs another type of suppressive T cell when it already has Tregs. But Tregs are

generalists that inhibit a variety of immune cells without killing them. Davis posits that the KIR-positive CD8 cells target particular T cells that switch on during an assault by a pathogen. Although these freshly activated T cells help clear the invaders, they can also attack healthy tissues. The KIR subclass serves as a “SWAT team” to kill off these potentially ruinous T cells once an infection is quelled, Davis proposes.

The explosion of KIR-positive CD8 T cells the researchers detected in patients with autoimmune diseases or COVID-19 may reflect an attempt to rein in destructive immune reactions—the immune overreaction to the novel coronavirus is what kills many COVID-19 patients in the end. How the suppressive CD8 cells distinguish T cells with self-destructive tendencies is one of the mysteries scientists still need to answer.

https://bit.ly/35I3sLO

Ancient art and genetics combine to reveal origin of world's most expensive spice

When and where was saffron first domesticated?

Saffron, the world's most expensive spice, is extracted from the flowers of the saffron crocus, Crocus sativus. It has been grown for thousands of years in the Mediterranean region. But when and where was saffron first domesticated by our ancestors?

In a review in *Frontiers in Plant Science*, researchers conclude that lines of evidence from ancient art and genetics converge on the same region.

"Both ancient artworks and genetics point to Bronze Age Greece, in approximately 1700 BCE or earlier, as the origin of saffron's domestication," said Ludwig Mann, one of the lead authors and a Ph.D. student at Technische Universität Dresden, Germany.

The genus Crocus, with approximately 250 species, ranges from South and Central Europe and North Africa to Western China. Unlike domesticated saffron, these species reproduce sexually in the wild. The first known use by humans of wild crocuses was as pigment for cave paintings, approximately 50,000 years ago in today's Iraq. Ancient texts from Sumer, Assyria, and Babylonia also describe the use of wild crocuses in medicine and dye.

In contrast, domesticated saffron doesn't grow in the wild, and can only be propagated asexually with human help, by dividing its underground "corms"—stem-like storage organs. The process was first described by the Greek philosopher Theophrastus in the fourth to third century BCE.

Today, domesticated saffron is grown around the globe, for use in cooking and perfumes and as a yellow dye. Between 15,000 and 16,000 flowers, requiring between 370 and 470 person-hours to collect, yield a single kilo, worth between $1,300 and $10,000.

"Finding out where and when saffron was first domesticated isn't straightforward: The species is difficult to study genetically, because it has three copies of every chromosome instead of the usual two, and a large genome containing a high percentage of difficult-to-sequence repetitive DNA," said lead author Seyyedeh-Sanam Kazemi-Shahandashti, a Ph.D. student at the Institute of Bio- and Geosciences of the Forschungszentrum Jülich, Germany.

"As there are no ancient crocus remains preserved from ancient times, we here revisit ancient artworks that depict saffron-like plants. We expected that these could point us to specific regions."

The authors argue that artworks from the Minoan civilization of ancient Greece are likely the oldest to depict domesticated saffron. For example, the dense patches of crocus flowers on the fresco "The Saffron Gatherers" from the island of Santorini (approximately 1600 BCE) suggest cultivation. Another fresco on the same island, "The Adorants," shows flowers with long, dark-red stigmas which overtop dark violet petals, typical of domesticated saffron.

Flowers with these traits are also depicted on ceramics and cloth

from Bronze Age Greece, and symbolically rendered in the ideogram for saffron in the ancient Linear B script. In Egypt, tombs from the 15th and 14th centuries BCE depict how ambassadors from Crete brought tribute in the form of textiles dyed with saffron.

An origin in Bronze Age Greece agrees with results from genetic studies from 2019, which showed that C. cartwrightianus, which only occurs in mainland Greece and Crete, is saffron's closest wild relative.

The authors believe that the modern saffron crocus with its three genomes arose naturally from the wild, either exclusively from C. cartwrightianus or from hybrids between C. cartwrightianus and another crocus species. The saffron crocus would then have been retained by the Bronze Age Greeks because of its superior qualities as a spice.

The authors will continue to trace saffron's properties, said final author Dr. Tony Heitkam, leader of the Plant Genomics group at Technische Universität Dresden: "Around the globe today, all saffron crocuses are effectively clones dating back to saffron's emergence in ancient Greece. Nevertheless, despite sharing the same genome, saffron can have different properties depending on the region. We have started to investigate the molecular causes, in particular so-called 'epigenetic' differences, for this regional variation."

More information: *Seyyedeh-Sanam Kazemi-Shahandashti et al, Ancient Artworks and Crocus Genetics Both Support Saffron's Origin in Early Greece, Frontiers in Plant Science (2022).* *DOI: 10.3389/fpls.2022.834416*

https://bit.ly/3hWW6qb

Haunting 'mermaid' mummy in Japan is probably a gruesome monkey-fish mix

The 300-year-old mummy likely consists of a monkey's torso sewed onto the bottom half of a fish.

By Harry Baker

Researchers in Japan are investigating the origins of a nightmarish, 300-year-old mummified "mermaid," which has been worshipped for centuries due to its supposed medicinal properties. The haunting remains are most likely a gruesome amalgam of a monkey's torso sewed onto a fish's tail, potentially embellished with hair and nails from a human.

The 'mermaid' was allegedly caught in the Pacific Ocean between 1736 and 1741. **(Credits: Kinoshita Hiroshi via Pen News)**

Hiroshi Kinoshita, board member of the Okayama Folklore Society, discovered the mermaid mummy, which is around 12 inches (30.5 centimeters) long, inside a box at a temple in Okayama Prefecture. He first became aware of the mummy after he found a picture of the bizarre specimen in an encyclopedia of mythical creatures.

A fisherman supposedly caught the specimen sometime between 1736 and 1741, and he subsequently sold it to an affluent family, according to a note left inside the mummy's box.

Researchers still don't know exactly how the mermaid ended up inside the temple, according to Japanese news site The Asahi Shimbun.

Now, Takafumi Kato, a paleontologist at the Kurashiki University of Science and the Arts, and colleagues have begun looking into the mummy's origins after Kinoshita convinced the temple to let the scientists investigate the unusual remains.

On Feb. 2, the scientists imaged the mummy using a CT scan, as seen in this video. Researchers will also take DNA samples to identify which species have been combined to make the mermaid. The team will release their results later in the year, they said.

The mermaid mummy somewhat resembles two mythical creatures

from Japanese folklore: Amabies — mermaids with beaks instead of mouths and three distinct tail-fins — and Ningyos, which are fish-like creatures with human heads.

Both of these types of creatures have been associated with stories of miraculous health cures and increased longevity. In one famous tale, Yao Bikuni, a woman, is said to have lived for 800 years after accidentally eating an entire Ningyo, according to U.K. news site Metro.

The temple's priests look to the mummy as an omen of good health. "We have worshipped it, hoping that it would help alleviate the coronavirus pandemic even if only slightly," Kozen Kuida, the head priest at the temple, told The Asahi Shimbun.

The mummy was previously put on display in a glass case at the temple for visitors to pray to, but it has spent the last 40 years in a fireproof safe within the temple to prevent it from deteriorating. Similar mermaid mummies have been worshipped at two other temples in Japan, according to The Asahi Shimbun.

These fake mermaids were likely created by local people to sell to curious Western tourists, Live Science previously reported. A similar hoax, known as the Feejee Mermaid, was sold to Dutch travelers in Japan in the 1810s and later resold to English merchants, before being shipped to the U.S., where it became part of the famous collection of P.T. Barnum (the real-life inspiration for the movie "The Greatest Showman"). This 3-foot-long (91 cm) mermaid is believed to have been made from the body of an orangutan and the tail of a salmon.

The priests at the temple in Okayama Prefecture say they hope that the new study will add to the mummified mermaid's legacy and help it live on through future folklore. "I hope the research project can leave scientific records for future generations," Kuida told The Asahi Shimbun.

https://wb.md/3t2d5NZ

Israel Detects First Polio Case Since 1989

Israel has detected its first polio case since 1989 in a 4-year-old boy in Jerusalem, according to an announcement from the country's Ministry of Health.

Carolyn Crist

The child wasn't vaccinated against polio as part of routine vaccinations that children receive in Israel, the ministry said. The source of the disease in this case is a mutated strain of polio virus that can cause illness in unvaccinated people.

"The most important means for preventing polio disease is to make sure that you follow routine vaccination protocols," the ministry said. "Those who have yet to complete their routine vaccinations are urged to do so with all due haste."

The 4-year-old child is in a state of weakness that could deteriorate to paralysis, a ministry official told *Israel Hayom*. Neither the child nor his family were vaccinated against polio, the official said, adding that the boy could be one of hundreds or thousands of children who may have been exposed to the mutant strain of polio.

"The population vaccinated against polio is protected," the official said. "But this could be significant for the unvaccinated population, and the recommendation is to get vaccinated. It's disturbing, mostly because this is a completely preventable disease."

