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4,000-Year-Old Game Board Carved into the Earth Shows How Nomads Had Fun

Pattern of holes cut into the floor of an ancient rock shelter shows that one of the world's most [ancient board games](#) was played there around 4,000 years ago

By [Tom Metcalfe, Live Science Contributor](#)

A pattern of small holes cut into the floor of an ancient rock shelter in Azerbaijan shows that one of the world's most [ancient board games](#) was played there by nomadic herders around 4,000 years ago, according to an archaeologist who has investigated the find.

Walter Crist, a research associate with the American Museum of Natural History in New York, visited the rock shelter in a national park in Azerbaijan last year, searching for traces of the ancient game now known as "58 Holes."



A distinctive pattern of holes scored into the rock of an ancient shelter in Azerbaijan are the remains of a board for one of the world's oldest games.

Walter Crist/Gobustan National Park

The game is also sometimes called "Hounds and Jackals." British archaeologist Howard Carter found a game set with playing pieces fashioned like those animals in the tomb of the ancient Egyptian Pharaoh Amenemhat IV, who lived in the 18th century B.C.

The distinctive pattern of round pits scored in the rock of the shelter in Azerbaijan came from that same game, Crist told Live Science. But the Azerbaijan version may be even older than the game set found in the [pharaoh's tomb](#).

Evidence from rock drawings near this shelter suggested that it dated to the second millennium B.C., or about 4,000 years ago, when that part of Azerbaijan was populated by nomadic cattle herders, he said. At that time, the game was widespread across the ancient Middle East, including [Egypt](#), [Mesopotamia](#) and Anatolia, he said.

"It suddenly appears everywhere at the same time," Crist said. "Right now, the oldest one is from Egypt, but it's not by very much. So, it could just be because we haven't found it from somewhere else older. So, it seems to [have] spread really quickly." Azerbaijan journey Crist was looking for the remains of another copy of 58 Holes or Hounds and Jackals that he had seen in a photograph in a magazine from Azerbaijan.

But after arranging to fly there, he learned a new housing development had buried the archaeological site near the country's capital, Baku.

So, Crist investigated other archaeological sites in Azerbaijan, which led him to the [Gobustan National Park](#), a UNESCO World Heritage site in the southwest of the country, which is famed for its ancient rock carvings and drawings.

Archaeologists at the park knew about the holes in the rock shelter, but not that they had been used as a board game. The holes are cut into the rock of the shelter in a distinctive pattern that shows how they were used, Crist said. "There is no doubt in my mind — the games played for about 1,500 years, and very regular in the way that it's laid out," Crist said.

Though the rules of 58 Holes are unknown, many think it was played a bit like modern backgammon, with counters, such as seeds or stones, moved around the board until they reached a goal.

"It is two rows in the middle and holes that arch around outside, and it's always the fifth, 10th, 15th and 20th holes that are marked in some way," Crist said of the pattern cut into the rock shelter. "And the hole

on the top is a little bit larger than the other ones, and that's usually what people think of as the goal or the endpoint of the game."

Players may have used dice or casting sticks to regulate the movement of counters on the board, but so far, no dice have been found with any ancient game set of 58 Holes or Hounds and Jackals, he said.

While it has been reported that the game is an ancient ancestor of modern backgammon, Crist rejects that idea — they have some similarities, but backgammon was derived from the much later Roman game [Tabula](#), he said.

The game of 58 Holes is old, but it's not the oldest yet found; the Royal Game of Ur, dating from the third millennium B.C., is older, for example. Crist has also studied the ancient Egyptian board games of Senet and Mehen, which appeared starting around 3000 B.C.

Ancient players

Crist said the use of such ancient games throughout a wide area showed that they were able to cross cultural boundaries.

"People are using the games to interact with one another," he said.

Games were "kind of a uniquely human thing, kind of an abstraction — moving stones in blank spaces on the ground has no real effect on your daily life, except for the fact that it helps you interact with another person.

"So, a game is a tool for interaction, kind of like language — a shared way of being able to interact with people," Crist said.

He [presented his findings](#) at the American Schools of Oriental Research annual meeting in Denver in November.

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Skin creams can lead to fire deaths

People who use emollient creams to treat dry and itchy skin conditions are being warned they can build up in fabrics and cause them to catch fire more easily.

The medicines regulator says clear warnings on product packaging is needed to alert consumers. The MHRA says it has heard of more than 50 such deaths reported by UK fire and rescue services.

People should not stop using the creams but be aware of the risk.

Washing clothing and bedding can reduce product build-up but not totally remove it.

It was previously thought the risk occurred with emollients that contained more than 50% paraffins. But evidence now points to a risk with all emollients, including paraffin-free ones.

Fabric that has been in repeated contact with these products burns more easily, meaning users should not smoke or go near naked flames.

[Philip Hoe](#) died after accidentally setting himself on fire at Doncaster Royal Infirmary in 2006, when sparks from a cigarette reacted with the emollient cream he was covered in.

Within seconds, Mr Hoe, who was receiving treatment for psoriasis, was engulfed in flames and he died shortly after being transferred to another hospital, in Sheffield.

June Raine, from the MHRA, said: "We don't want to unduly worry people into not using these products, which offer relief for what can be chronic skin conditions, but it is equally important people are aware of the risks and take steps to mitigate them.

"If you use emollients and have any questions or concerns, we'd recommend speaking to a healthcare professional, such as your pharmacist or GP."

The MHRA has been working with the Commission on Human Medicines, which has come up with recommendations for manufacturers:

- *outer packaging and product containers should include a warning about the fire hazard and advice not to smoke, accompanied by short explanatory text and a picture warning in the most prominent field of view*

• *where available, the patient information leaflet or instructions for use and the summary of product characteristics should be updated to include warnings about the risk and how best to minimise it*

John Smith, from the Proprietary Association of Great Britain, said: "Emollient products are an important and effective treatment for chronic and often severe dry skin conditions, such as eczema and psoriasis.

"People should continue to use these products but it is vital they understand the fire risk associated with a build-up of residue on fabric and take steps to mitigate that risk.

"We have been working with MHRA during its review of the evidence to ensure the warning is implemented consistently across industry and to support efforts to raise awareness of this issue."

<http://bit.ly/2GQLFEW>

Long-Hidden "Pyramid" Found in Indonesia Was Likely an Ancient Temple

The structure has potentially been used as a place of worship for thousands of years

By [Mindy Weisberger](#), [LiveScience](#)

An enormous pyramid-like structure in Indonesia that may represent the remains of an [ancient temple](#) hid underground for thousands of years.

Scientists presented evidence of the remarkable construction Dec. 12 here at the annual meeting of the American Geophysical Union (AGU).



[Getty Images](#)

Located atop Mount Padang in West Java, the structure is topped by an archaeological site that was discovered in the early 19th century and holds rows of ancient stone pillars. But the sloping "hill"

underneath isn't part of the natural, rocky landscape; it was crafted by human hands, scientists discovered.

"What is previously seen as just surface building, it's going down—and it's a huge structure," said Andang Bachtiar, an independent geologist from Indonesia who supervised core drilling and soil analysis for the project.

Though the buried structure may superficially resemble a pyramid, it differs from similar pyramids built by [the Mayans](#), Danny Hilman Natawidjaja, lead project researcher and a senior scientist with the Indonesian Institute of Sciences, told Live Science. While [Mayan pyramids](#) tend to be symmetrical, this structure is elongated, with what appears to be a half-circle in the front.

"It's a unique temple," Natawidjaja said.

He and his colleagues suspected that the exposed megalith might be more than it appeared, because some partly exposed features in the existing archaeological site didn't quite match the standing stones. The "peculiar" shape of the hill also stood out from the landscape, he said. "It's not like the surrounding topography, which is very much eroded. This looks very young. It looked artificial to us," Natawidjaja explained.

Using an array of techniques to peer underground—including [ground-penetrating radar surveys](#), X-ray tomography, 2D and 3D imaging, core drilling, and excavations—the researchers gradually uncovered several layers of a sizable structure. It spread over an area of around 15 hectares (150,000 square meters) and had been built up over millennia, with layers representing different periods.

At the very top were pillars of basalt rocks framing step terraces, with other arrangements of rock columns "forming walls, paths and spaces," the scientists reported at AGU. They estimated this layer to be about 3,000 to 3,500 years old.

Underneath the surface, to a depth of about 10 feet (3 m), was a second layer of similar rock columns, thought to be 7,500 to 8,300 years old. And a third layer, extending 49 feet (15 m) below the surface, is more than 9,000 years old; it could even date to 28,000 years ago, according to the researchers. Their surveys also detected multiple chambers underground, Natawidjaja added.

Today, local people still use the exposed site at the top of the structure as a sacred destination for prayer and meditation, and this could also be how it was used thousands of years ago, Natawidjaja said.

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Woman Develops Donor's Peanut Allergy After Lung Transplant

Sometimes, you just really want a [peanut butter](#) and jelly sandwich. And, as long as you're not allergic to the ingredients, that's totally fine. At least, that's what one woman thought.

By [Cari Nierenberg, Live Science Contributor](#)

The 68-year-old woman, who had never had a peanut allergy, had a severe allergic reaction to the sandwich, according to a recent report of her case, which was published in August in the journal [Transplantation Proceedings](#). But someone else *did* have a peanut allergy, it turned out: the donor who supplied the woman with a transplant lung.

It's a very rare occurrence for lung transplant recipients to acquire a food allergy from a donor organ, said lead case report author Dr. Mazen Odish, a fellow in pulmonary and critical care medicine at the University of California - San Diego Medical Center, who treated the woman.

There have only been about four or five case reports in which organ recipients have acquired peanut allergies with anaphylaxis following a [lung transplant](#), Odish told Live Science.

Identifying the culprit

The woman in the case had needed a single-lung transplant to treat her [emphysema](#), a condition in which the air sacs in the lungs become damaged, making it difficult to breathe. She received a new left lung from a 22-year-old male donor, Odish said.

The woman's recovery was going well after the transplant, but the day before she was scheduled to go home from the hospital, she felt tightness in her chest and found it very difficult to breathe, according to the report. Initially, her doctors weren't sure why she was experiencing these symptoms of respiratory failure, and tests done at the time didn't turn up any clear explanation for it.

It wasn't until the woman mentioned that her symptoms started immediately after she had eaten a PB & J sandwich that doctors began to suspect a food allergy, even though the woman lacked [other common allergy symptoms](#), such as a rash or stomachache.

Because the woman had never had problems eating peanuts before, doctors contacted the transplant agency, who confirmed that the male donor had a known peanut allergy, according to the case report.

So, along with the lung, the woman also appears to have received a peanut allergy from the donor, Odish told Live Science.

Although it's rare for food allergies to be transferred from organ donors to transplant recipients, it does occur: cases of [food allergies](#) being acquired from organ donors have been reported after liver, kidney, lung, bone marrow, heart and kidney transplants, the authors wrote.

But not every transplant recipient who obtains an organ from a donor with food allergies picks up the sensitivity, which may turn up anywhere from days to months after the transplant. Studies have suggested, for example, that children and people who receive liver transplants may be more likely to develop food allergies from organ donors who have them.

Other research has shown that transplant-acquired food allergies occur more frequently when organ recipients are prescribed

tacrolimus, an immunosuppressive drug used to reduce the risk of [organ rejection](#) following a transplant. The woman in this case had been on tacrolimus.

Skin tests later confirmed that the woman was allergic to peanuts, and she also tested positive for almonds, cashews, coconuts and hazelnuts. Doctors advised her to avoid peanuts and tree nuts, and she was given an [EpiPen](#) in case of another severe allergic reaction to these foods.

