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## How to make irresistible traps for Asian giant hornets using sex

*Traps placed near nests in China attracted thousands of males*

By [Erin Garcia de Jesús](#)

Male Asian giant hornets captivated by the chemical signals of a ready-to-mate queen could one day find themselves stuck in a trap instead.

In a new study, scientists identified three chemicals in the sex pheromone of Asian giant hornet queens. When traps with those chemicals were placed near the hornets' nests in China — part of their native range — [the traps ensnared thousands of males but no other insects](#), researchers report March 14 in *Current Biology*.



*Chemicals in the sex pheromone of Asian giant hornet queens could help researchers build better traps for the invasive insect in North America.*

*Shown are two hornets outside a honeybee colony. Dong Shihao*

The finding is a step toward designing pheromone traps, a common tool to monitor or control insect populations, for these hornets, says James Nieh, a behavioral ecologist at the University of California, San Diego.

Starting in 2019, nests housing Asian giant hornets (*Vespa mandarinia*) — nicknamed “murder hornets” for their habit of feasting on honeybees — have [popped up in a few places](#) in western North America (*SN*: 5/29/20). Studies hint that [the insects could spread](#) across eastern Washington, Oregon and British Columbia in Canada, and scientists have launched efforts to control the invasion (*SN*: 10/1/20). The Washington State Department of Agriculture even [encourages state residents to help trap the hornets](#)

using plastic bottles, orange juice and rice cooking wine.

But potent insect traps should provide “something that would ideally be irresistible,” Nieh says.

Using gas chromatography and mass spectrometry, Nieh and colleagues identified hexanoic acid, octanoic acid and decanoic acid as key components of a queen’s sex pheromone. In the lab, male hornet antennae reacted — a sign of attraction — to each of the pure compounds as well as a mixture of the three. The team then crafted traps using a sticky board, a dummy male hornet and a vial filled with each of the individual pure acids, a mix of the three or extracts from the pheromone-secreting glands from a queen.



*North American researchers have mounted efforts to track down Asian giant hornet nests — like this one collected in its native territory in Kunming, China — in an effort to control the invasive insect’s spread. Dong Shihao*

The male hornets had a clear preference for the queen extracts, though the isolated chemicals as well as mixes of the three trapped many hornets as well. In one test, for example, extracts from just one gland trapped about 500 male hornets — more than twice the number trapped by full concentrations of the three-chemical cocktail, which itself performed on par with two of the undiluted isolated chemicals. Control traps lacking the extracts or pure chemicals, meanwhile, attracted few males.

Because male Asian giant hornets were most attracted to the pheromone gland chemicals compared with the individual acids or the mix, that means there are probably other compounds in the pheromone that could make traps even more effective, Nieh says. It’s unclear whether the traps work over longer distances. But hornet queens’ sex pheromones probably lure males from farther

away to avoid “incestuous interbreeding,” Nieh says. The traps could be most useful in late fall during the hornets’ mating season. The finding is “important work,” says Timothy Lawrence, an apiculturist at Washington State University in Coupeville, who wasn’t involved with the study. Finding a way to attract worker hornets, not just males in search of a mate, would be great, but the results are still a “major step forward,” he says. “The sooner we find a reliable way to attract males and find nests, the better.”

#### Citations

S. Dong et al. [Identification of giant hornet \*Vespa mandarinia\* queen sex pheromone components](https://doi.org/10.1016/j.cub.2022.01.065). *Current Biology*. Published online March 14, 2022. doi: 10.1016/j.cub.2022.01.065.

<https://bit.ly/3CQQQ0k>

### **Benefits of Taking Statins Called Into Question: Link Between High Cholesterol and Heart Disease “Inconsistent”**

***Link between ‘bad’ cholesterol and poor health outcomes may not be as strong as previously believed***

New research from RCSI University of Medicine and Health Sciences has revealed that the link between ‘bad’ cholesterol (LDL-C) and poor health outcomes, such as heart attack and stroke, may not be as strong as previously thought.

Published in *JAMA Internal Medicine*, the research questions the efficacy of statins when prescribed with the aim of lowering LDL-C and therefore reducing the risk of cardiovascular disease (CVD).

Previous research has suggested that using statins to lower LDL-C positively affects health outcomes, and this is reflected in the various iterations of expert guidelines for the prevention of CVD. Statins are now commonly prescribed by doctors, with one third of Irish adults over the age of 50 taking statins, according to previous research.

The new findings contradict this theory, finding that this

relationship was not as strong as previously thought. Instead, the research demonstrates that lowering LDL-C using statins had an inconsistent and inconclusive impact on CVD outcomes such as myocardial infarction (MI), stroke, and all-cause mortality.