The Jerusalem District Health Bureau has launched a contact tracing investigation and will provide specific guidance to those who have been in close contact with the child. More recommendations will be issued based on the results of the investigation, the ministry said.

"It should be noted that the virus has been found in sewage water samples collected from the area, a finding that occurs occasionally, but so far there were no clinical cases in similar past incidents," the ministry said.

In 2013, traces of the polio virus were detected in sewer systems across Israel, but no diagnoses were made, according to *The Times of Israel*. At the time, Israeli health officials launched a mass vaccination drive among children under age 9.

With the discovery of the latest case, the first polio vaccine dose should be moved up to 6 weeks after birth, and the second should be given at 12 weeks after birth, Sharon Alroy-Preis, MD, head of Israel's Public Health Services, said during a news conference on Monday, according to *The Jerusalem Post*.

Polio is a highly contagious disease that spreads from person to person or through contaminated water. It attacks the nervous system and can cause paralysis. The disease typically affects children under age 5 and has been stamped out in most countries. There is no cure, but it can be prevented through vaccination.

The case in Jerusalem comes after an outbreak of the virus in Malawi in February, including a report of a 3-year-old girl who has been paralyzed. The strain was linked to a strain in Pakistan, where it is still endemic. It is also still endemic in Afghanistan.

Starting March 21, a nationwide vaccination campaign in Malawi will focus on nearly 3 million children under age 5, who will receive four doses of the oral polio vaccine.

"The resurgence of the wild poliovirus in Malawi, decades after it was last detected, is cause for serious concern," Rudolf Schwenk, a UNICEF Malawi representative, said in a statement.

"Vaccination is the only way to protect the children of Malawi from this crippling disease, which is highly infectious," he said.

https://bit.ly/3J6kjpI

Damage to General Intelligence Brain Networks Causes Dementia Patients To Struggle With Change

Dementia patients struggle to cope with change because of damage to general intelligence brain networks.

People with dementia struggle to adapt to changes in their environment because of damage to areas of the brain known as 'multiple demand networks', highly-evolved areas of the brain that support general intelligence, say scientists at the University of Cambridge.

There are many different types of dementia, such as Alzheimer's disease and frontotemporal dementia (FTD), which are characterized by the build-up of different toxic proteins in different parts of the brain. This means that the symptoms of dementia vary, and can include problems with memory, speech, behavior, or vision. But one symptom seen across every type of dementia is a difficulty in responding to unexpected situations.

Dr. Thomas Cope from the MRC Cognition and Brain Science Unit and Department of Clinical Neurosciences at the University of Cambridge said: "At the heart of all dementias is one core symptom, which is that when things change or go unexpectedly, people find it very difficult. If people are in their own environment and everything is going to plan, then they are OK. But as soon as the kettle's broken or they go somewhere new, they can find it very hard to deal with."

To understand why this happens, Dr. Cope and colleagues analyzed data from 75 patients, all of whom are affected by one of four types of dementia that affect different areas of the brain. The patients, together with 48 healthy controls, listened to changing sounds while their brain activity was recorded by a magnetoencephalography machine, which measures the tiny magnetic fields produced by electrical currents in the brain.

Unlike traditional MRI scanners, these machines allow very precise timing of what is happening in the brain and when. The results of their experiment are published today (March 8, 2022) in the *Journal of Neuroscience*.

During the scan, the volunteers watched a silent film – David Attenborough's *Planet Earth*, but without its soundtrack – while

listening to a series of beeps. The beeps occurred at a steady pattern, but occasionally a beep would be different, for example, a higher pitch or different volume.

The team found that the unusual beep triggered two responses in the brain: an immediate response followed by a second response around 200 milliseconds – a fifth of a second – a later.

The initial response came from the basic auditory system, recognizing that it had heard a beep. This response was the same in the patients and healthy volunteers.

The second response, however, recognized that the beep was unusual. This response was much smaller among the people with dementia than among the healthy volunteers. In other words, in the healthy controls, the brain was better at recognizing that something had changed.

The researchers looked at which brain areas activated during the task and how they were connected up, and combined their data with that from MRI scans, which show the structure of the brain. They showed that damage to areas of the brain known as 'multiple demand networks' was associated with a reduction in the later response.

Multiple demand networks, which are found both at the front and rear of the brain, are areas of the brain that do not have a specific task, but instead are involved in general intelligence – for example, problem-solving. They are highly evolved, found only in humans, primates, and more intelligent animals. It is these networks that allow us to be flexible in our environment.

In the healthy volunteers, the sound is picked up by the auditory system, which relays information to the multiple demand network to be processed and interpreted. The network then 'reports back' to the auditory system, instructing it whether to carry on or to attend to the sound.

"There's a lot of controversy about what exactly multiple demand networks do and how involved they are in our basic perception of the world," said Dr. Cope. "There's been an assumption that these intelligence networks work 'above' everything else, doing their own thing and just taking in information. But what we've shown is no, they're fundamental to how we perceive the world.

"That's why we can look at a picture and immediately pick out the faces and immediately pick out the relevant information, whereas somebody with dementia will look at that scene a bit more randomly and won't immediately pick out what's important."

While the research does not point to any treatments that may alleviate the symptom, it reinforces advice given to dementia patients and their families, said Dr. Cope.

"The advice I give in my clinics is that you can help people who are affected by dementia by taking a lot more time to signpost changes, flagging to them that you're going to start talking about something different or you're going to do something different. And then repeat yourself more when there's a change, and understand why it's important to be patient as the brain recognizes the new situation."

Although their study only looked at patients with dementia, the findings may explain similar phenomena experienced by people living with conditions such as schizophrenia, where brain networks can become disrupted.

Reference: "Causal Evidence for the Multiple Demand Network in Change Detection: Auditory Mismatch Magnetoencephalography across Focal Neurodegenerative Diseases" by Thomas E. Cope, Laura E. Hughes, Holly N. Phillips, Natalie E. Adams, Amirhossein Jafarian, David Nesbitt, Moataz Assem, Alexandra Woolgar, John Duncan and James B. Rowe, 8 March 2022, Journal of Neuroscience.

DOI: 10.1523/JNEUROSCI.1622-21.2022

The research was funded by the Medical Research Council and National Institute for Health Research, with additional support from Wellcome, the Biotechnology and Biological Sciences Research Council, and the James S McDonnell Foundation.

Dr. Cope is a fellow at Murray Edwards College, Cambridge.

https://bit.ly/37n9JwO

Radical Plan to Make Earth's Deepest Hole Could Unleash Limitless Energy

Combining conventional drilling methods with a megawatt-power flashlight

Mike McRae

Since its launch in 2020, a pioneering energy company called Quaise has attracted some serious attention for its audacious goal of diving further into Earth's crust than anybody has dug before.

Following the closure of first round venture capital funding, the MIT spin-off has now raised a total of US$63 million: a respectable start that could potentially make geothermal power accessible to more populations around the world.

The company's vision for getting closer to the center of the Earth is to combine conventional drilling methods with a megawatt-power flashlight inspired by the kind of technology that could one day make nuclear fusion energy possible.

Geothermal energy has become the forgotten renewable. With solar and wind increasingly dominating the market of green energy, efforts to tap the vast reservoir of heat deep beneath our feet remain stubbornly well behind. It's not hard to understand why. Despite being a perfectly good choice of clean, uninterrupted, limitless power, there are very few places where hot rocks suitable for geothermal energy extraction sit conveniently close to the surface.

Quaise aims to change that by developing technology that will allow us to bake holes in the crust to record depths.

To date our best efforts at chewing our way through the planet's skin have bottomed out at around 12.3 kilometers (7.6 miles). While the Kola Superdeep Borehole and others like it may have reached their limit, though, they nonetheless represent amazing feats of engineering.

To push further, we'd need to find ways to grind away at material squeezed by dozens of kilometers of overhead rock, and then cart it back up to the surface.

Digging tools would also need to still be able to grind rock at temperatures exceeding 180 degrees Celsius (356 degrees Fahrenheit). Turning the drill bits over such a long distance would also need some clever thinking. One potential alternative to the above obstacles is to drill less – and burn more.

Born out of nuclear fusion research at MIT Plasma Science and Fusion Center, Quaise's solution is to use millimeter long waves of electromagnetic radiation that force atoms to melt together.

Devices called gyrotrons can efficiently churn out continuous beams of electromagnetic radiation by shaking electrons at high speed inside powerful magnetic fields.

By hooking a megawatt-power gyrotron up to the latest in cutting tools, Quaise expects to be able to blaze its way through the toughest, hottest rock, down to depths of around 20 kilometers (12.4 miles) in a matter of months.

At these depths, the heat of the surrounding rock can hit temperatures of around 500 degrees Celsius – enough to transform any liquid water pumped down there into a vapor-like supercritical state that's perfect for generating electricity.