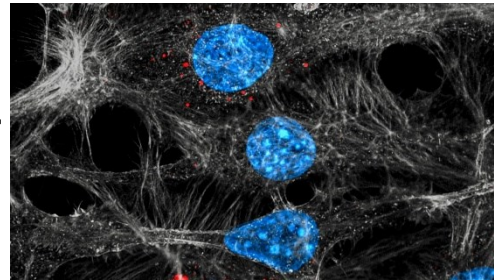
It's unclear if transplant-acquired food allergies remain a lifelong concern for patients, Odish said, because it's possible that the allergy may wane in some individuals. Allergy doctors will likely continue to test the woman for peanut and tree nut allergies to see if her tolerance to these foods change over time, he noted.

<http://bit.ly/2LKB9hd>

Tumors backfire on chemotherapy

If a tumor resists neoadjuvant therapy, there can be a higher risk of developing metastatic disease

Some patients with breast cancer receive chemotherapy before the tumor is removed with surgery. This approach, called 'neoadjuvant' therapy, helps to reduce the size of the tumor to facilitate breast-conserving surgery, and can even eradicate the tumor, leaving few or no cancerous cells for the surgeon to remove. In those cases, the patients are very likely to remain cancer-free for life after surgery.



Endothelial cells (blue/grey) internalizing exosomes (red) released from chemotherapy-treated tumors. C. Cianciaruso/I. Keklikoglou/EPFL

But not all tumors shrink under chemotherapy. If the tumor resists neoadjuvant therapy, there can be a higher risk of developing metastatic disease, meaning that the tumor will recur in other

organs, such as bones or lungs. This could be due to cancerous cells that resist chemotherapy and spread to other organs while the primary tumor is being treated.

Now, an international team of scientists led by Michele De Palma at EPFL has shed new light into this process.

Working with experimental tumor models, the researchers found that two chemotherapy drugs frequently used for patients, paclitaxel and doxorubicin, induce mammary tumors to release small vesicles called exosomes. Under chemotherapy, the exosomes contain the protein annexin-A6, which is not present in the exosomes released from untreated tumors. "It seems that loading of annexin-A6 into exosomes is significantly enhanced in response to chemotherapy," explains Ioanna Keklikoglou, first author of the study.

After being released from a chemotherapy-treated tumor, the exosomes circulate in the blood. Upon reaching the lung, the exosomes release their content, including annexin-A6. This stimulates the lung cells to release another protein, CCL2, which attracts immune cells called monocytes.

This immune reaction can be dangerous, as previous studies have shown that monocytes can facilitate the survival and growth of cancerous cells in the lung, which is one of the initial steps in metastasis. "In short, our study has identified a new link between chemotherapy and breast cancer metastasis," says De Palma.

Corroborating their laboratory data, the researchers found increased levels of annexin-A6 also in the exosomes of breast cancer patients undergoing neoadjuvant chemotherapy. However, De Palma cautions against jumping to conclusions: "While this observation supports the significance of our findings, at the moment we don't know if annexin-A6 has any pro-metastatic activity in human breast cancer".

Importantly, the researchers found that neutralizing annexin-A6 or blocking monocytes during chemotherapy prevents the experimental

mammary tumors from metastasizing to the lung. These results may help to improve the efficacy and safety of neoadjuvant chemotherapy. "Various monocyte inhibitors have been developed for clinical use, so they may be tested in combination with neoadjuvant chemotherapy to potentially limit unwanted side effects mediated by exosomes," says De Palma.

"Our findings must not discourage patients from receiving neoadjuvant chemotherapy when it's indicated," adds the study's clinical team. "It remains an essential and potentially curative treatment for many invasive breast cancers, as shown by multiple clinical trials."

Professor De Palma's lab is part of the Swiss Institute for Experimental Cancer Research (ISREC) within the School of Life Sciences at EPFL. ISREC is deeply involved in the Swiss Cancer Center Léman (SCCL), a cancer research consortium that includes the University hospital of Lausanne (CHUV), the Geneva University Hospitals (HUG), the universities of Lausanne (UNIL) and Geneva (UNIGE), and EPFL.

Other contributors

- The University of Edinburgh (MRC Centre for Reproductive Health)
- Harvard Medical School (Massachusetts General Hospital Cancer Center and Department of Radiation Oncology)
- University of Sheffield (Medical School)
- Oregon Health & Science University (Department of Cell, Developmental and Cancer Biology and Knight Cancer Institute)
- University of Los Angeles (Jonsson Comprehensive Cancer Center)
- Albert Einstein College of Medicine (Department of Developmental and Molecular Biology)

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Ioanna Keklikoglou, Chiara Cianciaruso, Esra Gu?ç, Mario Leonardo Squadrito, Laura M. Spring, Simon Tazzyman, Lore Lambein, Amanda Poissonnier, Gino B. Ferraro, Caroline Baer, Antonino Cassarà, Alan Guichard, M. Luisa Iruela-Arispe, Claire E. Lewis, Lisa M. Coussens, Aditya Bardia, Rakesh K. Jain, Jeffrey W. Pollard, Michele De Palma. [Chemotherapy elicits pro-metastatic extracellular vesicles in breast cancer models](#). Nature Cell Biology, 31 December 2018. DOI: 10.1038/s41556-018-0256-3

<https://wb.md/2SCR0kJ>

Doctors' Kids Absorb a Lot

"Children are very intuitive and perceptive and are always picking up on the things we say and do in our everyday lives,"

Nick Mulcahy

Heather Thompson Boom, MD, an internist at the University of Minnesota in Minneapolis, was diagnosed with [breast cancer](#) in 2016 after finding a lump while doing a self-exam in the shower.

She immediately faced a dilemma — what and how to tell her two young children, Sam, 11, and Lydia, 8.

Uncertain, Boom sought help from colleagues, who, among other things, advised: "Tell them just enough information, and not too much; let them ask the questions, I'm sure they will surprise you."

Indeed, what follows for Boom are plenty of surprises, including the revelation that her kids have been paying a lot of attention to their mom's work life.

On a school night, she delivers the news: "I am afraid that your mom has something to tell you...I found a lump in my breast; my doctors did a biopsy and discovered it is cancer."

It's a "very treatable disease," she tells a quiet Sam, and a crying Lydia.

"But is it curable?" asks Sam, a fifth-grader.

Yes, Boom tells him, it is potentially curable.

"But could it come back?" he counters.

"Yes, but the medicine helps prevent that," she answers.

Sam's responses "truly stopped me in my tracks," Boom told *Medscape Medical News* in an email.

Second-grader Lydia then takes a turn shocking her mom, weeks after her surgery.

"As I tuck Lydia in for the night," writes Boom in an essay [published online](#) in the *Journal of Clinical Oncology*, "sitting on the edge of her bed between a menagerie of stuffed animals and a pile of books,

suddenly she asks, 'What if I get breast cancer? And what if it's not stage 1 but stage 4?' After I swallow hard and take a deep breath, I think, wow, children overhear more conversations around this house than I think they do. My 8-year-old is asking about cancer staging, for God's sake."

Buum calms her daughter by saying that, when she grows up, she will have x-rays to look for any problem.

"You mean an MRI? I don't want to have an MRI!" Lydia says.

Buum is taken aback at how closely Lydia has been listening. "Whoa. Again, those big ears overheard me describe how loud and confining the machine felt," she writes.

My 8-year-old is asking about cancer staging, for God's sake. Dr Heather Thompson Buum

Despite her children's precociousness, the Minnesota internist suspects that her kids actually hear and absorb less than kids who have *two* physician parents.

"I'm a doc but my husband is an architect; therefore, I think I tend to 'talk shop' quite a bit less around the house than I would if we were both physicians," said Buum.

"It would be interesting to know if there were any differences in two-physician families vs one," she added.

Buum aspires to limit the shared details of her work to commonplace descriptions of patients' occupations or good qualities. But sometimes, her home is a place to release tension. "Over 16 years in practice I have shared a couple of stressful, negative outcomes when I just needed to vent about it," she acknowledged.

After a patient with a mass on a CT scan was lost to follow-up, Buum was deeply upset and she spoke to her children about it. "That stuck with me for months, and I had to talk about it at home because they could see I was obviously affected by it."

Cancer-versary

Buum's colleagues who predicted her kids would surprise her were prescient, as the two grammar schoolers continue to pay fresh and inspiring attention to their mom.

As Buum approaches her 12-month follow-up appointment and 1 year of being cancer free, Lydia coins a term for it: "cancer-versary." And Sam lets Buum read a year-old journal entry he wrote after her surgery. "4/26/16. (Log). Tuesday. Today I practiced my play instead of having English class. And...my Mom is cured of cancer! Today was good."

Her diagnosis and treatment have been transformed into a cause for celebration instead of one of "fear or dread," says Buum.

"Bad news" is something all doctors have to deliver, she points out.

Her cancer experience has instilled her belief in the importance of involving family, even young children, in medical matters.

"It also reminded me about how intuitive and resilient children can be. Out of the mouths of babes...you have ordained strength (Psalms 8:2)," writes Buum.

In the end, Buum sees her children's knowledge about her work — difficult as it can be at times — to be a good thing.

"Children are very intuitive and perceptive and are always picking up on the things we say and do in our everyday lives," she said. "I hope on some level that would help them process an illness that occurs, either in them, or in another family member, such as when my grandpa recently fell, broke his hip, then came down with a severe pneumonia and passed away in a matter of days."

Buum's new essay serves as a preview of her forthcoming book, "Mirth is God's Medicine: Coping with a Cancer Diagnosis, As a Physician" (Joshua Tree Publishing, Chicago). The book will be available online at Barnes & Noble and Amazon, and at the Coffman Memorial Union bookstore at the University of Minnesota.

J Clin Oncol. Published online November 15, 2018. [Full text](#)

<http://bit.ly/2F2xOsn>

What could have wiped 3km of rock off the entire Earth?

Some evidence for the cause of geology's Great Unconformity.

[Scott K. Johnson](#) - 1/2/2019, 12:00 AM

Believe it or not, the geology at the bottom of the Grand Canyon is extraordinarily common. There, layers of sedimentary rock lie flat atop angled layers of significantly more ancient metamorphic rock. The gap there is enormous—if Earth's rocks constitute a book of the planet's history, there are about a billion pages missing. The story only picks up again around 540 million years ago in the Cambrian period, with an evolutionary explosion of complex life just as remarkable as the sudden change in the rock.

This gap can be found all around the world, and has picked up the name the Great Unconformity. Cambrian sedimentary rocks rarely rest on anything other than much older metamorphic or igneous rock, implying that whatever rock formed in the intervening time was scrubbed away by something. This erasure of a chunk of geologic history has long been an enticing mystery for geologists.

Have you seen this rock?

A period of intensive global erosion doesn't seem sufficient to fully explain the pattern of change in the rock. An alternative, that the formation of new rock suddenly accelerated beginning in the Cambrian, doesn't quite fit the evidence, either. So what gives?

To dig into this, a team led by the University of California, Berkeley's [C. Brenhin Keller](#) turned to a database of almost 30,000 zircon crystals. Zircons are most commonly found in the igneous rocks of volcanic arcs along tectonic plate subduction zones, where one plate is sent diving beneath the other (think of the Pacific Ring of Fire). If a huge amount of continental rock was eroded away, it would have ended up in the ocean, where it could hitch a ride into

the tectonic recycler at these subduction zones—possibly leaving a chemical mark in the magma fueling volcanoes.

To look for that chemical mark, the researchers analyzed an isotope of the element hafnium. This isotope is produced by the (*very slow*) radioactive decay of element-you-also-forgot-existed lutetium, meaning it is slowly accumulating in the Earth's mantle. But this is *not* happening in the Earth's crust, which means crustal rocks are a little light in the hafnium isotope department.

So what can hafnium tell us? Imagine you're cooking down a stew, aiming for a slightly thicker and saltier broth. At some point, you worry you've gone too far, so you add a little water back in. If you took out a spoonful every few minutes and set them aside in a sort of stew timeline, you could figure out just by taste where in that sequence you added the water.