In addition, it indicates that the overall benefit of taking statins may be small and will vary depending on an individual’s personal risk factors.

The lead author on the paper is Dr. Paula Byrne from the HRB Centre for Primary Care Research based in RCSI’s Department of General Practice. Commenting on the findings, Dr. Byrne said: “The message has long been that lowering your cholesterol will reduce your risk of heart disease, and that statins help to achieve this. However, our research indicates that, in reality, the benefits of taking statins are varied and can be quite modest.”

The researchers go on to suggest that this updated information should be communicated to patients through informed clinical decision-making and updated clinical guidelines and policy.

*Reference: “Evaluating the Association Between Low-Density Lipoprotein Cholesterol Reduction and Relative and Absolute Effects of Statin Treatment” 14 March 2022, JAMA Internal Medicine. DOI: 10.1001/jamainternmed.2022.0134*

*This important discovery was a collaboration with Professor Susan M Smith, also of RCSI and with researchers from the University of New Mexico, USA, (Dr. Robert DuBroff), the Institute for Scientific Freedom in Denmark (Dr Maryanne Demasi), Bond University in Australia (Dr. Mark Jones) and independent researcher Dr. Kirsty O’Brien.*

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

### **High Triglycerides May Increase Risk of Second Stroke – Even With Statin Drugs**

***Study found an association even in people taking statin drugs meant to lower triglycerides***

Stroke can have many causes. An atherothrombotic stroke is caused by a clot that forms from plaques that build up within blood vessels in the brain.

A new study suggests that people who have this type of stroke who

also have higher levels of triglycerides, a type of fat, in their blood may have a higher risk of having another stroke or other cardiovascular problems one year later, compared to people who had a stroke but have lower triglyceride levels.

The research is published in the March 16, 2022, online issue of *Neurology*, the medical journal of the American Academy of Neurology. The study found an association even when people were taking statin drugs meant to lower triglycerides and protect against heart attack and stroke.

Elevated triglyceride levels are thought to contribute to hardening of the arteries and increased risk of heart attack, heart disease, and stroke.

“Our study suggests that for people who had atherothrombotic stroke, having elevated levels of triglycerides in their blood is a risk factor for having another stroke or other cardiovascular problems in the future, and we found that to be true even if the person is on statin therapy,” said study author Takao Hoshino, MD, of the Tokyo Women’s Medical University in Japan.

“The good news is that statin medications are just one therapy for high triglycerides—diet and exercise can also be effective ways to reduce the levels in your blood at little or no cost.”

The study looked at 870 people who had a stroke or transient ischemic attack. Their average age was 70. Of those, 217, or 25%, had elevated triglyceride levels, defined as fasting triglycerides levels 150 milligrams per deciliter or higher.

Researchers followed up with the participants one year later to find out if there was an association between high triglyceride levels and having another stroke, acute coronary syndrome, which is any condition caused by a sudden reduction of blood flow to the heart, or death due to vascular causes.

After adjusting for factors like cholesterol level and statin use, researchers found that people who had high triglyceride levels had a

21% greater risk of death, stroke or heart condition one year, compared to 10% greater risk for those with lower levels.

When researchers looked specifically at people who had another stroke after an atherothrombotic stroke, they found that 14 out of 114 people with normal triglyceride levels, or 12%, had one during the study, compared to 33 out of 217 people, or 16%, of those with elevated levels.

For acute coronary syndrome, one out of 114 people, or 0.9%, with normal triglyceride levels developed the heart condition one year after an atherothrombotic stroke, compared to five out of 60, or 8%, of those with elevated levels.

Hoshino notes the study did not find an association between higher triglyceride levels and future cardiovascular problems in people who had a different type of stroke called cardioembolic stroke.

“More research is needed, but for people who have had an atherothrombotic stroke, triglyceride levels may emerge as a key target for preventing future strokes and other cardiovascular problems,” Hoshino said.

“Statin therapy is still an effective treatment for people with high triglyceride levels, but our study highlights how important it is to look at all the tools a person can use to lower their triglycerides, including diet modifications, exercise and taking omega-3 fatty acids.”

The study does not prove that lowering high triglyceride levels will prevent people with atherothrombotic strokes from having cardiovascular problems later; it only shows an association.

A limitation of the study is that researchers considered only the participants’ fasting levels of triglycerides.