Using its seed and investment funding, Quaise anticipates having field-deployable devices providing proof-of-concept operations within the next two years. If all goes well, it could have a working system producing power by 2026.

By 2028, the company hopes to be able to take over old coal-fueled power stations, transforming them into facilities powered by steam instead.

It's a technology at once so old and yet so novel, we're bound to have plenty of questions on how, and whether, it might ever succeed. Lucky for us, Loz Blain over at New Atlas has listed a bunch of them for Quaise's CEO and co-founder, Carlos Araque, to

answer.

Even without this technology, roughly 8.3 percent of the world's energy could come from a geothermal source, supplying around 17 percent of the world's population. Close to 40 nations could rely completely on geothermal energy right now.

Yet currently, less than half a percent of the world's electricity is provided by the heat beneath our feet. To remain on track for net zero emissions by 2050, geothermal energy should be growing at around 13 percent each year. Right now, its expansion is a mere fraction of that.

That leaves a lot of room to grow, even if we don't find a way to expand its reach. Whether companies like Quaise will help invigorate interest this underdog is left to be seen.

What's certain though is that time to cut emissions and cap global warming to something less catastrophic is rapidly shrinking. We're hitting rock bottom, so maybe it's time for us to dig a little deeper.

https://nyti.ms/3J87bke

At the Bottom of an Icy Sea, One of History's Great Wrecks Is Found

Explorers and researchers, battling freezing temperatures, have located Endurance, Ernest Shackleton's ship that sank in the Antarctic in 1915.

By Henry Fountain

The wreck of Endurance has been found in the Antarctic, 106 years after the historic ship was crushed in pack ice and sank during an expedition by the explorer Ernest Shackleton.

A team of adventurers, marine archaeologists and technicians located the wreck at the bottom of the Weddell Sea, east of the Antarctic Peninsula, using undersea drones. Battling sea ice and freezing temperatures, the team had been searching for more than two weeks in a 150-square-mile area around where the ship went down in 1915.

Endurance, a 144-foot, three-masted wooden ship, holds a revered place in polar history because it spawned one of the greatest survival stories in the annals of exploration. Its location, nearly 10,000 feet down in waters that are among the iciest on Earth, placed it among the most celebrated shipwrecks that had not been found.

The ship's stern still bore its name, "ENDURANCE," above a five-pointed star, a holdover from before Shackleton bought the ship, when it was named Polaris. **Credit...Falklands Maritime Heritage Trust**

The discovery of the wreck was announced Wednesday in a statement by the search expedition, Endurance22.

"We have made polar history with the discovery of Endurance, and successfully completed the world's most challenging shipwreck search," said John Shears, the expedition's leader.

The first images of the ship since those taken by Shackleton's photographer, Frank Hurley, revealed parts of the vessel in astonishing detail. An image of the stern showed the name "ENDURANCE" above a five-pointed star, a holdover from before Shackleton bought the ship, when it was named Polaris. Another showed the rear deck and the ship's wheel.

A video provided by the expedition's organizer, the Falklands Maritime Heritage Trust, showed the bow and portions of the deck and hull.

Mensun Bound, the expedition's exploration director and a marine archaeologist who has discovered many shipwrecks, said Endurance was the finest he had ever seen. It is upright, clear of the seabed and "in a brilliant state of preservation," he said.

The ship was found about four miles south of the last location recorded by Shackleton's captain and navigator, Frank Worsley.

The search had been conducted over a wide area to account for errors in Worsley's navigation equipment.

Endurance's relatively pristine appearance was not unexpected, given the cold water and the lack of wood-eating marine organisms in the Weddell Sea that have ravaged shipwrecks elsewhere.

Mr. Bound also described the wreck as "intact." Although Hurley's photographs before the sinking had shown major damage to, and the collapse of, the ship's mast and rigging, and there had been damage to the hull, Mr. Bound had expected most of the ship to be in one piece.

The expedition video showed what appeared to be broken masts and damage to the decks.

The hunt for the wreck, which cost more than $10 million, provided by a donor who wished to remain anonymous, was conducted from a South African icebreaker that left Cape Town in early February. Aside from a few technical glitches involving the two submersibles, and part of a day spent icebound when operations were suspended, the search proceeded relatively smoothly.

Endurance in 1915, trapped in Antarctic ice but not yet crushed. **Credit...Frank Hurley/Scott Polar Research Institute, University of Cambridge, via Getty Images**

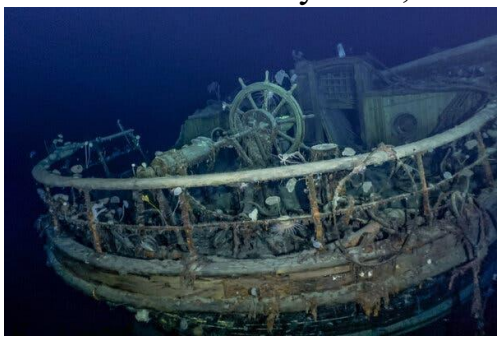
The battery-powered submersibles combed the seafloor twice a day, for about six hours at a time. They used sonar to scan a swath of the smooth seabed, looking for anything that rose above it. Once the wreck was located several days ago, the equipment was swapped for high-resolution cameras and other instruments to make detailed images and scans.

Under the terms of the Antarctic Treaty, the six-decade-old pact intended to protect the region, the wreck is considered a historical monument. The submersibles did not touch it; the images and scans will be used as the basis for educational materials and museum exhibits. A documentary is planned, as well.

Shackleton left England aboard Endurance with a crew of 27 in 1914, bound for a bay on the Weddell Sea that was meant to be the starting point for an attempt by him and a small party to be the first to cross Antarctica. This was close to the end of what has become known as the heroic age of Antarctic exploration, which included treks by the Norwegian Roald Amundsen, who in 1911 was the first to reach the pole, and by Robert Falcon Scott, a Briton who died after reaching it a month later.

Shackleton never made it to the pole or beyond, but his leadership in rescuing all his crew and his exploits, which included an 800-mile open-boat journey across the treacherous Southern Ocean to the island of South Georgia, made him a hero in Britain.

Shackleton was tripped up by the Weddell's notoriously thick, long-lasting sea ice, which results from a circular current that keeps much ice within it. In early January 1915 Endurance became stuck less than 100 miles from its destination and drifted with the ice for more than 10 months as the ice slowly crushed it.



The ship's rear deck and wheel. Its relatively pristine appearance was not unexpected, given the cold water and the lack of wood-eating marine organisms in the Weddell Sea that have ravaged shipwrecks elsewhere. **Credit...Falklands Maritime Heritage Trust**

As the ship became damaged, the crew set up camp on the ice and lived on the ice until it broke up five months after the ship sank.

The Weddell Sea still remains far icier than other Antarctic waters, though in recent years ice conditions have been lighter than usual.

That was the situation this year, and it helped the expedition reach the search site more easily and remain there safely. The icebreaker, Agulhas II, left the search area on Tuesday for the 11-day voyage back to Cape Town.

In addition to the expedition team, several ice researchers were on board, including Stefanie Arndt of the Alfred Wegener Institute in Germany. Dr. Arndt, who studies how Antarctic sea ice may change as the world warms because of human-caused emissions of greenhouse gases, and others spent much time out on the ice drilling cores. On Monday she said on Twitter that they had collected 630 samples from 17 locations, which she called "an incredible number."

https://bit.ly/3KC9fky

AI could decipher gaps in ancient Greek texts, say researchers

From imperial decrees to Sappho's poems, Ithaca system can find word patterns and suggest age of text

Nicola Davis Science correspondent

Artificial intelligence could bring to life lost texts, from imperial decrees to the poems of Sappho, researchers have revealed, after developing a system that can fill in the gaps in ancient Greek inscriptions and pinpoint when and where they are from.

***Ancient Greek writing chiselled on stone*. Photograph: Getty Images/iStockphoto**

Dr Thea Sommerschield, a co-author of the research at Ca' Foscari University of Venice and Harvard University, said inscriptions were important as they were written directly by ancient people and were evidence of the thought, language, society and history of past civilisations.

"But most surviving inscriptions have been damaged over the centuries. So their texts are now fragmentary or illegible," she said, adding that they may also have been moved from their original location, while methods such as radiocarbon dating were unusable on materials such as stone.

Writing in the journal Nature, Sommerschield and colleagues report how they built an AI system that they nicknamed Ithaca, after the Greek island that was home to the legendary King Odysseus.

This inscription (*Inscriptiones Graecae*, volume 1, edition 3, document 4, face B (*IG* I^3 4B)) records a decree concerning the Acropolis of Athens and dates to 485/4 bc. Marsyas, Epigraphic Museum, WikiMedia CC BY 2.5.

The team fed Ithaca more than 63,000 transcribed ancient Greek inscriptions, enabling it to pick out patterns in the order of letters and words, as well as associations between words and phrases and the age and provenance of the text.