The idea here is similar. If a lot of continental sediment—containing less of that interesting hafnium isotope—was being eroded and recycled back into the zone where mantle rock is melted, you ought to see a sudden drop in the hafnium numbers in zircons produced by the volcanoes above.

Snowball-driven dump

And that's exactly what the researchers found. The zircons in the database span nearly the entire history of the Earth, and by far the most noticeable wiggle lines up neatly with the Great Unconformity. When they ran the numbers to see how much erosion would be required to explain a wiggle of that size, they found that it would be something in the neighborhood of *3 kilometers* (or 2 miles) of rock shaved off all the world's continents and dumped on the ocean floor. Erosion alone can't explain all the details of this episode, *and* you need something that affects the entire globe. Is there anything else that can wipe a few kilometers of rock off the Earth's face? The authors propose that three periods of epic cold snaps in the 180

million years leading up to the start of the Cambrian—sometimes referred to as “Snowball Earth” periods—could be the key.

The first two of these episodes, in particular, are thought to have seen huge ice sheets draped over *every* continent for millions of years. There are still big questions about how these events played out, but glaciers are often pretty potent agents of erosion. If temperatures drop low enough, glaciers will freeze to the ground like the tongue of an unfortunate child stuck on a flag pole. But it doesn't take much for normal geothermal warmth to keep that base thawed, and sliding ice will grind up a lot of bedrock.

On top of that, the growth of ice sheets on land comes with a lowering of global sea level, exposing vast areas of former seafloor to erosion. That also lowers the base level that glaciers and streams flow to, giving them a little more downhill energy.

Modeling erasure

The researchers played with a simple numerical model to see how this might work. Using reasonable estimates of glacial erosion rates from modern times, the model has no problem eroding the right amount of rock. And with sea level lower, all that eroded material would get deposited on the deep seafloor—ready to ride the tectonic plate into the recycler.

The really interesting result in the model is that all the glacial erosion creates low spots (especially along the coast) that are ready to hold a new blanket of sediment as the ice melts away. As sea level rises, more and more coastal sediment can accumulate there, eventually forming the sedimentary rocks that start the next intact chapter of Earth's history book. So the snowball glaciation is not just a possible source of erosion, but also accounts for some additional rock formation afterwards—a neat “little-of-column-A-little-of-column-B” explanation.

Because several remarkable events—the great glacial periods, the gap in the rock record, and the rise of multicellular life—happened

around the same time, researchers have long wondered about connections among them. The geological changes, for example, may well have produced chemical [changes in the oceans](#) that enabled interesting evolutionary responses. The huge swings in climate, too, may have had something to do with the timing of the evolutionary explosion. This new study builds up the idea that all three were linked. So the history book is not just missing pages—some of them were used to write the chapter that followed.

PNAS, 2018. DOI: [10.1073/pnas.180435011](https://doi.org/10.1073/pnas.180435011) ([About DOIs](#)).

<http://bit.ly/2VkJSi5o>

Sex differences identified in deadly brain tumors

Tailoring treatment to men, women may improve survival

For decades, scientists have recognized that more males get cancer and die of the disease than females. This is true for many types of cancer, including the deadly brain tumor glioblastoma. Now, a team of researchers led by Washington University School of Medicine in St. Louis has identified distinct molecular signatures of glioblastoma in men and women that help explain such underlying disparities in patients' response to treatment and survival.

The research suggests that tailoring treatments to men and women with glioblastoma based on the molecular subtypes of their tumors may improve survival for all patients.

The findings are published Jan. 2 in *Science Translational Medicine*. "It is our expectation that this study could have an immediate impact on the care of patients with glioblastoma and further research, as the findings indicate we should be stratifying male and female glioblastoma into risk groups and evaluating the effectiveness of treatment in a sex-specific manner," said Joshua B. Rubin, MD, PhD, a Washington University professor of pediatrics and of neuroscience and the study's co-senior author. "The biology of sex differences and its applications in medicine are highly relevant but almost always ignored aspects of personalized treatments."

Glioblastoma is the most common malignant brain tumor and kills about half of patients within 14 months of diagnosis. It is diagnosed nearly twice as often in males, compared with females.

The tumor is most often diagnosed in people over age 50, and standard treatment is aggressive -- surgery, followed by chemotherapy and radiation. However, stubborn stem cells often survive and continue to divide, producing new tumor cells to replace the ones killed by treatment. Most tumors recur within six months.

Studying adults with glioblastoma, the researchers found that standard treatment for glioblastoma is more effective in women than men.

To help understand such sex differences in treatment response, the researchers, including Kristin R. Swanson, PhD, a mathematical oncologist at the Mayo Clinic, measured tumor growth velocity in standard MRI scans.

"Basically, you can look at tumor growth velocity while patients are undergoing treatment and derive a value for how fast their tumors are growing," said Rubin, who also is co-founder and co-director of the Pediatric Neuro-Oncology Program at St. Louis Children's Hospital, where he treats patients. "This gives you an opportunity to think more deeply about whether the drug you're giving a patient is actually helping."

The researchers culled patient MRI scans and survival data from a cancer research database. They then calculated tumor growth velocity every two months for the duration of therapy in 63 glioblastoma patients -- 40 males and 23 females -- who received standard chemo-radiation treatment following surgery. While initial tumor growth velocities were similar between females and males, only the females showed a steady and significant decline in tumor growth after treatment with temozolomide, the most common chemotherapy drug used to treat glioblastoma.

"The males did not respond as well, and we wanted to understand why, so we looked at the underlying genetics of patients' tumors," said Rubin, a co-leader of the Solid Tumor Therapeutics Program at Siteman Cancer Center at Barnes-Jewish Hospital and Washington University School of Medicine.

The researchers tapped into The Cancer Genome Atlas (TCGA) -- a project launched in 2005 to pursue the genetic basis of cancer and funded by the National Cancer Institute and National Human Genome Research Institute, both of the National Institutes of Health (NIH). Led by the study's co-senior author Jingqin "Rosy" Luo, PhD, a Washington University associate professor of surgery in the Division of Public Health Sciences, and the study's lead author, Wei "Will" Yang, PhD, a Washington University bioinformaticist in the Department of Genetics, the researchers applied sophisticated statistical algorithms to distinguish male- or female-specific gene expression patterns from such patterns that were shared among the male and female patients. The team then focused on the sex-specific gene expression to identify molecular subtypes that corresponded to differences in survival for males and for females.

"We observed tremendous genetic sex differences in the tumors of glioblastoma patients that correlated with survival," Luo said. "All evidence supports the need to define these distinctions and incorporate the sex differences into glioblastoma biology research and treatment."

Specifically, the researchers showed that the tumors of patients with glioblastoma cluster into 10 distinct subtypes -- five for tumors in males and five for tumors in females. The clusters are distinguished by gene activity and survival. For example, females with tumors in one such cluster survived longer than females with tumors in any of the other four clusters -- just over three years compared with just over one year. Similarly, they found a male cluster linked to longer

survival -- just over 18 months compared with just over one year for men with tumors in the other clusters.

The researchers validated the clusters in three additional data sets and also showed that even genes activated at similar levels in tumors in males and females can result in substantial sex-specific effects on survival.

"Additionally, we identified genetic pathways that correlated with the longest survival, and they were very different in males compared with females," Rubin said. "For example, in males survival was all about regulating cell division, which suggests that drugs that block cell-cycle progression may be more effective in men. For females, survival was all about regulating invasiveness, which suggests that drugs targeting integrin signaling may be more effective in women. This tells us it might be better to separate males and females and examine their sex-specific genetic signatures. We tested this hypothesis by doing a series of in vitro drug screens in which we took four relatively common chemo drugs and looked at how the expression of these genes correlated with response to those drugs. In both males and females, there was a clear correlation."

Among diseases in general, sex differences are often tied to hormones. For example, the female hormone estrogen contributes significantly to more women getting breast cancer than men. However, with glioblastoma diagnosis and survival, sex hormones did not directly contribute to female and male differences, Rubin said. "The sex-specific genetic activity in glioblastoma is not dependent on the acute actions of circulating sex hormones as differences are evident across all stages of life."

"In a broader sense, I want our research to encourage people to think more about how diseases uniquely affect males and females, making it the norm and not the exception," Rubin added. "I hope the research will inspire more specific approaches to treatments. It may be that we shouldn't be using the same criteria when treating diseases in

males and females, and as a next step we should definitely develop and evaluate sex-specific treatment regimens for glioblastoma."

In addition to researchers at Washington University and the Mayo Clinic, scientists at the Cleveland Clinic, Case Western Reserve University and TGen, a genomics research institute, also contributed to the study.

<http://bit.ly/2R57R2x>

To head off late-life depression, check your hearing
The greater the hearing loss, the greater the risk of having symptoms of depression, finds study of elderly Hispanics

New York, NY - A new study found that elderly individuals with age-related hearing loss had more symptoms of depression; the greater the hearing loss, the greater the risk of having depressive symptoms. The findings suggest that treatment of age-related hearing loss, which is underrecognized and undertreated among all elderly, could be one way to head off late-life depression.

The study was [published online in JAMA Otolaryngology-Head & Neck Surgery](#).

"Most people over age 70 have at least mild hearing loss, yet relatively few are diagnosed, much less treated, for this condition," says lead author Justin S. Golub, MD, MS, assistant professor of otolaryngology-head & neck surgery at Columbia University Vagelos College of Physicians and Surgeons. "Hearing loss is easy to diagnose and treat, and treatment may be even more important if it can help ease or prevent depression."

Age-related hearing loss is the third-most common chronic condition in older adults. The condition is known to raise the risk of other conditions, such as cognitive impairment and dementia. But there are few large studies asking whether hearing loss may lead to depression in the elderly -- particularly in Hispanics, a group in which depression may be underdiagnosed because of language and cultural barriers.

The researchers analyzed health data from 5,239 individuals over age 50 who were enrolled in the Hispanic Community Health Study/Study of Latinos. Each participant had an audiometric hearing test -- an objective way to assess hearing loss -- and was screened for depression.

The researchers found that individuals with mild hearing loss were almost twice as likely to have clinically significant symptoms of depression than those with normal hearing. Individuals with severe hearing loss had over four times the odds of having depressive symptoms.

The study looked for an association at a single point in time, so it can't prove that hearing loss causes depressive symptoms. "That would have to be demonstrated in a prospective, randomized trial," says Golub. "But it's understandable how hearing loss could contribute to depressive symptoms. People with hearing loss have trouble communicating and tend to become more socially isolated, and social isolation can lead to depression."

Although the study focused on Hispanics, the results could be applied to anyone with age-related hearing loss, according to the researchers. "In general, older individuals should get their hearing tested and consider treatment, if warranted," says Golub.

The study is titled, "Association of Audiometric Age-Related Hearing Loss With Depressive Symptoms Among Hispanic Individuals." The other contributors are: Katharine K. Brewster (New York State Psychiatric Institute and Columbia University Irving Medical Center); Adam M. Brickman (CUIMC); Adam J. Ciarleglio (NYSPI, CUIMC, and George Washington University, Washington, DC); Ana H. Kim (CUIMC); José A. Luchsinger (CUIMC); and Bret R. Rutherford (NYSPI and CUIMC).

Drs. Golub and Kim reported receiving travel expenses for education and an industry conference paid for by Cochlear. No other financial or conflicts of interest were reported.

The study was supported by Collaborative and Multidisciplinary Pilot Research Awards from the Columbia University Irving Institute for Clinical and Translational Research and by grants from the National Institute on Aging (K23AG057832 and K24AG045334).

<http://bit.ly/2LRapeR>

Freaky superbug poured out of NIH sinks for a decade, infecting patients

From 2006 to 2016, an aquatic bacterium crept in clinic sinks, causing rare infections.

[Beth Mole](#)

An unusual multidrug-resistant bacterium lurked in sinks at the National Institutes of Health's Clinical Center for more than a decade, striking at least a dozen patients, a new report by NIH scientists concludes.