*Reference: “Prognostic Role of Hypertriglyceridemia in Patients With Stroke of Atherothrombotic Origin” 16 March 2022, Neurology.*

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

## Not One, Not Two, But Three Planetary Systems Are Forming Around This Binary Star

*Astronomers have spied three whole systems of exoplanets being born around one binary star.*

[Michelle Starr](#)

SVS 13 is a binary star system 980 light-years away, and the complex structures of dust around it are shedding light on how planetary systems are born in these fascinating environments.

Since a large proportion of stars is bound up in multiple-star systems, this has implications for our understanding of planet formation and evolution.



*Artist's impression of a binary protostar.* (ESO/L. Calçada)

"Our results have revealed that each star has a disk of gas and dust around it and that, in addition, a larger disk is forming around both stars," [says astronomer Ana Karla Díaz-Rodríguez](#) of the Institute of Astrophysics of Andalusia (IAA-CSIC) in Spain and the ALMA Regional Centre at the University of Manchester in the UK.

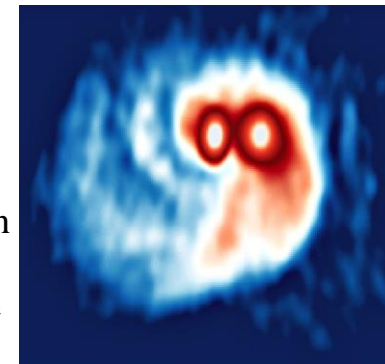
"This outer disk shows a spiral structure that is feeding matter into the individual disks, and in all of them planetary systems could form in the future. This is clear evidence for the presence of disks around both stars and the existence of a common disk in a binary system."

Stars are born from dense knots in clouds of molecular gas floating in space. Under the right conditions, one of these knots will collapse under its own gravity and start spinning. As it spins, the material around it flattens into a disk that spools into the star, feeding its growth.

When the star reaches the end of its formation, whatever is left becomes the protoplanetary disk. All the leftover dust and gas

jostles around, and eventually comes together in big enough clumps that build up to form planets, asteroids, comets, moons, dwarf planets and all the other chunky fun you can find in a planetary system.

We know this occurs around single stars pretty readily; the Solar System alone is proof that it can happen, and most of the exoplanets confirmed to date have been found orbiting single stars. It's thought that a system of multiple stars, creating an environment that is more gravitationally complicated, might be more hostile to the planet formation process.



*ALMA image of the disks in SVS 13.* (Díaz-Rodríguez et al.)

SVS 13 is relatively close, in a star-forming cloud called the Perseus molecular cloud, and very young. It consists of two stars with a combined mass about equal to that of the Sun, locked in a very tight orbit; they are only about 90 astronomical units apart (Pluto is about 40 astronomical units from the Sun).

To learn more about the space around this binary protostar, as well as the stars themselves, Díaz-Rodríguez and her team studied 30 years of observations from the National Radio Astronomy Observatory's [Very Large Array](#). They also took new observations with the [Atacama Large Millimeter/submillimeter Array](#), known as ALMA.

This allowed the team to reconstruct the binary's orbit, and determine the masses of the stars, the orientation of the system, and the sizes and masses of the disks. They found two small disks, one with a dust radius of 12 astronomical units, and the other with a dust radius of 9 astronomical units, both with a gas radius of 30 astronomical units.

The huge spiral circumbinary disk, enclosing both stars, has spiral



arms that extend 500 astronomical units.

"At the IAA we began studying this system twenty-five years ago. We were surprised when we discovered that SVS 13 was a radio binary, because only one star is seen in the optical," [said astronomer Guillem Anglada](#) of IAA-CSIC.

"It was very strange to discover a pair of twin stars where one of them seemed to have evolved much faster than the other. We designed several experiments to get more details and to find out if in such a case either of the stars could form planets. Now we have seen that both stars are very young, and that both can form planets." There are more reasons to be interested in the system than resolving the debates around the ages of the two stars. Previous studies of the system identified molecules in the dust and gas around the SVS 13, [including complex organic molecules](#) that are precursors to the building blocks of life.

"This means that when planets begin to form around these two suns," [Díaz-Rodríguez said](#), "the building blocks of life will be there." We might not be around to see the process unfold, but knowing that those molecules are there may help us unravel the mystery of our existence in the Universe.

The research has been accepted by *The Astrophysical Journal*, and is available on preprint server [arXiv](#).