The team then tuned the system before exploring whether it could accurately suggest when and where another 7,811 inscriptions were from, and propose a selection of letters and words to fill in artificially created gaps in the inscriptions, ranked by probability.

The results reveal that Ithaca achieved 62% accuracy when used alone to fill in the gaps in inscriptions, and 72% accuracy when the system's suggestions were interpreted by a historian – about three times higher than when historians worked alone. The team said Ithaca was able to date the inscriptions to within 30 years of their established date and correctly identified their provenance 71% of the time.

"Just as microscopes and telescopes have extended the range of what scientists can do today, Ithaca aims to singularly augment and expand the capabilities to study one of the most significant periods of human history," said Dr Yannis Assael, a co-author of the work from the AI company DeepMind.

The team said the approach could be used for any medium and any ancient written language, from Latin to Cuneiform, and it might be possible to train the system on Greek literary texts written on fragments of papyrus – an approach that could shed light on the writings of poets such as Sappho. There is also the potential to develop AI systems that could provide insights into the authorship of texts.

The researchers said Ithaca had already been used on a set of decrees most of which were found on the Acropolis of Athens, suggesting one – relating to the collection of tributes across the Athenian empire – dated to 424BC rather than 448-7BC as was long thought, chiming with recent dating breakthroughs.

"Although it might seem like a small difference, this 30-year shift has momentous repercussions for our understanding of the political history of classical Athens, and helps us better align literary sources – such as Thucydides' account of these years and events– with the epigraphic record," said Sommerschield.

Prof Peter Liddel, an expert in Greek history and epigraphy at the University of Manchester who was not involved in the research, said even the provenance of many of the marbles brought back by Lord Elgin was unclear.

"The application of AI through Ithaca certainly has the potential to contribute to the toolbox of historians involved in analysing ancient texts and using them to understand processes like the development of imperialism or the nature of cult activity," he said.

However, Liddel warned that, like scholars, AI was limited by gaps in the ancient record. "AI is only powerful as a tool to help us ask questions about, and make comparisons to, the existing evidence," he said.

Prof Melissa Terras, an expert in digital cultural heritage at the University of Edinburgh, said it was important to keep training scholars in traditional approaches to be able to develop AI systems such as Ithaca, and to interpret the suggestions they generate. But she said there was huge potential for AI to assist with interpretation of the past and its cultures given ancient texts were often fragmented yet followed structured formats.

"This means they require a lot of cross-referencing for the human brain to solve the puzzle – but this is the type of repetitive calculation that [AI systems such as] deep neural nets excel at," she said.

https://bit.ly/3hXILh4

Skin Cancer Cells Sabotage Brain's Immune Defenses With Alzheimer's Protein

Amyloid beta, a protein known to build-up in the brains of Alzheimer's patients, also helps skin cancer cells thrive when they spread to the brain, a new study finds.

Published online today (March 9, 2022) in *Cancer Discovery*, a journal of the American Association for Cancer Research, the study found that in melanoma, the deadliest form of skin cancer, cancer cells that have spread to the brain depend on amyloid beta to survive there. The study authors focused on melanoma because it spreads (metastasizes) to the brain in 40 percent of patients with advanced (Stage IV) disease, the highest rate among common cancer types.

Led by researchers from NYU Grossman School of Medicine and its Laura and Isaac Perlmutter Cancer Center, the study revealed that metastatic melanoma cells recovered from human brains and grown in tissue cultures make roughly three times as much amyloid beta as cancer cells that have spread to other parts of the body.

The research team also found that amyloid beta secreted by cancer cells ramps down immune responses that would otherwise recognize cancer cells as abnormal and attack them, much as they attack invading bacteria. The researchers theorize that amyloid beta shifts brain immune cells into a mode seen as infections fade and tissues begin to heal, enabling cancer cells to evade notice. In addition, the team showed that a treatment known to dramatically reduce amyloid beta levels, the beta secretase inhibitor LY2886721, decreased the size of brain melanoma metastases by about half in study mice.

"Our study reveals an unexpected role for tumor-secreted amyloid beta in promoting the survival of melanoma brain metastases, and suggest a new way to counter it," says senior study author Eva Hernando, PhD, professor in the Department of Pathology, and assistant dean for Research Integration, at NYU Langone Health.

The current finding adds to the mystery surrounding amyloid beta, the main component of deposits found in the brains of people with Alzheimer's disease. Despite myriad studies, its roles in normal function and Alzheimer's disease remain controversial, even as new proposed roles emerge, says Hernando, also a member of Perlmutter Cancer Center.

Cancer Can't Take Root

The new work featured refinements on standard techniques that captured a more accurate picture of which proteins are made in greater levels in melanoma cells that have spread to the brain. First, the research team grew cells taken from the human metastatic brain tumors in cultures, but only for a short time to keep them from evolving genetically until they no longer resembled the original cancer cells. The authors then measured the proteins produced by the melanoma cells in the first use, to their knowledge, of a whole cell proteomics test to study brain metastases.

Using 24 human brain and non-brain cancer metastases grown in short term-cultures, the team was able to show that melanoma cells from the brain produce proteins related to Alzheimer's, Parkinson's, and Huntington's diseases. The discovery of a connection between brain cancer and neurodegenerative diseases was made possible, say the authors, by new techniques that let the research team tell proteins made by cancer cells apart from those made in surrounding brain cells.

From these data, the researchers hypothesized that cancer cells produce amyloid beta in the brain to help their survival. To test the idea, they looked at the effect of silencing the gene that codes for amyloid precursor protein (APP), a protein that is processed by secretase enzymes (beta and gamma) into amyloid beta, in melanoma cells injected into the hearts of study mice. Silencing the APP gene, and therefore cutting off the amyloid beta supply from the cancer cells, dramatically reduced the amount of cancer metastases that formed in the brain, as measured by imaging.

Other experiments revealed that melanoma cells lacking amyloid beta became unable to successfully grow (divide and multiply) because of immune attack at the stage where they are forming small cell colonies (micro-metastases) needed for spreading cancer cells to "take root" in a new tissue.

Finally, the study found that amyloid beta released by melanoma cells changes gene expression in astrocytes, brain cells that nourish message-carrying brain cells (neurons), such that the astrocytes emit proteins that ramp down immune responses to cancer. Astrocytes are also known to exchange signals with microglia, a type of immune cell in the brain.

The researchers further demonstrated that amyloid beta released by melanoma cells prevents them from being destroyed by microglia. It may be that amyloid beta released by melanoma cells is influencing microglia, both through astrocytes and directly, to keep them from "swallowing" and destroying melanoma cells, say the

authors.

"The field has already developed treatments that have been shown in clinical trials to potently and safely reduce amyloid beta levels, but that fail to counter Alzheimer's disease for reasons unknown," said first study author Kevin Kleffman, PhD, an MD-PhD student at NYU Langone and member of Hernando's lab.

"With this in mind, our team is already evaluating whether repurposed, tested anti-amyloid beta antibodies could prevent or reduce brain metastases in animal studies. Another next step is combining immunotherapies, including checkpoint inhibitors, and anti-amyloid beta therapies to ensure they can be used safely together."

Reference: "Melanoma-secreted Amyloid Beta Suppresses Neuroinflammation and Promotes Brain Metasta" by Kevin Kleffman, Grace Levinson, Indigo V.L. Rose, Lili M. Blumenberg, Sorin A.A. Shadaloey, Avantika Dhabaria, Eitan Wong, Francisco Galan-Echevarria, Alcida Karz, Diana Argibay, Richard Von Itter, Alfredo Floristan, Gillian Baptiste, Nicole M. Eskow, James A. Tranos, Jenny Chen, Eleazar C. Vega y Saenz de Miera, Melissa Call, Robert Rogers, George Jour, Youssef Zaim. Wadghiri, Iman Osman, Yue-Ming Li, Paul Mathews, Ronald DeMattos, Beatrix Ueberheide, Kelly V. Ruggles, Shane A. Liddelow, Robert J. Schneider and Eva Hernando, 9 March 2022, Cancer Discovery. DOI: 10.1158/2159-8290.CD-21-1006

Along with Hernando and Kleffman, study authors in the Department of Pathology at NYU Grossman School of Medicine were Grace Levinson, Sorin Shadaloey, Francisco Galan-Echevarria, Alcida Karz, Diana Argibay, Richard Von-Itter, Alfredo Floristan, Gillian Baptiste, Nicole Eskow, Robert Rogers, and George Jour. Also NYU Langone Health authors were Indigo Rose and Shane Liddelow of the Neuroscience Institute, Lili Blumenberg and Kelly Ruggles in the Department of Medicine, Avantika Dhabaria and Beatrix Ueberheide in the Department of Biochemistry and Molecular Pharmacology; James Tranos, Jenny Chen, and Youssef Zaim Wadghiri in the Department of Radiology; Eleazar Vega Saenz de Miera, Melissa Call, and Iman Osman in the Department of Dermatology; Paul Mathews in the Department of Psychiatry, and Robert Schneider in the Department of Microbiology. Also authors were Eitan Wong and Yueming Li in the Chemical Biology Program at Memorial Sloan Kettering Cancer Center, and Ronald DeMattos of the Department of Neurobiologics at Eli Lilly.