Researchers tracked the superbugs to sinks in patient rooms amid a freaky outbreak in 2016. Searching through genetic sequences of clinical samples collected as far back as 2006—a year after a new inpatient hospital building opened—researchers identified eight other cases for a total of 12 instances where the sink-dwelling germs had splashed into patients.

The aquatic germ in these cases was *Sphingomonas koreensis*. Such *sphingomonas* species are ubiquitous in the environment but rarely cause infections. In the NIH patients, however, they were found to cause a variety of problems, including pneumonia, blood infections, a surgical site infection, and a potential urinary tract colonization. Some isolates were resistant to 10 antibiotics tested, spanning three classes of drugs.

Three of the 12 affected patients died following their infection. However, they were all also suffering from severe, unrelated infections prior to exposure to the sink-based germs, the NIH researchers note.

Their report, [published recently in the *New England Journal of Medicine*](#), highlights the murky problem of opportunistic, often drug-resistant pathogens endangering vulnerable patients by lurking in hospitals—and hospital sinks in particular. As Ars has reported before, superbug-spewing sinks have been fingered in a variety of

hospital outbreaks over the years. In 2017, researchers published [a splashy study showing that dangerous germs can survive in sink P-traps](#), climb plumbing using creeping films, and launch up onto touchable surfaces with a blast from the faucet.

However, that particular plumbing peril wasn't the problem in the NIH's case. After surveying a variety of potential sources, including ice machines and the municipal intake pipe for the hospital, researchers found the germs skulking in sink faucets and fixtures—not sink drains.

Disassembling infected sinks, researchers found *S. koreensis* inhabiting nine plumbing parts, including the faucet, aerators, and mixing valves. The researchers had several faucets replaced, only to find that they were recolonized shortly after, likely via shared contaminated water supply pipes between sinks. Ultimately, the researchers appeared to rid the sinks of the dangerous interlopers by upping the hot water temperature and chlorine concentrations for the hospital.

In all, the researchers suspect that “a single *S. koreensis* strain entered the water system soon after construction of the new NIH Clinical Center hospital building in 2004” and colonized pipes before the hospital opened, while water in the plumbing was stagnant. Then, the germ “disseminated throughout the hospital and diversified at multiple distinct locations,” causing a sporadic, decade-long clonal outbreak.

The outbreak isn't the first for the NIH's unique clinical research center, which aims to treat rare and intractable illnesses with innovative medicine. In 2011, the center was struck with an [outbreak of another superbug, carbapenem-resistant *K. pneumoniae*](#), which affected 18 patients, 11 of whom died. A case of fungal contamination at the hospital in 2015 prompted a leadership overhaul. An independent review had determined that patient safety at the hospital had become “[subservient to research demands](#).”

Yet, the authors of the new study note that the threat of *S. koreensis* is not unique to the NIH's hospital, regardless of its struggles. And they note that the “steps taken in this study to prevent further *S. koreensis* infections within the NIH Clinical Center are applicable to many opportunistic waterborne pathogens.”

New England Journal of Medicine, 2018. DOI: [10.1056/NEJMoa1803238](https://doi.org/10.1056/NEJMoa1803238) ([About DOIs](#)).

<https://nyti.ms/2F8oqo9>

Archaeologists Find Pre-Columbian Temple of ‘Flayed Lord’ in Central Mexico

Archaeologists in Mexico say they have found the first temple dedicated to a deity called the Flayed Lord, an important god in the Aztec Empire whose worshippers were said to wear the skin of sacrificial victims.

By Alan Yugas

Artifacts related to the god were found in the central state of Puebla, at a site built by the Popoloca people, Mexico's National Institute of Anthropology and History said in [a statement](#) on Wednesday. The Popolocas built in the area over several centuries, beginning around A.D. 900, and were assimilated into the sprawling Aztec kingdom.



A stone carving depicting Xipe Tótec, a pre-Columbian god known as the Flayed Lord. Artifacts related to the deity were found in the central state of Puebla. Meliton Tapia Davila/Associated Press

At the temple, which the institute said was probably built between A.D. 1000 and 1260, the archaeologists found artifacts related to the god, Xipe Tótec, including two stone skulls and a stone torso that had an extra hand hanging off its left arm. Scientists said the extra hand suggested the god was wearing the remains of a sacrificial victim.

Noemí Castillo Tejero, the archaeologist who led the project, was not available for an interview, but the institute said that the excavation at the complex, called Ndachjian-Tehuacan, had also uncovered two altars nearby, in a layout that appeared to match Aztec accounts of rituals associated with the cult of Xipe Tótec.

Those accounts, from around the time of the Spanish invasion in the early 1500s, say that worshipers of Xipe Tótec sacrificed people, usually prisoners of war, by having them fight a series of combatants in a kind of gladiatorial ritual — or by killing the prisoners with arrows. The worshipers then flayed the victims, and priests were said to have worn their skin.

“Part of the logic there is that this was, among other things, connected to renewal and the re-emergence of life, probably something like snakes sloughing off their own skins,” said John Henderson, a professor of anthropology at Cornell University who was not involved in the research.

The deity himself is often portrayed as wearing the skin of a sacrificial victim, Dr. Henderson said, and he was impersonated by actual priests who also wore skins. The temple, he and other experts suggested, may have been used to store such skins.

Dr. Henderson emphasized that a long period passed between the use of this building and the written descriptions of the rituals, and that the Aztecs — who took control over the region around A.D. 1450 — oversaw a complicated, cosmopolitan empire that adopted other cultures, languages and ethnic groups, such as the Popoloca people. Various depictions of Xipe Tótec, for instance, have been found around Mesoamerica, though until now archaeologists had not found a temple that seemed dedicated to him.

“Finds like this will help us understand how they used religion as one of the ways to create a multiethnic empire,” said Rosemary Joyce, a professor of anthropology at the University of California, Berkeley, who also did not take part in the research.

Dr. Joyce compared the cultural practice to that of the Roman Empire, which incorporated religious beliefs from the territories’ outlying people. “It’s really important that we’re beginning to get more information about people other than the Mexica,” she said, using the indigenous word for the rulers of the Aztec Empire.

She also warned against taking all Aztec artwork that portrays violence as proof that they were carried out as shown.

“We don’t really look at a Christian church and think that people are being crucified there,” she said. “We need a lot more archaeology from the site to understand the whole.”

<http://bit.ly/2F80AIf>

Why Your Doctor Should Also Be a Scientist

The physician-scientist is an endangered species, if we don't reverse this trend, patients could lose out on the next generation of life-saving treatments

Researchers at the University of Maryland recently announced a potential breakthrough in the fight against "neuropathic" pain—that is, [pain](#) that results from malfunctioning or damaged nerves. Neuropathic pain afflicts 100 million Americans and costs the nation over half a trillion dollars every year.

Though the condition isn't caused by physical trauma, it can nonetheless create a phantom sensation ranging from mild discomfort to debilitating agony. The Maryland researchers developed a [new technique](#) that uses ultrasound waves to neutralize this pain.

That research team has a distinctive feature: It's composed of physician-scientists. These specialized health care providers treat patients while also conducting research to develop new medicines and procedures.

Unfortunately, the physician-scientist is an endangered species—our country is suffering a severe and growing shortage of them. If we

don't reverse this trend, patients could lose out on the next generation of life-saving treatments.

Physician-scientists are defined by their formal training, which includes both a medical degree and a PhD in the biological and/or physical sciences. Unlike typical lab researchers, physician-scientists have an intimate perspective of the patient experience. They witness firsthand the interaction between different drugs, the success of key surgical techniques, and patterns among patients. They bring those insights into the laboratory, where they guide research and accelerate the discovery process.

Shortly after the University of Maryland team announced its breakthrough, a physician-scientist at Cedars-Sinai Medical Center, a large research hospital in Los Angeles, [discovered a blood protein](#) that is linked to a common type of heart failure. Other research teams had failed to find such a clear biomarker. This finding will likely be used to create a simple blood test to determine patients' risk of developing a catastrophic heart condition.

Other examples abound. In June, a group of physician-scientists at Oregon Health & Science University published [research](#) on a compound that could stop cancer cells from spreading throughout the body. A few years ago, physician-scientists at the Scintillon Institute in San Diego [uncovered a molecular link](#) between Alzheimer's and type 2 diabetes.

Such monumental discoveries are the specialty of the physician-scientist. This is the benefit of blending practical medicine with academic research.

Physician-scientists also help patients make informed care decisions. They're well-equipped to see through flashy pharmaceutical and medical device marketing that saturates the health care industry.

Consider the story of Dr. Jalees Rehman, a physician-scientist at the University of Illinois. In [Scientific American](#), Dr. Rehman recalled a patient asking him about a controversial heart procedure offered by

a private clinic in Thailand. For a small fortune, Thai doctors would treat the patient's advanced heart disease with a bone marrow injection. The stem cells in the marrow would, supposedly, heal damaged valves, chambers, and nerves.

Dr. Rehman's research specialty—studying the therapeutic application of stem cells to heart conditions—was directly relevant. He knew the procedure was bogus: Bone marrow actually contains very few stems cells and the injection process presented enormous health risks. He successfully deterred the patient from undergoing the procedure.

It's increasingly difficult for patients to receive such informed advice. Between 2003 and 2012, the already meager population of physician-scientists shrunk by nearly 6 percent, according to a [survey](#) from the American Medical Association. Today, physician-scientists represent just one out of every 100 doctors.

For the sake of medical innovation, it's imperative to grow a new crop of physician-scientists.

More federal funding for young physician-scientists would help tremendously. Currently, most funding goes to physician-scientists who are already well established in their respective fields. From 2012 to 2017, nearly six in 10 NIH pediatric research grants went to senior-level physician-scientists, according to a [JAMA study](#). When young physician-scientists can't secure grants, they often decide to abandon their research interests and practice medicine full-time.

Funding more research grants, and earmarking them for young physician-scientists, could lead to breakthrough treatments for cancer, Alzheimer's, and other diseases.

Institutions of higher education also have a role to play. Schools that only offer traditional medical degrees could create physician-scientist programs to attract more bright young people to the profession. My school—the New York Institute of Technology College of Osteopathic Medicine—recently launched a seven-year

DO/PhD program. Physician-scientists bridge the gap between scientific theory and practical medicine. We need to boost their ranks. ABOUT [Kurt Amsler](#), PhD, is a professor of biomedical sciences at the New York Institute of Technology's College of Osteopathic Medicine.

<http://bit.ly/2LOIxIi>

Egg metabolites in blood related to lower risk of type 2 diabetes

Daily egg associated with a blood metabolite profile that is related to a lower risk of type 2 diabetes

Consumption of one egg every day seems to associate with a blood metabolite profile that is related to a lower risk of type 2 diabetes, a new study conducted in the University of Eastern Finland shows. The findings were published in *Molecular Nutrition and Food Research*. Eggs remain one of the most controversial food items. High intake of eggs has traditionally been discouraged, mainly due to their high cholesterol content. However, eggs are also a rich source of many bioactive compounds that can have beneficial effects on health. This means that the health effects of consuming eggs are difficult to determine based solely on their cholesterol content.

The investigators have previously shown that eating roughly one egg per day was associated with a lower risk of developing type 2 diabetes among middle-aged men participating in the Kuopio Ischaemic Heart Disease Risk Factor Study in eastern Finland.

"The purpose of the current study was to explore potential compounds that could explain this association using non-targeted metabolomics, a technique that enables a broad profiling of chemicals in a sample," says Early Stage Researcher and lead author of the study Stefania Noerman from the University of Eastern Finland.

The study found that the blood samples of men who ate more eggs included certain lipid molecules that positively correlated with the blood profile of men who remained free of type 2 diabetes. In

addition, the researchers identified several biochemical compounds in blood that predicted a higher risk of developing type 2 diabetes, including the amino acid tyrosine.