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

## **Potential Supplement for Longer Human Lifespans: Natural Plant Extract Makes Worms Live 40% Longer**

*First study on how a natural plant extract of a particular kind of wormwood, Artemisia scoparia, could lead to longer lifespans, including potentially for humans. Key lies in enhanced metabolic health.*

A research team in the LSU Department of Biological Sciences led by Assistant Professor Adam Bohnert has published a landmark study linking greater metabolic health—achieved through a natural

plant extract—with longer lifespans in *C. elegans*, commonly known as roundworms. Although worms and humans don't appear to have much in common, the researchers say there is good reason to assume the results could be replicated in people, as the study builds on previous work on metabolic health in mice, conducted at LSU's Pennington Biomedical Research Center under Professor Jacqueline Stephens.

"The reason this study made so much sense to do in worms is because worms live for only about three weeks, so in a month or two, we had definite results," said Bhaswati Ghosh, LSU student and lead author of the published study.



*Artemisia scoparia*. Credit: Creative Commons / Mokkie Bohnert's and Stephens's research teams are interested in studying the effects of *Artemisia scoparia* (茵陳ハマヨモギ), a natural plant extract of a particular kind of wormwood that is native to Asia. Made from its leaves, the extract was fed to worms in various doses in Bohnert's lab. The treated worms who received the highest and second-highest dose showed near-immediate improvement in their metabolic health. Not only did the treated worms live up to 40% longer than the untreated control group—they also grew fat and a little slow, as their increased body mass made it harder for them to move around. But the worms also became healthier and more resilient. It was easier for the treated worms to handle stress. In addition, the researchers found that *Artemisia scoparia* helps convert unhealthy fat stores into healthy fat stores in the body. This study adds to previous work by Bohnert and LSU Assistant Professor Alyssa Johnson on ways [dietary changes influence aging at a cellular level](#). Now, it appears *Artemisia scoparia* also can activate many pro-longevity pathways in the body, and effectively turn on multiple genes involved in the lifespan regulation process.

“Until recently, it wasn’t really known how aging could be modified through diet, or how core metabolic signaling pathways influence longevity,” Bohnert said. “What we’ve been able to show is that a natural extract can come in and influence these pathways in much the same way a genetic mutation would.”

The study positions aging as non-deterministic and under our control.

“Importantly, it gives us a therapeutic standpoint,” Bohnert said. “We know age is the primary risk factor for many diseases, such as cancer and cardiovascular disease, but if you think of aging as a treatable disease, you can actually treat many diseases at once.”

While the worms who lived the longest were fed *Artemisia scoparia* during the time they reached reproductive maturity, or adulthood, Bohnert’s team also observed significant effects in worms treated for the first time in middle age. Instead of a 40% increase in lifespan, these worms still managed to live about 20% longer.

The study offers a first look at how *Artemisia scoparia* could change aging and longevity. It also reinforces the connection between metabolic health, fat regulation, and longer lifespans.

“Usually people think of fat as ‘bad,’ but in these cases, it seems good, and actually pro-longevity,” Bohnert said. “*Artemisia scoparia* could have some exciting potential as a dietary supplement.”

“Also, the simple fact that an organism is short, fat, and slow-moving does not necessarily qualify it as in poor health,” Ghosh added. “These phenotypes must be considered in the full context of other parameters, including lifespan.”

There is currently no recommendation for humans to take *Artemisia scoparia* as a supplement or any indication of what an effective and safe dosage could be. The researchers investigated several kinds of related plant extracts and only observed positive effects on fat

regulation and longevity with *Artemisia scoparia*. Common wormwood, *Artemisia absinthium*, used as an ingredient in the alcoholic beverage absinthe, is moderately poisonous and was not included in the study.

*Reference: “A fat-promoting botanical extract from Artemisia scoparia exerts geroprotective effects on C. elegans lifespan and stress resistance” by Bhaswati Ghosh, MSc, Hayden J Guidry, BSc, Maxwell Johnston and K Adam Bohnert, PhD 15 February 2022, The Journals of Gerontology. DOI: 10.1093/gerona/glac040*

*This work was funded by a pilot grant through Pennington Biomedical’s NIH-funded Botanicals Dietary Supplements Research Center. The study was published on February 15, 2022 in The Journals of Gerontology.*

<https://bit.ly/3tks5aj>

## **The Time of Day That People With Diabetes Eat May Be Just As Important as Portion Size and Calories**

*Study finds people with diabetes who eat less processed food at night may live longer and eating carbs earlier in the day is linked to better heart health.*

The time of day that people with diabetes eat certain foods may be just as important to their well-being as portion size and calories, according to a new study published in the Endocrine Society’s *Journal of Clinical Endocrinology and Metabolism*.

Mealtimes should be in line with the biological clock—a natural, internal process that regulates the sleep–wake cycle and repeats every 24 hours. Health outcomes for people with diabetes may be improved if certain foods are eaten at different times of the day.