The study was supported by National Institutes of Health grants (NIH) NCI 5R01CA243446, P01CA206980, NCI P50 CA225450, F30CA221068, 5 T32 CA009161-37, P30CA016087, NIGMS 5 T32 GM007308-41, and S10 Grants NIH/ORIP S10OD01058 and S10OD018338. Also supporting the work were an American Cancer Society-Melanoma Research Alliance Team Science Award, a Vilcek Foundation Scholarship, a Fundacion Ramon Areces fellowship, the Cure Alzheimer's Fund, the Blas Frangione Foundation, the MD Anderson Neurodegenerative Consortium, Anonymous Donors, and NYU Grossman School of Medicine.

Of note, none of the study authors from NYU Grossman School of Medicine received any financial compensation from Eli Lilly, which supplied the beta secretase inhibitor used in the study. Study author Ronald DeMattos is a full-time employee at Eli Lilly. Eva Hernando, Robert Schneider and Kevin Kleffman are inventors on pending International Patent Application No. PCT/US2019/033377 filed on May 21, 2019, for a method-of-treatment patent in the use of an anti-amyloid beta therapeutic. Shane Liddelow is a founder of AstronauTx Ltd, a company making therapies to target astrocytes in neurodegenerative disease. These relationships are being managed in accordance with the policies of NYU Langone Health.

https://bbc.in/3hZHoP9

Covid deaths probably three times higher than records say

More than 18 million people - three times higher than official records suggest - have probably died because of Covid, say researchers.

By Michelle Roberts Digital health editor

Their report comes two years to the day from when the World Health Organization first declared the pandemic.

The Covid-19 excess mortality team at the US's Washington University studied 191 countries and territories for what they call the true global death figure. Some deaths were from the virus, while others were linked to the infection.

This is because catching Covid might worsen other pre-existing medical conditions, such as heart or lung disease, for example.

The measure used is called excess deaths - how many more people have been dying than would be expected compared to recent years, before the pandemic hit.

To calculate this, the researchers gathered data through searches of various government websites, the World Mortality Database, the Human Mortality Database, and the European Statistical Office.

Rates of excess deaths are estimated to have varied dramatically by country and region, but the overall global rate calculated in the study is 120 deaths per 100,000 people. That would mean about 18.2 million deaths have happened because of Covid in the two years between the start of 2020 and the end of 2021 - three times as many as the official 5.9 million that have actually been recorded.

Excess death estimates were calculated for the full study period only, and not by week or month, because of lags and inconsistencies in reporting of Covid death data that could drastically alter the estimates, the investigators stress.

According to the research, which is published in The Lancet, the

highest rates were in lower income countries in Latin America, Europe and sub-Saharan Africa. But deaths were also fairly high in some high-income countries, such as Italy and parts of the US.

The five countries with the highest estimated excess death rates were:

- Bolivia
- Bulgaria
- Eswatini
- North Macedonia
- Lesotho

The five with the lowest were:

- Iceland
- Australia
- Singapore
- New Zealand
- Taiwan

For the UK, the estimated total number of Covid-related deaths in 2020 and 2021 was similar to official records at about 173,000, with an excess mortality rate of 130 people per 100,000.

Lead author Dr Haidong Wang, from the Institute for Health Metrics and Evaluation, said: "Understanding the true death toll from the pandemic is vital for effective public health decision-making. "Studies from several countries, including Sweden and the Netherlands, suggest Covid was the direct cause of most excess deaths, but we currently don't have enough evidence for most locations. "Further research will help to reveal how many deaths were caused directly by Covid, and how many occurred as an indirect result of the pandemic."

The researchers predict that excess mortality linked to the pandemic will decline, thanks to vaccines and new treatments. But they warn that the pandemic is not yet over. And new, dangerous variants of the virus could emerge.

https://bit.ly/3qjGcLd

Immigration reform is key to keeping US economy competitive, says report

U.S. immigration system failing to provide the economy with enough high-skilled and productive workers to remain globally competitive

by Avery Ruxer Franklin, Rice University

The United States' immigration system is failing to provide the nation's economy with enough high-skilled and productive workers to grow and remain competitive on a global scale, according to a new report from experts at Rice University's Baker Institute for Public Policy. "The American workforce will be under enormous stress as demographic changes impact the larger economy," write co-authors Tony Payan, director of the Baker Institute's Center for the United States and Mexico, and Pamela Lizette Cruz, research analyst at the center.

U.S. population growth has been slowing for years, and in 2021, the population grew by the lowest rate since the nation's founding—just 0.1%. The population is also aging; the Census Bureau projects that by 2034, Americans 65 and older will outnumber those under 18 for the first time in the nation's history.

Immigration reform could relieve the stress caused by these demographic trends and ensure America's stability and competitiveness in the global economy, the authors argue.

"There is an urgent need for Congress to act, especially after the COVID-19 pandemic highlighted the many barriers, challenges, vulnerabilities and inequities facing vulnerable populations such as the elderly and immigrants, and exposed key weaknesses in the U.S. labor market," they write. "It is also paramount for the United States to invest in its essential workforce now and for the future."

The next decade will see net international migration to the U.S. overtake native births as the largest driver of population growth,

according to the report. American fertility rates fell by 4% in 2020, a record low for the country.

"And because, increasingly, migrants from Latin America and Asia are younger and their fertility rates higher than in previous years, the U.S. will become more ethnically diverse," the authors write.

Currently, people of color make up 23% of the 65-and-older population in the U.S. That number is projected to increase to 45% by 2060. "This will have serious implications for the development of a workforce with linguistic and cultural skills that fit the needs of a growing, diverse population," they write.

Payan and Cruz argue that the U.S. should establish new legal immigration avenues and broaden existing ones to address the future needs of the economy.

"Determining the ideal level of immigrant inflows is challenging and often politicized and polarizing, but the United States must modernize an outdated immigration system that is incapable of adapting to the long-term problems ahead," they write. "Preparing for the coming changes goes beyond studying demographic trends; it requires innovative strategies and solid policy responses."

Payan and Cruz write that immigration "should be viewed as the greatest opportunity to bolster overall growth and build a stronger, legal workforce, and keep America thriving in an increasingly competitive world economy."

https://bit.ly/3I78mPs

Thick, black 'hairs' coated a man's tongue. Here's why.

"Black hairy tongue" is a fairly common condition.

By Nicoletta Lanese

A man went to a dermatology clinic after the top of his tongue became coated in a dense carpet of hairlike fibers. His doctors quickly diagnosed him with a surprisingly common medical condition: "black hairy tongue," known medically as lingua villosa nigra.

Three months prior to his examination, the man, who is in his 50s, had a stroke that caused paralysis on the left side of his body, and his left side still remained weak at the time of his dermatology appointment, according to a new report of the case, published Wednesday (March 9) in the journal JAMA Dermatology.

After the stroke, the man was put on a diet of pureed food and liquids, and about two and a half months later, his caretakers noticed "black pigmentation" covering the surface of his tongue.

The left image shows the bottom half of a man's face as he sticks out his tongue, which is covered in a thick black coating; the right image shows a close-up of the tongue. **(Image credit: Image courtesy of JAMA Network ® / © 2022 American Medical Association)**

The thick, black coating was tinged with "yellowish" streaks near the midline and back of the tongue, according to the case report. (The outer edges, tip and dead center of the tongue were free of the gunk, the authors noted.) A closer examination revealed that the black coating was made up of long, thin fibers, with bright, yellow deposits — likely trapped food particles — scattered throughout. The man's doctors also scraped mucus samples from his tongue to check for abnormal bacterial or fungal growth, but they found no such growth when they cultured the scrapings in lab dishes.

"With these findings, a diagnosis of black hairy tongue (BHT) was made," they wrote.

Black hairy tongue occurs when tiny, cone-shaped bumps on the surface of the tongue, called filiform papillae, don't shed as they normally do, according to the Cleveland Clinic. These papillae typically grow about 0.04 inch (1 millimeter) long before detaching

from the tongue in a process called desquamation. But if the top of the tongue does not undergo regular abrasion — for instance, from a toothbrush, tongue scraper, or solid, textured foods — these papillae can grow to be unusually long — up to about 0.7 inch (18 mm) in length.

For these reasons, poor oral hygiene and a diet of soft foods can raise the risk of developing black hairy tongue. Excessive consumption of coffee, tea, alcohol or tobacco products; certain medications, like antibiotics; radiation treatment of the head and neck; and certain mouthwashes can also disrupt the process of desquamation and drive the condition's onset, according to the Cleveland Clinic. Dry mouth is another risk factor, according to the case report.