The study suggests some plausible mechanisms which could at least partly explain the inverse association between egg intake and the previously observed lower risk of developing type 2 diabetes.

"Although it is too early to draw any causal conclusions, we now have some hints about certain egg-related compounds that may have a role in type 2 diabetes development. Further detailed investigations with both cell models and intervention studies in humans that use modern techniques, such as metabolomics, are needed to understand the mechanisms behind physiological effects of egg intake," Early Stage Researcher Noerman concludes.

Research article:

Metabolic profiling of high egg consumption and the associated lower risk of type 2 diabetes in middle-aged Finnish men.

Stefania Noerman, Olli Kärkkäinen, Anton Mattsson, Jussi Paananen, Marko Lehtonen, Tarja Nurmi, Tomi-Pekka Tuomainen, Sari Voutilainen, Kati Hanhineva, and Jyrki K Virtanen

Molecular Nutrition and Food Research, published online 12 December 2018

Link to the article: <http://doi.wiley.com/10.1002/mnfr.201800605>

<http://bit.ly/2VoTViu>

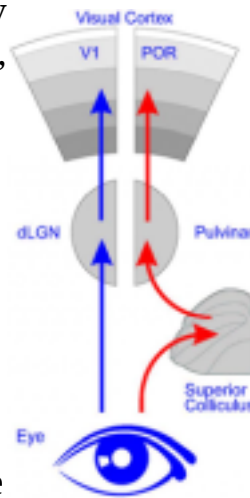
Surprise discovery reveals second visual system in mouse cerebral cortex

Research challenges 75-year-old dogma of mammalian vision

The visual system is probably the best understood part of the brain. Over the past 75 years, neuroscientists have assembled a detailed account of how light waves entering your eyes allow you to recognize your grandmother's face, to track a hawk in flight, or to read this sentence. But a new study by UC San Francisco researchers is calling a fundamental aspect of vision science into question, showing that even the best-studied parts of the brain can still hold plenty of surprises.

According to the standard model of visual processing, all visual information from the retina must first pass through the primary visual cortex (V1) in the back of the brain, which extracts simple features like lines and edges, before being distributed to a number of "higher order" visual areas that extract increasingly complex features like shapes, shading, movement, and so on.

The new study -- published online January 4, 2019 in [Science](#) -- shows for the first time that one of these supposedly higher-order visual areas, which is involved in the perception of moving objects, does not depend on information from V1 at all. Instead, this region, known as the post-rhinal cortex (POR), appears to obtain visual data directly from an evolutionarily ancient sensory processing center at the base of the brain called the superior colliculus.



Location of visual areas in the mouse brain, including primary visual cortex (V1) and postrhinal cortex (POR). Scanziani lab / UCSF

"It's as if we've discovered a second primary visual cortex," said study senior author Massimo Scanziani, PhD, a professor of physiology at UCSF and a Howard Hughes Medical Institute investigator. "This undermines the whole concept of the visual system in mammalian cortex as a perfect hierarchy with V1 as the gatekeeper and raises a multitude of questions, including how these two parallel visual systems evolved and how they cooperate to produce a unified visual experience."

What the Lizard Brain Shows the Mammalian Cortex

The ancestral superior colliculus (called optic tectum in non-mammals) is the main sensory processing center in creatures with little or no cortex, such as fish, amphibians, lizards, and birds. It is particularly attuned to motion and tied in to reflexive behaviors --

think of a frog's ability to snag a fly from the air with its tongue or a fish's ability to dart away from a looming predator.

However, the superior colliculus did not disappear with the development of the cortex in mammals. In primates, including humans, it has been linked to rapid and unconscious forms of visual processing, such as jumping in fright when you see a stick that looks like a snake, or automatically catching a ball thrown at your face. It may also play a role in directing the spotlight of visual attention (such as when you are waiting for a traffic light to turn green or searching a crowded scene for someone in a particular red and white striped hat). But the new paper is the first time anyone has shown that this evolutionarily ancient system has a dedicated space in cortex.

The research was launched when lead author Riccardo Beltramo, PhD, a postdoctoral researcher in the Scanziani lab, was recording neural responses to moving visual stimuli in the mouse POR, which is known to play roles in perceiving motion and in spatial memory. He used a technique called optogenetics to temporarily silence activity in V1 with light, hoping to confirm his expectation that POR responses depend on information flow through the standard visual hierarchy. But to his surprise, he found that POR neurons continued to respond to moving stimuli even without input from V1.

"It was absolutely remarkable," Beltramo said. "We silenced the main visual area in the cortex and visual responses in POR remained unaffected. That was the first big 'wow' moment that told us we were on to something completely unexpected."

If POR's responses to moving objects were not coming from V1, Beltramo wondered, then how did they get there? There must be another pathway connecting POR to visual information coming in from the retina, he reasoned. To identify this parallel visual pathway, Beltramo used injections of custom-engineered viruses that label neurons that are connected to one another. This let him show that POR neurons get two sources of anatomical input -- one from V1,

and a second from the superior colliculus, each routed through distinct zones of the thalamus, the brain's central relay station.

To confirm that the superior colliculus was driving POR responses to movement, Beltramo used optogenetics to systematically silence either V1 or the superior colliculus while recording from POR. He showed that -- unlike inactivating V1 -- shutting down the superior colliculus made POR activity totally disappear. Indeed, the superior colliculus appears to be critical for POR's ability to track moving objects, something the researchers found POR's V1 inputs were unable to do on their own.

Study Raises Fundamental Questions About Brain Evolution, Function

More research is needed to test whether visual responses in POR-like areas of the brains of primates like ourselves also depend on input from the superior colliculus, as well as how V1-driven and colliculus-driven activity interact to influence animals' behavior, the authors say. "We hypothesize that POR, which was previously considered a higher order visual area, could be a sort of 'primal' visual cortex, similar to a simple early amphibian, reptilian or avian visual cortex, and that it may be dedicated to the detection that something is moving in the environment, whether it is small, close prey or a large distant predator," Beltramo said. "From this perspective, perhaps V1 would add to this information a more precise discrimination of the nature of the moving object, such as its exact location or whether it is a potentially tasty beetle or a potentially deadly scorpion."

Based on previous studies, the newly discovered superior colliculus-POR system could also be linked to fear responses, spatial attention and navigation, or even face recognition -- all specialties of the region of temporal cortex where POR is located.

The findings could also have implications for an intriguing phenomenon called "blindsight," in which people who become blind because of damage to V1 are still able to identify the positions of

objects and navigate obstacles, even though they cannot consciously perceive them. Based on studies in primates, blindsight is thought depend on the superior colliculus, but the new study suggests it could involve POR-like areas of the cortex as well.

"This is one of those findings that raises a lot of questions rather than answering any, because, as many discoveries, it presents questions no one knew to ask," Scanziani said.

Authors:

Study senior author Massimo Scanziani, PhD, is a professor of physiology at UCSF. He is also a Howard Hughes Medical Institute Investigator.

Study lead author Riccardo Beltramo, PhD, is a postdoctoral researcher in the Scanziani lab.

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Disclosures: *The authors declare no competing interests.*

<http://bit.ly/2ToGGwy>

Scientists engineer shortcut for photosynthetic glitch, boost crop growth by 40 percent

Crops engineered with a photorespiratory shortcut are 40 percent more productive in real-world agronomic conditions

Plants convert sunlight into energy through photosynthesis; however, most crops on the planet are plagued by a photosynthetic glitch, and to deal with it, evolved an energy-expensive process called photorespiration that drastically suppresses their yield potential. Researchers from the [University of Illinois](#) and U.S. Department of Agriculture [Agricultural Research Service](#) report in the journal *Science* that crops engineered with a photorespiratory shortcut are 40 percent more productive in real-world agronomic conditions.

"We could feed up to 200 million additional people with the calories lost to photorespiration in the Midwestern U.S. each year," said principal investigator Donald Ort, the Robert Emerson Professor of Plant Science and Crop Sciences at Illinois' [Carl R.](#)

[Woese Institute for Genomic Biology](#).

"Reclaiming even a portion of these calories across the world would go a long way to meeting the 21st Century's rapidly expanding food demands--driven by population growth and more affluent high-calorie diets."



Four unmodified plants (left) grow beside four plants (right) engineered with alternate routes to bypass photorespiration -- an energy-expensive process that costs yield potential. The modified plants are able to reinvest their energy and resources to boost productivity by 40 percent. Claire Benjamin/RIPE Project

This landmark study is part of [Realizing Increased Photosynthetic Efficiency](#) (RIPE), an international research project that is engineering crops to photosynthesize more efficiently to sustainably increase worldwide food productivity with support from the [Bill & Melinda Gates Foundation](#), the [Foundation for Food and Agriculture Research](#) (FFAR), and the U.K. Government's [Department for International Development](#) (DFID).

Photosynthesis uses the enzyme Rubisco--the planet's most abundant protein--and sunlight energy to turn carbon dioxide and water into sugars that fuel plant growth and yield. Over millennia, Rubisco has become a victim of its own success, creating an oxygen-rich atmosphere. Unable to reliably distinguish between the two molecules, Rubisco grabs oxygen instead of carbon dioxide about 20 percent of the time, resulting in a plant-toxic compound that must be recycled through the process of photorespiration.

"Photorespiration is anti-photosynthesis," said lead author Paul South, a research molecular biologist with the Agricultural Research Service, who works on the RIPE project at Illinois. "It costs the plant precious energy and resources that it could have invested in photosynthesis to produce more growth and yield."

Photorespiration normally takes a complicated route through three compartments in the plant cell. Scientists engineered alternate pathways to reroute the process, drastically shortening the trip and saving enough resources to boost plant growth by 40 percent. This is the first time that an engineered photorespiration fix has been tested in real-world agronomic conditions.

"Much like the Panama Canal was a feat of engineering that increased the efficiency of trade, these photorespiratory shortcuts are a feat of plant engineering that prove a unique means to greatly increase the efficiency of photosynthesis," said RIPE Director Stephen Long, the Ikenberry Endowed University Chair of Crop Sciences and Plant Biology at Illinois.

The team engineered three alternate routes to replace the circuitous native pathway. To optimize the new routes, they designed genetic constructs using different sets of promoters and genes, essentially creating a suite of unique roadmaps. They stress tested these roadmaps in 1,700 plants to winnow down the top performers.

Over two years of replicated field studies, they found that these engineered plants developed faster, grew taller, and produced about 40 percent more biomass, most of which was found in 50-percent-larger stems.

The team tested their hypotheses in tobacco: an ideal model plant for crop research because it is easier to modify and test than food crops, yet unlike alternative plant models, it develops a leaf canopy and can be tested in the field. Now, the team is translating these findings to boost the yield of soybean, cowpea, rice, potato, tomato, and eggplant.

"Rubisco has even more trouble picking out carbon dioxide from oxygen as it gets hotter, causing more photorespiration," said co-author Amanda Cavanagh, an Illinois postdoctoral researcher working on the RIPE project. "Our goal is to build better plants that

can take the heat today and in the future, to help equip farmers with the technology they need to feed the world."

While it will likely take more than a decade for this technology to be translated into food crops and achieve regulatory approval, RIPE and its sponsors are committed to ensuring that smallholder farmers, particularly in Sub-Saharan Africa and Southeast Asia, will have royalty-free access to all of the project's breakthroughs.

Realizing Increased Photosynthetic Efficiency (RIPE) is engineering staple food crops to more efficiently turn the sun's energy into yield to sustainably increase worldwide food productivity, with support from the Bill & Melinda Gates Foundation, the Foundation for Food and Agriculture Research (FFAR), and the U.K. Government's Department for International Development (DFID).

RIPE is led by the University of Illinois in partnership with the Australian National University; Chinese Academy of Sciences; Commonwealth Scientific and Industrial Research Organisation; Lancaster University; Louisiana State University; University of California, Berkeley; University of Essex; and the U.S. Department of Agriculture, Agricultural Research Service.

<http://bit.ly/2FegAIV>

Wild monkeys with killer herpes are breeding like crazy in Florida

Florida man's got nothin' on these dirty primates.

[Beth Mole](#) - 1/4/2019, 2:00 AM

A quick reminder: there's [a band of feral monkeys running wild in Central Florida](#) that carries a type of herpes lethal to humans. The mischievous simians—[who are not shy around people](#)—can transmit deadly disease with just a scratch, nip, or [fling of poo](#).



[Getty | DEA / C.DANI / I.JESKE](#)

Last year, experts warned that the rhesus macaques are a public health threat. It now seems that the monkey business is likely to get

worse, with a wildlife expert revealing that [their population is set to double](#) in the next few years.

"[It's going to be a problem](#)... Continual growth of that population is going to occur without intervention," Steve Johnson told Florida ABC-affiliate WFTV in a report published January 3. Johnson is a professor and wildlife expert at the University of Florida and part of a team of researchers that has followed the monkeys for years.

Early last year, Johnson and colleagues [published a study](#) estimating that about 25 percent of Florida's population of free-wheeling monkeys carries the deadly virus, known as macacine herpesvirus 1 (McHV-1), herpes B, or monkey B virus. The study appeared in the February issue of *Emerging Infectious Diseases*.

The monkey's herpes affects them much like human herpes (HSV-1 and HSV-2) affects us. The virus infects nerves and can go dormant until the immune system is stressed or weakened, at which point the virus can erupt, typically around the mouth or genitals.

But in humans, McHV-1 can cause a flu-like illness that can progress to neurological problems, such as double vision and paralysis. At that point, an infected person is likely to die of the infection.

So far, researchers have only documented 50 cases of McHV-1 spreading to humans, all of which came from captive, not wild, monkeys. But with a feisty population of monkeys running amok around Central Florida, researchers say the potential for the virus to jump from the wild to humans is real—particularly with more monkeys around.

Currently, Johnson and colleagues estimate that there are about 200 monkeys in Florida's Silver Spring State Park. "By the year 2022, there are probably going to be around 400 animals," Johnson said.

The population got its start during the 1930s and 1940s when the captain of a glass-bottom boat released a handful of macaques on an island in Florida's Silver River to amuse tourists. The monkeys,

which are excellent swimmers, established in the surrounding Silver Spring State Park and nearby Ocala National Forest.

<http://bit.ly/2LRf7cC>

Once considered outlandish, the idea that plants help their relatives is taking root

The notion that plants really do care for their most genetically close peers is taking root

By [Elizabeth Pennisi](#) Jan. 3, 2019 , 12:10 PM

For people, and many other animals, family matters. Consider how many jobs go to relatives. Or how an ant will ruthlessly attack intruder ants but rescue injured, closely related nestmates. There are good evolutionary reasons to aid relatives, after all. Now, it seems, family feelings may stir in plants as well.

A Canadian biologist planted the seed of the idea more than a decade ago, but many plant biologists regarded it as heretical—plants lack the nervous systems that enable animals to recognize kin, so how can they know their relatives? But with a series of recent findings, the notion that plants really do care for their most genetically close peers—in a quiet, plant-y way—is taking root. Some species constrain how far their roots spread, others change how many flowers they produce, and a few tilt or shift their leaves to minimize shading of neighboring plants, favoring related individuals.

"We need to recognize that plants not only sense whether it's light or dark or if they've been touched, but also whom they are interacting with," says Susan Dudley, a plant evolutionary ecologist at McMaster University in Hamilton, Canada, whose early plant kin recognition studies sparked the interest of many scientists.

Beyond broadening views of plant behavior, the new work may have a practical side. In September 2018, a team in China reported that rice planted with kin grows better, a finding that suggested family ties can be exploited to improve crop yields. "It seems anytime

anyone looks for it, they find a kin effect," says André Kessler, a chemical ecologist at Cornell University.

From termites to people, kin-specific behaviors have evolved over and over in animals, showing there is a strong advantage to helping relatives pass on shared genes. Dudley reasoned that the same evolutionary forces should apply to plants. Not long after researchers proved that plants can distinguish "self" from "nonself" roots, she tested whether they could also pick out and favor kin. She grew American searocket (*Cakile edentula*), a succulent found on North American beaches, in pots with relatives or with unrelated plants from the same population. With strangers, the searocket greatly expanded its underground root system, but with relatives, it held these competitive urges in check, presumably leaving more room for kin roots get nutrients and water. The claim, published in 2007, shocked colleagues. A few sharply criticized the work, citing flawed statistics and bad study design.

Since then, however, other researchers have confirmed her findings. Recently, working with *Moricandia moricandioides*, a Spanish herb, Rubén Torices and his colleagues at the University of Lausanne in Switzerland and the Spanish National Research Council demonstrated cooperation in flowering. After growing 770 seedlings in pots either alone or with three or six neighbors of varying relatedness, the team found the plants grown with kin put out more flowers, making them more alluring to pollinators. The floral displays were especially big in plants in the most crowded pots of relatives, Torices and his colleagues reported on 22 May 2018 in *Nature Communications*.

Torices, now at King Juan Carlos University in Madrid, calls the kin effects "altruistic" because each individual plant gives up some of its ultimate seedmaking potential to expend more energy making flowers. In the end, he suspects, more seeds are fertilized overall in the closely related pots.

Doubts linger. Is a plant identifying genetic kin, or simply recognizing that its neighbor is more or less similar to itself? "I do not think that there has been convincing evidence for kin recognition in plants yet," says H el ene Fr eville, a population biologist studying crops at the Montpellier outpost of the French National Institute for Agricultural Research.

Sagebrush bushes (*Artemisia tridentata*) have provided some strong clues, however. When injured by herbivores, these plants release volatile chemicals that stimulate neighboring sagebrush to make chemicals toxic to their shared enemies. Ecologist Richard Karban at the University of California, Davis, wondered whether kin were preferentially warned. His group had already found that sagebrush plants roughly fall into two "chemotypes," which mainly emit either camphor or another organic compound called thujone when their leaves are damaged.

The team showed that the chemotypes are heritable, making them a potential kin recognition signal. In 2014, the researchers reported that when volatiles from a plant of one chemotype were applied to the same type of plant, those plants mounted stronger antiherbivore defenses and had much less insect damage than when the volatiles were applied to a plant of the other chemotype—a hint of a kin effect.



Initially disbelieved, Susan Dudley's work on plant kin recognition is winning over more biologists. Tasmin Chu

The mustard *Arabidopsis thaliana* has provided another clue. About 8 years ago, Jorge Casal, a plant biologist at the University of Buenos Aires, noticed that *Arabidopsis* plants growing next to relatives shift the arrangement of their leaves to reduce shading of their neighbors, but don't do that when the neighbors are unrelated. How they sense the presence of relatives was a mystery, however.

The plants do have light sensors, and in 2015, Casal's team discovered that the strength of reflected light striking nearby leaves signaled relatedness and triggered the rearrangements. Relatives tend to sprout leaves at the same height, bouncing more light onto each other's leaves. By shifting leaves to reduce how much they shade each other, the relatives cumulatively grow more vigorously and produce more seeds, his team found. "There is no other case of kin recognition in plants where the cue, the receptors, and the fitness consequences have been established," Casal says.

Since then, he has shown that when sunflower kin are planted close together, they, too, arrange themselves to stay out of one another's way. The sunflowers incline their shoots alternately toward one side of the row or the other, Casal and his colleagues reported in 2017 in the *Proceedings of the National Academy of Sciences*. Taking advantage of the effect, they planted 10 to 14 related plants per square meter—an unheard of density for commercial growers—and got up to 47% more oil from plants that were allowed to lean away from each other than plants forced to grow straight up.

Chui-Hua Kong, a chemical ecologist at the China Agricultural University in Beijing, is exploiting a similar effect to boost rice yields. His lab studies rice varieties that give off weed-killing chemicals in their roots. Right now, they don't have high enough yields to replace commonly grown varieties that require herbicides. But in 3-year-long field tests, kin-recognizing versions of these self-protective rice varieties produced a 5% increase in yield when grown with kin, rather than unrelated plants, Kong and colleagues reported in late September 2018 in *New Phytologist*. To test the approach on a larger scale, he and his colleagues are planting "kin" seedlings of the weed-killing strain together in paddy fields in South China.

Brian Pickles, an ecologist at the University of Reading in the United Kingdom, proposes that kin recognition could even help forests regenerate. By tracing flows of nutrients and chemical signals

between trees connected by underground fungi, he showed that the firs preferentially feed their kin and warn them about insect attacks. The finding suggested a family of firs would grow faster than unrelated trees.

To some biologists, the emerging picture of communicating, cooperating plants is still based on thin evidence. Laurent Keller, an evolutionary biologist at the University of Lausanne who has shown that some apparent signs of kin recognition in *Arabidopsis* can instead stem from innate differences among the plants, calls for more rigor in studies. "People have started to realize that it is important to think carefully about the design of the experiment to rule out other potential explanations," he says.

Keller is keeping an open mind and predicts stronger evidence of plant kin recognition will emerge. Karban is already convinced. "We are learning that plants are capable of so much more sophisticated behavior than we had thought," he says. "It's really cool stuff."

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

AAN Calls for Uniform Definition of Brain Death

The American Academy of Neurology (AAN) has issued a position statement calling on US lawmakers to require a uniform definition of brain death.

Megan Brooks

"The AAN believes that a specific, uniform standard for the determination of brain death is critically important to provide the highest quality patient-centered neurologic and end-of-life care," James Russell, DO, first author of the statement and chair of the AAN's Ethics, Law, and Humanities Committee, said in a news release.

The position statement was [published online](#) January 2 in *Neurology*. It has been endorsed by the American Neurological Association and the Child Neurology Society.

Following Nevada's Lead

According to the AAN, brain death is defined as death due to irreversible loss of function of the entire brain — comparable to circulatory death, which is defined as irreversible loss of function of the circulatory system. Such a state, as determined by one or more medical professionals through application of accepted medical standards, is accepted as legal death in all US jurisdictions.

The brain death standards for adults and children that are now widely accepted and used are the AAN's 2010 Evidence-Based Guideline Update: Determining Brain Death in Adults and the 2011 Guidelines for the Determination of Brain Death in Infants and Children, issued by the Pediatric Section of the Society of Critical Care Medicine, the Sections of Neurology and Critical Care, the American Academy of Pediatrics and the Child Neurology Society.

The AAN says it is not aware of any cases in which use of these guidelines led to inaccurate determination of death with return of any brain function. Yet only the state of Nevada has adopted legislation that requires use of these brain death guidelines as the medical standard.

"The AAN supports the development of legislation in every state modeled after the Nevada statute, which specifically defers to these current adult and pediatric brain death guidelines and any future updates," said Russell, of Lahey Hospital and Medical Center in Burlington, Massachusetts.

The AAN also calls for uniform policies across US medical centers that would ensure compliance to the brain death guidelines.

"The lack of specificity in most states' laws, coupled with inconsistency among brain death protocols in medical facilities, has contributed to differing interpretations by the courts in a few high-profile cases," said Russell. "The AAN wants the general public to know that when these guidelines are followed, the result is an accurate determination of brain death."

In addition, the AAN encourages the development of programs that train and credential physicians who determine brain death and that public and professional education be provided regarding brain death and its determination.

The AAN position statement also provides guidance to medical professionals regarding circumstances in which a family may not accept a determination of death of a loved one for religious, moral, or cultural reasons and requests continued life support.

"This guidance is provided in response to an AAN-sponsored survey of its members, in which respondents requested that clear, simple, and universal guidelines be provided on how to respond to objections to determination of death by neurologic criteria and requests for temporary or indefinite accommodation," the AAN explains.