It's thought that the overlong papillae produce keratins, the same proteins found in hair, which contribute to their odd, hairlike appearance, the authors noted. Bacteria, fungi and food particles trapped in the "hairs" also contribute to their color.

"Hairy tongue may appear brown, white, green or pink, depending upon the specific cause and other factors, such as mouthwashes or even candy," the American Academy of Oral Medicine states.

An estimated 13% of people develop black hairy tongue at some point in their lives, although the condition is most common in eldery people, according to the American Academy of Oral Medicine. Thankfully, the condition is usually harmless and short-lived. In the man's recent case, he experienced no pain as a result of the condition, and his black hairy tongue cleared up quickly with simple oral hygiene practices, his doctors noted in the case report.

"The patient and caregivers were given advice regarding proper cleansing measures, and the discoloration resolved after 20 days," the authors said. Generally speaking, "avoidance of predisposing factors and instituting regular cleansing and desquamation measures lead to complete clearance of lesions," they noted.

https://bit.ly/3w2iSoE

Traces of Life Discovered Deep in the Earth's Mantle

The rapid development of fauna 540 million years ago has permanently changed the Earth — deep into its lower mantle.

A team led by ETH researcher Andrea Giuliani found traces of this development in rocks from this zone.

It is easy to see that the processes in the Earth's interior influence what happens on the surface. For example, volcanoes unearth magmatic rocks and emit gases into the atmosphere, and thus influence the biogeochemical cycles on our planet.

What is less obvious, however, is that the reverse is also true: what happens on the Earth's surface effect the Earth's interior — even down to great depths. This is the conclusion reached by an international group of researchers led by Andrea Giuliani, SNSF Ambizione Fellow in the Department of Earth Sciences at ETH Zurich, in a new study published in the journal *Science Advances*. According to this study, the development of life on our planet affects parts of Earth's lower mantle.

Carbon as a messenger

In their study, the researchers examined rare diamond-bearing volcanic rocks called kimberlites from different epochs of the Earth's history. These special rocks are messengers from the lowest regions of the Earth's mantle. Scientists measured the isotopic composition of carbon in about 150 samples of these special rocks. They found that the composition of younger kimberlites, which are less than 250 million years old, varies considerably from that of older rocks. In many of the younger samples, the composition of the carbon isotopes is outside the range that would be expected for rocks from the mantle.

The researchers see a decisive trigger for this change in composition of younger kimberlites in the Cambrian Explosion. This relatively short phase — geologically speaking — took place

over a period of few tens of million years at the beginning of the Cambrian Epoch, about 540 million years ago. During this drastic transition, almost all of today's existing animal tribes appeared on Earth for the first time. "The enormous increase in life forms in the oceans decisively changed what was happening on the Earth's surface," Giuliani explains. "And this in turn affected the composition of sediments at the bottom of the ocean."

From the oceans to the mantle and back

For the Earth's lower mantle, this changeover is relevant because some of the sediments on the seafloor, in which material from dead living creatures is deposited, enter the mantle through plate tectonics. Along the subduction zones, these sediments — along with the underlying oceanic crust — are transported to great depths. In this way, the carbon that was stored as organic material in the sediments also reaches the Earth's mantle. There the sediments mix with other rock material from the Earth's mantle and after a certain time, estimated to at least 200-300 million years, rise to the Earth's surface again in other places — for example in the form of kimberlite magmas.

It is remarkable that changes in marine sediments leave such profound traces, because overall, only small amounts of sediment are transported into the depths of the mantle along a subduction zone. "This confirms that the subducted rock material in the Earth's mantle is not distributed homogeneously, but moves along specific trajectories," Giuliani explains.

The Earth as a total system

In addition to carbon, the researchers also examined the isotopic composition of other chemical elements. For example, the two elements strontium and hafnium showed a similar pattern to carbon. "This means that the signature for carbon cannot be explained by other processes such as degassing, because otherwise the isotopes of strontium and hafnium would not be correlated with those of carbon," Giuliani notes.

The new findings open the door for further studies. For example, elements such as phosphorus or zinc, which were significantly affected by the emergence of life, could also provide clues as to how processes at the Earth's surface influence the Earth's interior. "The Earth is really a complex overall system," Giuliani says. "And we now want to understand this system in more detail."

Reference: "Perturbation of the deep-Earth carbon cycle in response to the Cambrian Explosion" by Andrea Giuliani, Russell N. Drysdale, Jon D. Woodhead, Noah J. Planavsky, David Phillips, Janet Hergt, William L. Griffin, Senan Oesch, Hayden Dalton and Gareth R. Davies, 4 March 2022, Science Advances.
DOI: 10.1126/sciadv.abj1325

https://bbc.in/3I1ofqA

Pancreatic cancer: Life-changing medication not given to 40%

Two-fifths of pancreatic cancer patients are not being prescribed medication recommended to improve their lives, a charity has warned.

By Dafydd Morgan BBC News

A lack of awareness of pancreatic enzyme replacement therapy (PERT) means they are not being offered it. Without it, eating can be painful, resulting in little appetite and weight loss.

The Welsh government said it expects PERT to be offered in line with professional guidance. According to Pancreatic Cancer UK, half of people with the disease die within three months of diagnosis. Just 5.7% of people diagnosed with pancreatic cancer in Wales survive five years.

Hannah Davies, of Knighton in Powys, lost her husband Mark to the disease in 2020. "Mark was a healthy 40-year-old man," the 38-year-old said. "He was a very, very hands on dad to our two boys, Freddie and Rupert. "He was a wonderful husband. Very lucky that we found each other in life."

In March 2020 Mark began suffering stomach pains, tiredness and

appetite loss. Between April and June he called a doctor 19 times about his symptoms. In July he went to hospital. A scan and biopsy confirmed he had pancreatic cancer.

"He did confirm that due to the size of the tumour that it was inoperable, and that it would be terminal as well," Ms Davies said.

Pancreatic cancer makes eating painful because enzymes made by the pancreas to help us digest food don't reach the bowel. PERT resolves this by replacing those missing enzymes.

The change when it was first given to Mark was "unbelievable". Ms Davies said: "I remember, he had cheese on toast, simple. "This was a real foodie, who really loved his food. But to see him sit there and have some cheese on toast and he was like, 'oh my God this is great, I'm able to eat this'. It gave us memories of being able to eat together as a family that we would never have had if he didn't have PERT medication."

Despite costing just £7 a day only 63% of pancreatic cancer patients in Wales are prescribed PERT, according to Pancreatic Cancer UK.

The charity's Anna Jewell said: "It really seems to be awareness of needing to get these tablets to people with pancreatic cancer and awareness and understanding of the fact that they will become very malnourished and not be able to tolerate treatment if they don't get access to these tablets."

Of those diagnosed with pancreatic cancer, 80% are at a stage when lifesaving treatment is not possible.

"But here we have something really simple," Ms Jewell said. "A simple tablet that is available, that isn't costly, that can really make a difference, and a significant difference, in people's quality of life when they've been diagnosed with pancreatic cancer. "So it's just so crucial that we get these tablets to people."

Royal College of Surgeons pancreatic cancer lead Keith Roberts published a study in 2018 comparing patients who had PERT with those who did not. "It didn't matter what the scenario was," he said. "If you looked at people having surgery, people having chemotherapy, people having no treatment at all, the survival was pretty much twice as long in the group that received PERT."

Without it patients faced losing muscle and wasting away.

"If you're not getting the goodness from your food how can you get through treatment and how can you fight this cancer?" said Mr Roberts.

The Welsh government said health boards and trusts should provide PERT in line with guidance from the National Institute for Health and Care Excellence (NICE) and as agreed by the NHS in Wales.

"The Wales Cancer Network has also raised awareness of the importance of PERT prescribing," a spokesman said.

https://bit.ly/3tUatBa

Strong scientific link between forests and human health

New report synthesizes a mounting body of evidence documenting how human health relies on forests

by Sarah Fogel, WWF

Marking two years since the current pandemic spread across the globe, World Wildlife Fund (WWF) today released The Vitality of Forests, a new report synthesizing a mounting body of evidence that documents how human health depends on forests. This is one of the first reports that details the escalating risks to human health associated with forest loss and degradation, including the emergence of zoonotic infectious diseases. The findings strongly argue that the conservation, protection and restoration of the world's forests are undeniably critical to safeguarding and promoting human health.

"Forests deliver critical benefits to people, nature and climate," said Kerry Cesareo, senior vice president for forests at WWF. "They are habitats for wildlife, capture and store carbon, and protect our water supply. This report now outlines another compelling reason to safeguard forests: They are indispensable to human health. We can

use these findings as a road map for collaboration across the health and environment sectors to help resolve public health issues ranging from emerging infectious diseases to mental well-being."

The report finds that forests play a vital role in supporting human health across several dimensions—infectious diseases; noncommunicable diseases like cancer, diabetes, and mental health issues; nutrition and food security; and physical hazards.