Although the AAN is "respectful of and sympathetic toward requests for limited accommodation based on reasonable and sincere social, moral, cultural, and religious considerations," it acknowledges that there is "no ethical obligation to provide medical treatment to a deceased person. The AAN recognizes the potential for harm to the patient, the family, or other patients and the health care team from indefinite accommodation," the guideline states.

It further states that a neurologist who is opposed to indefinite accommodation on the basis of religious or moral conscience should be allowed to transfer the care of a deceased person to another individual if possible, "without reprisal, if continued care is mandated by law or institutional policy."

The AAN also states that if, on the basis of religious or moral conscience, a neurologist is opposed to determining brain death, he or she should seek to transfer this responsibility to another qualified physician.

Development of the position statement was funded by the AAN. The authors have disclosed no relevant financial relationships.

Neurology. Published online January 2, 2019. [Abstract](#)

<http://bit.ly/2RyiEln>

What does 'dead' mean?

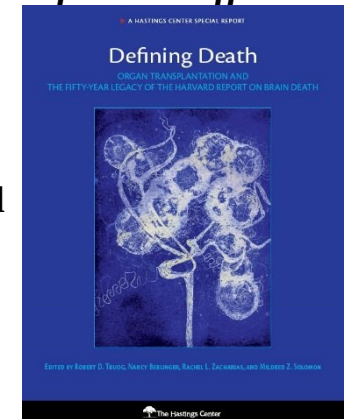
Should death be defined in strictly biological terms or is it essentially a social construct that should be defined in different ways?

Should death be defined in strictly biological terms -- as the body's failure to maintain integrated functioning of respiration, blood circulation, and neurological activity? Should death be declared on the basis of severe neurological injury even when biological functions remain intact? Or is it essentially a social construct that should be defined in different ways?

Defining Death: Organ Transplantation and the Fifty-Year Legacy of the Harvard Report on Brain Death Brainscape 17, by Susan Aldworth, 2006, etching and aquatint, 30 x 25 cms. Private collection/Bridgeman Images

These are among the wide-ranging questions explored in a new special report, "[Defining Death: Organ Transplantation and the Fifty-Year Legacy of the Harvard Report on Brain Death](#)," published with the current issue of the *Hastings Center Report*. The special report is a collaboration between The Hastings Center and the Center for Bioethics at Harvard Medical School. Editors are [Robert D. Truog](#), the Frances Glessner Lee professor of medical ethics, anaesthesiology & pediatrics and director of the Center for Bioethics at Harvard Medical School; [Nancy Berlinger](#), a research scholar at The Hastings Center; Rachel L. Zacharias, a student at the University of Pennsylvania Law School and a former project manager and research assistant at The Hastings Center; and [Mildred Z. Solomon](#), president of The Hastings Center.

Until the mid-twentieth century, the definition of death was straightforward: a person was pronounced dead when found to be



unresponsive and without a pulse or spontaneous breathing. Two developments prompted the need for a new concept of death, culminating in the definition of brain death proposed in the Harvard report published in 1968.

The first development was the invention of mechanical ventilation supported by intensive care, which made it possible to maintain breathing and blood circulation in the body of a person who would otherwise have died quickly from a brain injury that caused loss of these vital functions. The second development was organ transplantation, which "usually requires the availability of 'living' organs from bodies deemed to be 'dead,'" as the [introduction](#) to the special report explains. "Patients determined to be dead by neurologic criteria and who have consented to organ donation . . . are the ideal source of such organs, since death is declared while the organs are being kept alive by a ventilator and a beating heart."

While the legal determination of death in all 50 states includes death by neurological criteria - the irreversible cessation of all functions of the entire brain - the concept of brain death remains contested, most recently by the case of Jahi McMath, who was declared dead by neurological criteria but continued to have unexpected biological development. In the new special report, leading experts in medicine, bioethics, and other fields discuss and debate areas of continuing and new controversy, including:

- ***Are brain-dead organ donors dead? "[A Conceptual Justification for Brain Death](#)" by James Bernat, emeritus professor of medicine and neurology at the Geisel School of Medicine at Dartmouth, upholds the longstanding view that brain death quickly leads to the disintegration of the body, regardless of medical support. But "[Brain Death: A Conclusion in Search of a Justification](#)" by D. Alan Shewmon, emeritus professor of pediatrics and neurology at the David Geffen School of Medicine at UCLA, discusses several cases in which the bodies of patients pronounced brain dead did not "disintegrate" but were maintained by mechanical ventilation and tube feeding. "[DCDD Donors](#)***

[Are Not Dead](#)" by Ari Joffe, clinical professor in the department of pediatrics at the University of Alberta, argues that a subset of organ donors - those whose death is declared five minutes after the onset of pulselessness - are not dead because their condition could be reversed with medical intervention.

- ***Ethical conundrums: saving patients vs. saving organs. Potential organ donors who have undergone unexpected cardiac arrest outside of the hospital pose ethical challenges because their preferences concerning life-sustaining interventions and concerning organ donation may be unknown. When a patient's chances of survival and recovery are extremely uncertain, first responders have a limited window of opportunity to act to preserve potentially viable organs. In some cases where organ preservation protocols were initiated after CPR failed, patients have recovered to some degree. "[Uncontrolled DCD: When Should We Stop Trying to Save the Patient and Focus on Saving the Organs?](#)" by Iván Ortega-Deballon, associate professor of health law and medical ethics and resuscitation at the Universidad de Alcalá in Spain, and David Rodríguez-Arias, Ramón y Cajal researcher of moral philosophy and bioethics in the philosophy department at the Universidad de Granada in Spain, examines whether current protocols prematurely consider as potential donors patients who have some chance of meaningful survival. They propose a pathway for first responders to uphold the best interests of patients even as they are being assessed and treated as potential donors.***

• ***The future of organ transplantation. Two essays explore ethical questions associated with using pigs and other animals as organ donors for humans: "[The Other Animals of Transplant's Future](#)" by Leslie A. Sharp, the Barbara Chamberlain and Helen Chamberlain Josefsberg '30 chair in anthropology at Barnard College, and "[Bodies in Transition: Ethics in Xenotransplantation Research](#)" by Sheila Jasanoff, Pforzheimer professor of science and technology studies at Harvard University's John F. Kennedy School of Government.***

- ***The case of Jahi McMath. The concept of brain death was prominent in conflicts arising after McMath, an African-American***

teenager, was declared brain dead in a California hospital in 2013 after complications from elective surgery. Rejecting this determination, her family moved her to New Jersey, whose brain death statute includes a religious exemption and where a patient covered by this exemption can be enrolled in Medicaid to pay for long-term care. For nearly four years, McMATH was kept biologically alive, until she was declared dead from cardiac arrest in New Jersey in 2018. Three essays explore the medical, ethical, and social questions that the case raised and reconsider the situation of Jahi McMATH and her family in light of recent findings on the health consequences of implicit bias: "[Lessons from the Case of Jahi McMATH](#)" by Robert D. Truog; "[The Case of Jahi McMATH: A Neurologist's View](#)" by D. Alan Shewmon; and "[Revisiting Death: Implicit Bias and the Case of Jahi McMATH](#)" by Michele Goodwin, a chancellor's professor at University of California, Irvine, and the founding director for the Center for Biotechnology and Global Health Policy.

*The special report, funded by the Boger Initiative for the Wise Use of Emerging Technologies at The Hastings Center, originated from presentations given at a 2018 conference at the Center for Bioethics at Harvard Medical School. The full text of the report, *Defining Death: Organ Transplantation and the Fifty-Year Legacy of the Harvard Report on Brain Death*, can be found [here](#).*

<http://bit.ly/2RErjD7>

Recurrent miscarriage linked to faulty sperm

Multiple miscarriages may be linked to the poor quality of a man's sperm, suggests new research.

The early-stage study, from scientists at Imperial College London, investigated the sperm quality of 50 men whose partners had suffered three or more consecutive miscarriages.

The research, [published in the journal *Clinical Chemistry*](#), revealed that, compared to men whose partners had not experienced miscarriages, the sperm of those involved in the study had higher levels of DNA damage.

The study team hope these findings may open new avenues to finding treatments to reduce the risk of miscarriage.

Recurrent miscarriage affects around one in 50 couples in the UK, and is defined as the consecutive loss of three or more pregnancies before 20 weeks gestation.

Until recently recurrent miscarriage was thought to be caused by health issues with the mother, such as infection or immune problems. However, doctors are now realising sperm health may also play a role, explained Dr Channa Jayasena, lead author of the research from Imperial's Department of Medicine: "Traditionally doctors have focused attention on women when looking for the causes of recurrent miscarriage. The men's health - and the health of their sperm, wasn't analysed.

"However, this research adds to a growing body of evidence that suggests sperm health dictates the health of a pregnancy. For instance, previous research suggests sperm has an important role in the formation of the placenta, which is crucial for oxygen and nutrient supply to the foetus."

In the new research, the team analysed the sperm of 50 men who were patients at the Recurrent Miscarriage Clinic at St Mary's Hospital in London, part of Imperial College Healthcare NHS Trust. They then compared the results to the sperm health of 60 male volunteers whose partners had not suffered miscarriage.

The analysis revealed sperm from men with partners who had suffered recurrent miscarriage had twice as much DNA damage compared to the control group.

The research team suggest this DNA damage may be triggered by so-called reactive oxygen species.

There are molecules formed by cells in semen (the fluid that contains sperm cells) to protect sperm from bacteria and infection. However, in high enough concentrations the molecules can cause significant damage to sperm cells.

The results from the study revealed sperm from men whose partners had suffered miscarriage had a four-fold increase in the amount of reactive oxygen species compared to the control group.

The research team are now investigating what may trigger high levels of these reactive oxygen species.

Dr Jayasena explained: "Although none of the men in the trial had any ongoing infection such as chlamydia - which we know can affect sperm health - it is possible there may be other bacteria from previous infections lingering in the prostate gland, which makes semen. This may lead to permanently high levels of reactive oxygen species."

He added there is increasing evidence obesity can lower sperm health - possibly because high levels of body fat can trigger an increase in reactive oxygen species. Therefore the team are analysing the metabolic health of the 50 men in the study, and assessing weight and cholesterol levels.

The men whose partners had suffered miscarriage were also slightly older than the control group - with an average age of 37 compared to 30, and were slightly more overweight. The team are now investigating whether these factors may have affected the levels of reactive oxygen species.

Dr Jayasena concluded: "Although this is a small study, it gives us clues to follow. If we confirm in further work that high levels of reactive oxygen species in semen increase the risk of miscarriage, we could try to develop treatments that lower these levels and increase the chance of a healthy pregnancy.

"It has taken medicine a long time to realise sperm health has a role to play in miscarriage - and that the cause doesn't lie solely with women. Now we realise both partners contribute to recurrent miscarriage, we can hopefully get a clearer picture of the problem and start to look for ways of ensuring more pregnancies result in a healthy baby."

The work was supported by the Medical Research Council, Biotechnology and Biological Sciences Research Council, and the National Institute for Health Research Imperial Biomedical Research Centre.

<http://bit.ly/2Apxyu>

Our bodies may cure themselves of diabetes in the future

Researchers have found that neighbour-cells can take over functions of damaged or missing insulin-producing cells; the discovery may lead to new treatments for diabetes

Diabetes is caused by damaged or non-existing insulin cells inability to produce insulin, a hormone that is necessary in regulating blood sugar levels. Many diabetes patients take insulin supplements to regulate these levels.

[In collaboration with other international researchers](#), researchers at the University of Bergen have discovered that glucagon-producing cells in the pancreas, can change identity and adapt so that they do the job for their neighbouring damaged or missing insulin cells.

"We are possibly facing the start of a totally new form of treatment for diabetes, where the body can produce its own insulin, with some start-up help," says Researcher Luiza Ghila at the Raeder Research Lab, Department of Clinical Science, University of Bergen (UiB).

Cells can change identity

The researchers discovered that only about 2 per cent the neighbouring cells in the pancreas could change identity. However, event that amount makes the researchers are optimistic about potential new treatment approaches.

For the first time in history, researchers were able to describe the mechanisms behind the process of cell identity. It turns out that this is not at passive process, but is a result of signals from the surrounding cells. In the study, researchers were able to increase the number of insulin producing cells to 5 per cent, by using a drug that

influenced the inter-cell signalling process. Thus far, the results have only been shown in animal models.

"If we gain more knowledge about the mechanisms behind this cell flexibility, then we could possibly be able to control the process and change more cells' identities so that more insulin can be produced," Ghila explains.

Possible new treatment against cell death

According to the researchers, the new discoveries is not only good news for diabetes treatment.

"The cells' ability to change identity and function, may be a decisive discovery in treating other diseases caused by cell death, such as Alzheimer's disease and cellular damage due to heart attacks", says Luiza Ghila.

Facts: Pancreas

- *There are three different types of cells in the pancreas: alpha-cells, beta-cells and delta-cells. These produce different kinds of hormones for blood sugar regulation.*
- *The cells make clusters. Alpha-cells produce glucagon, which increases the blood sugar levels. Beta-cells produce insulin, which decreases glucagon levels. Delta-cells produce somatostatin, which controls the regulation of the Alpha and Beta Cells.*
- *Persons with diabetes have a damaged beta-cell function, and therefore have constant high blood sugar levels.*

<https://bbc.in/2SDtDYf>

Fish fumes blamed for allergy death of Brooklyn boy *Authorities investigating the death of an 11-year-old boy in Brooklyn are said to be looking into whether fish cooking nearby could have been to blame.*

Cameron Jean-Pierre, who had a fish allergy, fell unconscious on New Year's Day at his grandmother's house.

An official cause of death from a medical examiner is still pending.

But his family have told US media they believe he died after a severe asthma attack was prompted by fish protein he inhaled in the air.

[The boy's mother, Jody Pottingr, said her son suddenly became ill while visiting his grandmother's house](#), where a traditional Caribbean cod dish had been cooking.

"They thought that he left... I guess they forgot something at the house and went back, and he went in the house and then he inhaled the fish," she told ABC News.

His mother says Cameron was first diagnosed with the allergy at school, after becoming sick after a lunch.

Ms Pottingr said she wants his story to serve as a warning to other parents whose children have allergies.

"I just want whatever happened to my family not to happen to someone else," Jody Pottingr, the mother of Cameron Jean-Pierre, told ABC News on Thursday. <https://t.co/NcozCCzvAD>

— KRDO NewsChannel 13 (@KRDONC13) [January 4, 2019](#)

Cameron's father, [Steven Jean-Pierre, told the Washington Post newspaper that he gave his son a nebuliser device](#) when he began to wheeze and gasp, but it failed to restore his breathing.

["My son's last words were 'Daddy I love you, daddy I love you,'"](#) he told ABC7 New York, while crying.

"He gave me two kisses, two kisses on my face. He said, 'I feel like I'm dying.' I said, 'Don't say that. What are you talking about. Don't say that.'"

When police arrived they found the 11-year-old unconscious and unresponsive. He was later declared dead at a nearby hospital.

The US-based Food Allergy Research and Education group say [about 15 million Americans, including six million children, are estimated to have food allergies.](#)

Fish is one of the eight most-common allergens required by federal law on food labelling.

Although direct consumption is the most obvious source of risk from foods, [the American College of Asthma and Immunology recommends people with fish allergies should also avoid areas where it is cooking](#), because proteins may be released into the air.

US reality television star Bethenny Frankel, who also has a severe fish allergy, revealed on Thursday a flight she was on was forced to turn around because of bass being cooked on board.

She shared her experience in a series of posts and said she had warned the airline in advance.

I don't care about the meal. Being trapped in a cabin w no windows w cooking fish is a death trap. <https://t.co/h911JIMm6d>

— Bethenny Frankel (@Bethenny) [January 3, 2019](#)

To clarify: some allergens are transmitted by touch & air. Fish is one & is fatal. The more exposure to them, the more susceptible. It's not like an immunity thing where more exposure means less susceptible. It's opposite. I've always kept it quiet but that's over now.

— Bethenny Frankel (@Bethenny) [January 3, 2019](#)

Ms Frankel described the environment on-board as a potential "death trap" for sufferers.

She shared the story of Cameron's death to her 1.6m followers as a warning on the dangers of airborne allergens.

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

The Sounds That Haunted U.S. Diplomats in Cuba?

Lovelorn Crickets, Scientists Say

Diplomatic officials may have been targeted with an unknown weapon in Havana. But a recording of one "sonic attack" actually is the singing of a very loud cricket, a new analysis concludes.

By Carl Zimmer

In November 2016, American diplomats in Cuba complained of persistent, high-pitched sounds followed by a range of symptoms, including headaches, nausea and hearing loss.

Exams of nearly two dozen of them eventually revealed signs of concussions or other brain injuries, and speculation about the cause turned to weapons that blast [sound](#) or [microwaves](#). Amid an international uproar, a recording of the sinister droning was widely circulated in the news media.

On Friday, two scientists presented evidence that those sounds were not so mysterious after all. They were made by crickets, the researchers concluded.

That's not to say that the diplomats weren't attacked, the scientists added — only that the recording is not of a sonic weapon, as had been suggested.

Alexander Stubbs of the University of California, Berkeley, and Fernando Montealegre-Z of the University of Lincoln in England studied a recording of the sounds made by diplomats and [published by The Associated Press](#).

"There's plenty of debate in the medical community over what, if any, physical damage there is to these individuals," said Mr. Stubbs in a phone interview. "All I can say fairly definitively is that the A.P.-released recording is of a cricket, and we think we know what species it is."

Mr. Stubbs presented the results of the analysis at the annual meeting of the Society of Integrative and Comparative Biology. He and Dr. Montealegre-Z also [posted an early version of their study](#) online. They plan to submit the paper to a scientific journal in the next few days.

When Mr. Stubbs first heard the recording, he was reminded of insects he came across while doing field work in the Caribbean. When he and Dr. Montealegre-Z downloaded the sound file, they found that its acoustic patterns — such as the rate of pulses and the strongest frequencies — were very similar to the songs of certain kinds of insects.

Male singing insects produce regular patterns during courtship. Females are attracted to certain males based on their songs, which has led to the evolution of different songs in different species.

If the sounds heard by the diplomats were made by insects, Mr. Stubbs and Dr. Montealegre-Z reasoned, it might be possible to pinpoint the particular species.

To search for a match, the researchers analyzed field recordings of North American insects [stored in an online database at the University of Florida](#). They found a striking resemblance to one species in particular: the [Indies short-tailed cricket](#).

Yet the cricket's song differs from the Cuban recording in one important respect. The noises heard by the diplomats were erratic, while the insects make high-pitched, rapid-fire pulses.

Mr. Stubbs suspected that this mismatch might be an artifact of the recording itself. Diplomats made their recordings inside houses, while biologists have recorded the crickets in the wild.

So Mr. Stubbs played the cricket recording in a house. As the calls bounced off the walls, they echoed in a pattern similar to the irregular pulses heard on the Cuban recording.

The song of the Indies short-tailed cricket "matches, in nuanced detail, the A.P. recording in duration, pulse repetition rate, power spectrum, pulse rate stability, and oscillations per pulse," the scientists wrote in their analysis.

Experts on cricket songs said the analysis was well done. "It all seems to make sense," said Gerald Pollack of McGill University, who studies acoustic communication among insects. "It's a pretty well supported hypothesis."

When the American diplomats first complained of the strange noises in Cuba, they dismissed the possibility that insects were responsible. But short-tailed crickets are exceptional: They have long been known to make a tremendous racket.

"The song of the males of this cricket, here, is a continuous ringing z-z-z-z-z-z- of tremendous volume and penetration which practically fills a room with veritable din," an entomologist in the Dominican Republic [reported in 1957](#).

Mr. Stubbs recorded short-tailed crickets while in Costa Rica, and he found their songs overpowering. "They're incredibly loud," he said. "You can hear them from inside a diesel truck going forty miles an hour on the highway."

The Indies short-tailed cricket is known to live in the Florida Keys, Jamaica and Grand Cayman. A closely related cricket is known to live in Cuba, and Mr. Stubbs suspects that its Indies cousin lives there, too.

Mr. Stubbs said that his conclusion does not rule out an attack on American diplomats. But the sounds linked to the initial complaints may have been a red herring.

"It's entirely possible that they got sick with some other completely unrelated thing that was not a sonic attack, or that they were targeted in some other way," he said.

Dr. Douglas Smith, who led the medical examination of the American diplomats, questioned how much a single recording could reveal about the experience. Some patients didn't report hearing anything unusual, he noted, while others heard a range of sounds.

"It could be like a low-tone motor, or metal scraping, or like driving in a car with the back window open," said Dr. Smith, director of the Center for Brain Injury and Repair at the University of Pennsylvania. Dr. Smith wouldn't rule out the possibility that some diplomats might have heard crickets, but said that had no bearing on the real damage they've suffered.

"These patients have gone through a lot," he added. "I would like to know what the sounds are, but for us the more important thing is really what's going on in the patients' brains and what we can do about it."

<http://bit.ly/2AwwQlc>

Prehistoric Shark May Have Caught a Dinner on the Wing

A fossil tooth hints at a startling interaction between an ancient shark and a flying reptile.

By [Brian Switek](#)

Museum fossil halls can be overwhelming. There's so much to see. Towering skeletons, bones behind glass, dozens of text placards, and looping multimedia displays, all competing with each other for awe and attention. It's easy to breeze through lest you become fossilized in the hall yourself. But take your time and secrets may jump out at you. One of my favorites is hidden in an upstairs alcove at the Natural History Museum of Los Angeles' Dinosaur Hall. It's a curiously-placed shark tooth.



Cretoxyrhina nabs a Pteranodon snack in the Western Interior Seaway.

[Mark Witton, from Hone et al 2018](#)

The tooth isn't by itself. The Cretaceous fossil is nestled against the neck vertebrae of a *Pteranodon* - one of the most charismatic of the flying pterosaurs - known to experts as LACM 50926. Even if you know what you're looking for, it can take a moment for it to pop out from the osteological background. But it's there, the triangular, serrated profile the remnant of a large shark called *Cretoxyrhina mantelli* that used to swim a warm seaway divided North America in two circa 75 million years ago.

This fossil, paleontologists Dave Hone, Mark Witton, and Michael Habib note in [a study of the fossil](#), is an association. It puts *Pteranodon* and *Cretoxyrhina* in the same place at the same time, the fossils buried way back in the Late Cretaceous. And it's a rare one. Of over a thousand *Pteranodon* fossils collected so far, only seven

have been found with signs of interactions with sharks. The question is what kind of interaction brought this *Cretoxyrhina* tooth to come to rest against the neck bone of the *Pteranodon*.

The *Pteranodon* bones don't show bite marks - as other fossils chomped on by *Cretoxyrhina* do - and the tooth tip isn't jammed into the bone. All the same, Hone and colleagues write, there is an "intimate association of the fossils" in which the tooth is "wedged" beneath part of the *Pteranodon* vertebra. It seems unlikely that the tooth became firmly nestled in this spot by chance, and so it may be evidence of the shark biting the pterosaur.

The shark could have scavenged on the *Pteranodon* after the flying archosaur died, its carcass perhaps floating on the surface or settling on the bottom. Then again, *Pteranodon* is thought to have been a fish-eating species that was able to launch from the water as some modern seabirds do. Perhaps one such *Pteranodon* was in repose, bobbing along, when assaulted from below by *Cretoxyrhina*. It's a scene both alien and familiar, an interaction played out tens of millions of years before tiger sharks and young albatrosses would play out the same violent dance. Seek out the display, if you have the chance. It's an opportunity to look, and wonder, about what a now-static monument might tell us about ancient life.