For example, the authors detail how deforestation drives the emergence and spread of zoonotic pathogens, infectious diseases that pass from animals to humans. These account for most of the recent epidemics, including COVID-19, the Zika virus, human immunodeficiency virus (HIV), sudden acute respiratory syndrome (SARS), the H1N1 flu, and the Ebola virus. By shrinking and fragmenting forests, the report says, deforestation can concentrate interactions between animals and the diseases they carry, resulting in more opportunities for disease transmission among animal species and people.

The report also emphasizes the active role forests play in safeguarding human health. Exposure to forests lowers cardiovascular disease risks and stress hormones. Forests are essential to both local and global food security; can help lessen the impacts of natural hazards, including heat waves, floods and landslides; and clean polluted air and water. Additionally, forests help mitigate climate change and its associated health effects.

"We found that public health and forests are entwined—at the local, regional and global level—and that across each of nature's contributions to human health, forest conservation, protection and management can improve our lives," said Craig Beatty, manager of forest strategy and research at WWF and one of the report's primary authors. "And when we consider the public health challenges we face in our communities, counties and countries, we should examine the very real health implications of how we're treating our forests—and how they're treating us."

With this in mind, the report presents a framework to understand the public health value of forests and outlines numerous actions to safeguard the vitality of forests and promote long-term human well-being. These include protecting forests and avoiding forest conversion; improving forest management on working lands; taking a diversified approach to forest restoration; creating urban forests; and fostering a learning exchange between the conservation and health fields.

More information: *The Vitality of Forests report can be found here: www.worldwildlife.org/publicat ... sts-and-human-health*

https://bit.ly/3CGNxcH

1st-of-its-kind heart transplant in infant could prevent organ rejection

The procedure may prevent the child's body from rejecting the organ without the need for lifelong drugs to suppress the immune system.

By Rachael Rettner

Easton Sinnamon is the first person to receive a heart transplant along with implantation of thymus tissue from the same donor. On the left, Easton after his heart transplant; on the right, Easton at home during his first week out of the hospital. (Image credit: Sinnamon family)

A baby in North Carolina has received a first-of-its-kind heart transplant that may prevent his body from rejecting the organ without the need for lifelong drugs to suppress the immune system.

The child, Easton Sinnamon, is the first person to receive a heart transplant along with implantation of thymus tissue from the same donor, according to a statement from Duke University, where the procedure was performed. Because the thymus plays an important role in immune system function — in particular, teaching the body to recognize its own cells and tissues versus foreign invaders — it's

possible that this combination transplant could allow the child's body to accept the new heart as part of itself instead of treating it as a foreign organ.

"We thought, if we did a thymus and heart transplant on Easton, there's a potential that taking that from the same donor will allow that transplanted heart to be recognized as self," Dr. Joseph Turek, Duke's chief of pediatric cardiac surgery, said in a media briefing on Monday (March 7).

Much more research is needed to see if this combination transplant allows Easton to live without immunosuppressive drugs — which are typically necessary in transplant patients to stop the body from rejecting the organ — as well as whether it could work for other transplant recipients.

If the approach proves successful, it could potentially "be applied to all solid organs down the road," Turek said.

Easton was born with a heart defect and underwent open heart surgery at just 5 days old, according to Duke University. But the surgery wasn't enough to fix the problem, and Easton's doctors determined he would need a heart transplant to survive.

Then, doctors discovered that Easton also had a thymus condition that meant he would need transplanted thymus tissue. Serendipitously, researchers at Duke had been studying this very combination — a heart and thymus transplant — in animal models.

With special approval from the Food and Drug Administration, Easton's doctors performed his heart transplant on Aug. 6, 2021, when he was 6 months old; and two weeks later, they implanted thymus tissue from the same donor that had been cultured in a laboratory.

Tests taken 172 days after the transplant show that the thymus tissue is working to produce immune cells known as T-cells in Easton's body, according to Duke University. Although Easton is currently taking immunosuppressive drugs to prevent organ rejection, his doctors will attempt to taper him off the drugs in the next few months to see if his body treats the new organ as "self."

Usually, transplant recipients must take immunosuppressive drugs their entire lives to prevent organ rejection. But long-term use of the drugs can be toxic, particularly to the kidneys, Turek said. And even with the drugs, the organs may eventually be rejected, with the typical donated heart lasting around 10 to 15 years, according to Duke University.

Easton's case "could truly change the way that transplants are done in the future," Turek said.

Still, even if the procedure works for Easton, there are additional challenges in applying the technique to people with a functioning thymus, NBC News reported. "The main issue is we have to try to figure out how to do this in a patient that has a very competent immune system, where you'll have a native thymus competing with the donor thymus tissue," Turek said, according to NBC News.

Easton continues to do well and recently turned 1 year old. "We not only were able to be given the gift to have our son back, but we were also able to give the gift of this possibility with the thymus, to help expand this for other children that are going through the same thing," Easton's mother, Kaitlyn Sinnamon, said in the briefing.

https://wb.md/3q442tY

Pharma Should Stop Doing Business in Russia, Says Ethicist

Should pharmaceutical companies continue to do business in Russia, running ongoing clinical trials, starting new ones, or continuing to sell their products there?

Arthur L. Caplan, PhD

Some argue that medicine and science must not get enmeshed in politics, staying above the fray to protect their independence and credibility. Other defenders of business-as-usual say the pharmaceutical industry deals in health and aids the vulnerable.

Humanitarianism requires continued interaction with Russia.

I think both arguments fail. Pharma should follow the lead of other Western companies and suspend their involvement with Putin's Russia.

We are fighting a war with Russia. It is a war of economic strangulation, social isolation, and pushing Russia as hard as we can to become a pariah state so that internal pressure on Putin will cause him to rethink his cruel, unjustified invasion or the Russian people to replace him. This pressure must be harsh and it must happen quickly. Why?

Having failed to rapidly defeat the Ukrainian army in the war's first weeks, Russian commanders are now resorting to the horrible barbarism they used in previous wars in Chechnya and Syria: flattening cities, attacking civilians, killing children with massive and indiscriminate firepower.

To mention one recent horror among many, Russian shelling destroyed a maternity hospital in Mariupol. Ukraine's president, Volodymyr Zelensky, in bemoaning the Russians for their continuing series of war crimes called on the world to act.

"Mariupol. Direct Strike of Russian troops at the maternity hospital," he wrote in a Twitter post. "People, children are under the wreckage. Atrocity! How much longer will the world be an accomplice ignoring terror?"

The Russian government's response: "It is not the first time we have seen pathetic outcries concerning the so-called atrocities," said Minister of Foreign Affairs Sergei Lavrov, claiming the hospital was being used as a base by an "ultra-radical" Ukrainian battalion.

Health and its preservation are key parts of the aim of medicine and science. There is no way that medicine and science can ignore what war does to health, what attacks on hospitals do to the sick and those who serve them there, the psychological toll that intentional terrorism takes on civilians and their defenders, and what the destruction of infrastructure means for the long-term well-being of Ukrainians.

There can be no collusion with war criminals. There can be no denial of the inextricable link between medicine, science, and politics. Medicine and science are controlled by political forces; their use for good or evil is driven by political considerations, and each doctor, scientist, and scientific society must take a stand when politics corrodes the underlying aims of research and healing.

How far does noncooperation with Russia go? Very, very far. All research, both ongoing and new, must cease immediately. Whatever can be done to minimize harm to existing subjects in a short period of time ought to be done, but that is it.

Similarly, no sale of medicines or therapies ought to be occurring, be they life-saving or consumer products. Putin will see to it that such shipments go to the military or are sold on the black market for revenue, and there is nothing pharma companies can do to stop that.

The Russian people need to be pinched not only by the loss of cheeseburgers and boutique coffee but by products they use to maintain their well-being. War is cruel that way, but if you tolerate a government that is bombing and shelling a peaceful neighbor to oblivion, then pharma must ensure that efforts to make Putin and his kleptocratic goons feel the wrath of their fellow citizens.

Given the realities of nuclear Armageddon, the civilized world must fight obvious barbarity as best it can with sanctions, financial assaults, property seizures, and forgoing commerce, including important raw materials and health products. War, even in a fiscal form, is not without terrible costs; but achieving a rapid, just resolution against tyranny permits no exceptions for pharma or any other business if it is a war that must be fought.

https://bit.ly/3i2GeT5

Blood Tests Show a 'Nordic Diet' Improves Key Health Markers – Even Without Weight Loss

The Nordic diet reduced blood sugar and cholesterol even when no weight was lost

Tessa Koumoundouros

A new study adds support to the idea that eating better foods is beneficial even without obtaining weight loss – with the Nordic diet reducing blood sugar and cholesterol even when no weight was lost.

"It's surprising because most people believe that positive effects on blood sugar and cholesterol are solely due to weight loss," University of Copenhagen nutritionist Lars Ove Dragsted said. "Here, we have found this not to be the case. Other mechanisms are also at play."

While the better-known and thoroughly studied Mediterranean diet is highly recommended for good health, it is not always practical for people in other regions of the world to consume, due to limitations of what grows locally or cultural challenges.

So the concept of healthy regional diets, like the Nordic diet, has been developed, using equivalent food items that are easily available locally and traditionally eaten in the region.

The Nordic diet has many similarities to the Mediterranean diet with an emphasis on plant-based foods, with moderate amounts of fish and eggs, and a small amount of dairy.

Both limit processed foods, sweets, and meats, but the Nordic diet favors canola oil over olive, which has some healthy omega-3 fatty acids similar to those found in fish.

It includes berries, cabbage, potatoes, carrots, and beans amongst other fruits and vegetables, whole-grain cereals like rye and barley, as well as fatty fish.

Like the Mediterranean diet, observational studies suggest following it lowers the risk of cardiovascular diseases, type 2 diabetes, and overall mortality.

In the new study, Dragsted and colleagues analyzed regular blood and urine samples from 200 overweight volunteers over the age of 50 from six centers across Sweden, Denmark, Iceland, and Finland during a four-week period where they ate their usual diet.

They sampled them again during another 19-24 weeks when half the participants followed the Nordic diet and the others followed a control diet. Both diets were calculated so that the volunteers maintained a stable weight.

"The group that had been on the Nordic diet for six months became significantly healthier," explained Dragsted, "with lower cholesterol levels, lower overall levels of both saturated and unsaturated fat in the blood, and better regulation of glucose, compared to the control group."

The team detected differences in fat-soluble substances in the patients who benefitted most from the diet change.

"The fat composition in the Nordic diet, which is higher in omega-3 and omega-6 unsaturated fats, is probably a considerable part of the explanation for the health effects we find from the Nordic diet, even when the weight of participants remains constant," explained Dragsted.

These fats come from fish, flaxseeds, sunflower, and canola oil, but how they influence both blood sugar and cholesterol levels is still to be investigated

"We can confirm that the absence of highly processed food and less saturated fats from animals have a very positive effect on us," Dragsted concluded.

With obesity levels rising around the world, contributing to cardiovascular diseases, diabetes, and other diseases, researchers stress that weight loss remains important, but that it's not the only factor contributing to the Nordic diet's benefits.

Similar results have also been found with the Mediterranean diet –

with a huge, long-term study of 79,000 people revealing those who mostly stuck to the diet had better mortality outcomes regardless of their weight.

A 2018 study also indicated focusing on types of foods rather than portions can be a more effective and more sustainable method for weight loss. But how effective any particular diet ends up being may also depend on the quality of foods you can afford.

So focusing on healthy food choices (to the best of our ability!) could prove more beneficial to those of us struggling with our weight than shaming ourselves – or each other – over how heavy we are.

This research was published in *Clinical Nutrition*.

The Touching Reason Prehistoric People May Have Collected And Reused Old Tools

Some stone tools appear to have two life cycles: used and discarded then picked up a second time and reused

David Nield

Prehistoric sites are full of stone tools that appear to have two life cycles: They've been crafted, used, and discarded before being picked up a second time and used again. A new study puts forward an interesting hypothesis as to why this is.

The research suggests that the recycling of these tools is about them being "memory objects" that represent a connection to the past and previous generations: something to remember places, events, and people.

Archaeologists looked at 49 flint tools dug up from the well-known Revadim site in the south of Israel's Coastal Plain. The examined tools were from a sediment layer dated to about 500,000 years ago.

Through a study of the patina of the objects – that's the chemical coating that settles on flint when it's exposed to the open air for a long period of time – the researchers determined the function of these objects across two different life cycles of use.

"Why did prehistoric humans collect and recycle actual tools originally produced, used, and discarded by their predecessors, many years earlier?" says archaeologist Bar Efrati from Tel Aviv University in Israel.

"Scarcity of raw materials was clearly not the reason at Revadim, where good-quality flint is easy to come by. Nor was the motivation merely functional, since the recycled tools were neither unusual in form nor uniquely suitable for any specific use."

Using microscopic analysis, the tools had two active edges, an old one and a new one. It seems that the second time these stone objects were used, it was for less demanding tasks – scraping soft materials like leather and animal flesh rather than cutting or chopping.

What's more, the reshaping that took place as these tools were picked up and used a second time looks to have been very minimal.

The scars from their first deployment were largely retained, suggesting that it was important to preserve their appearance.

Based on these clues, researchers think the tools held sentimental value and were collected because of memories they evoked or their specific connections to the past.

It's difficult to know for sure, but it's an interesting idea with some evidence to back it up.

"Imagine a prehistoric human walking through the landscape 500,000 years ago, when an old stone tool catches his eye," says archaeologist Ran Barkai from Tel Aviv University. "The tool means something to him – it carries the memory of his ancestors or evokes a connection to a certain place."

"He picks it up and weighs it in his hands. The artifact pleases him, so he decides to take it home. Understanding that daily use can preserve and even enhance the memory, he retouches the edge for his own use, but takes care not to alter the overall shape – in honor of the first manufacturer."

It is possible these tools were reused because it was less effort than

creating new tools from scratch, but alongside the 49 reused objects analyzed here, there were also plenty of newly created tools – so that strategy was extensively used as well. And adapting an old tool is not necessarily easier than creating a new one from scratch.

In other words, these early humans living some 500,000 years ago weren't all that different from us in how they collected keepsakes – functional keepsakes that did a job, but nevertheless reminders of something that had happened in the past.

"In a modern analogy, the prehistoric human may be likened to a young farmer still plowing his fields with his great-grandfather's rusty old tractor, replacing parts now and then, but preserving the good old machine as is, because it symbolizes his family's bond with the land," says Barkai.

The research has been published in *Scientific Reports*.

https://bit.ly/3w2FkOw

A Strain of Tuberculosis Traveled Across The Pacific Thousands of Years Pre-Contact

Centuries before first contact with Europeans, new research suggests a strain of tuberculosis was already circulating from the South American coasts to the mountains.

Carly Cassella

Deadly European diseases, like tuberculosis (TB), whooping cough, and smallpox, were spread around the world with colonization, but recent evidence indicates this wasn't the first time TB arrived in South America.

In 2014, researchers found the DNA of a bacterium related to *Mycobacterium tuberculosis* – the strain that causes tuberculosis in humans – in South American skeletons from about a thousand years ago, which is well before the arrival of Spanish, French and Portuguese colonizers.

Scientists have known for a while that TB can easily jump from one species of mammal to another; it's happened tens of thousands of times around the world. But the discovery of several ancient strains in South America suggests our history books might be slightly incorrect about the original spread of these bacteria.

The pre-contact bacterial strains found in 2014 carried the closest resemblance to *M. pinnipedii*, a strain found in marine mammals with flippers (pinnipeds), like seals and sea lions.

A genetic analysis then indicated that the most recent common ancestor for all genetically related *Mycobacterium* strains (known as the *M. tuberculosis* complex, or MTBC) emerged less than 6,000 years ago, pointing the finger at sea mammals as the potential first voyagers who carried TB across the ocean.

A new study has now found three more ancient strains of TB in the skeletons of people who lived in what is now inland Peru and Columbia. The skeletons were discovered far from the coastlines, and yet even here, over wide mountain ranges, TB appears to have been common, chronic and likely endemic in the local human population.

"These three new cases of pre-contact-era South American TB are from human remains that come from inland archaeological sites, two of which are situated in the highlands of the Colombian Andes," says anthropologist Tanvi Honap from the University of Oklahoma.

"All of these new three ancient TB genomes resemble *M. pinnipedii* – the same TB variant found in the ancient coastal Peruvian individuals and in modern-day seals and sea lions."

Archaeological evidence from inland Peru and Columbia suggests that local people here did not usually eat seal or sea lion meat traded from the coast. That means the pinniped-derived disease probably got this far inland via another host.

Instead of jumping directly from pinniped to these inland individuals, these bacterial strains would have likely crept inland over time, bouncing from human to human or spreading among

other land mammals. In New Zealand today, for instance, there are reports of TB jumping from seals over to grazing cattle, providing a bridge from sea creatures to land creatures.

"Colombia has a wide variety of terrestrial mammals, so *M. pinnipedii* could have been brought inland via the animal life," explains Honap. "Or in a more likely scenario, it could have been brought inland via human-to-human transmission facilitated by trade routes, or a combination of both!" Ultimately, European strains of TB replaced the original South American strains, disguising the deeper ecology of this bacterial infection.

Researchers are now teasing apart the complex history of this disease in precolonial times. Using genomic research, they hope to identify new strains of ancient TB to figure out how the illness became endemic in different locations at different times.

"[W]e believe that one or multiple separate introductions of *M. pinnipedii* from pinniped populations to human and/or terrestrial animal populations is currently the most parsimonious explanation for their spread to these inland locations," the authors conclude.

"Additional genomic data… from the pre-contact Americas will help develop these hypotheses further."

The study was published in *Nature Communications*.