“We observed that eating potatoes in the morning, whole grains in the afternoon, greens and milk in the evening and less processed meat in the evening was associated with better long-term survival in people with diabetes,” said Qingrao Song, M.D., of Harbin Medical University in Harbin, China. “Nutritional guidelines and intervention strategies for diabetes should integrate the optimal consumption times for foods in the future.”

The researchers analyzed data from 4,642 people with diabetes

from the National Health and Nutrition Examination Survey to determine their risk of dying from heart disease. They found people with diabetes who ate potatoes or starchy vegetables in the morning, whole grains in the afternoon, and dark vegetables such as greens and broccoli and milk in the evening were less likely to die from heart disease. Those who ate a lot of processed meat in the evening were more likely to die from heart disease.

*Reference: "The Association of Consumption Time for Food with Cardiovascular Disease and All-Cause Mortality Among Diabetes Patients" 15 March 2022, The Journal of Clinical Endocrinology & Metabolism.*

*Other authors of this study include: Wenbo Jiang, Jia Zhang, Yunyan Chen, Hongyan Jiang, Yujia Long, Ying Li, Tianshu Han, Hongru Sun and Wei Wei of Harbin Medical University.*

*The study received funding from the National Natural Science Foundation of China.*

<https://bit.ly/3tgC7Jn>

**Battery-free sensor-carrying device floats in the wind**  
***Researchers from the University of Washington have developed a tiny sensor-carrying device that can be blown by the wind and provide environmental insights.***

Wireless sensors can monitor how temperature, humidity and other environmental conditions vary across large swaths of land such as farms or forests. These tools have applications in areas such as monitoring climate change and digital agriculture, but deploying sensors across a large area can be time-consuming and expensive.

Inspired by how dandelions use the wind to distribute their seeds, the team's sensor-carrying device is around 30 times as heavy as a 1 mg dandelion seed, but can reportedly travel up to 100 metres in a moderate breeze once released by drone.

The device can hold at least four sensors. It uses solar panels to power its onboard electronics and can share sensor data up to 60 metres away, researchers said. The device uses backscatter, a method involving sending information by reflecting transmitted signals, to wirelessly send data back to researchers.

"We show that you can use off-the-shelf components to create tiny things," said senior author of the [study](#) Shyam Gollakota, a UW professor in the Paul G. Allen School of Computer Science & Engineering.

"Our prototype suggests that you could use a drone to release thousands of these devices in a single drop. They'll all be carried by the wind a little differently, and basically you can create a 1,000-device network with this one drop."

Gollakota described the sensor-carrying device as 'transformational', because it could currently take months to deploy so many sensors.

The team needed to develop a shape that would allow the system to take its time falling to the ground so that it could be 'tossed around' by a breeze. Researchers said they tested 75 designs to determine what would lead to the smallest 'terminal velocity' or the maximum speed a device would have as it fell through the air.

"The way dandelion seed structures work is that they have a central point and these little bristles sticking out to slow down their fall," said lead author Vikram Iyer, a UW assistant professor in the Allen School. "We took a 2D projection of that to create the base design for our structures. As we added weight, our bristles started to bend inwards. We added a ring structure to make it more stiff and take up more area to help slow it down."

The solar-powered devices landed with the solar panels facing upright 95 per cent of the time according to researchers, with their shape and structure allowing them to flip over in a similar way to a dandelion seed.

However, the sensors stop working after the sun goes down and need energy to get started in the morning when the sun comes up. The team designed the electronics to include a capacitor that can store some charge overnight.

"Then we've got this little circuit that will measure how much



energy we've stored up and, once the sun is up and there is more energy coming in, it will trigger the rest of the system to turn on because it senses that it's above some threshold," Iyer said.

While the device will keep going until it physically breaks down, one drawback is that electronics will be scattered across the ecosystem of interest. Researchers are now studying how to make the systems more biodegradable.

<https://wb.md/3CT4Oaz>

## Opting Out of Dialysis Not Instant Death Sentence for Kidney Disease

*Findings challenge common misconception that the only alternative to dialysis is no care or death*

Pam Harrison

Many older patients with advanced kidney disease who decide to forgo dialysis still survive for several years after making their decision and have a good quality of life until their final days, a new systematic review of cohort studies suggests.

"Our findings challenge the common misconception that the only alternative to dialysis for many patients with advanced [chronic kidney disease](#) is no care or death," say Susan Wong, MD, Renal Dialysis Unit, Seattle, Washington, and colleagues in their review, [published online](#) March 14 in *JAMA Network Open*.

In an [accompanying commentary](#), Christine Liu, MD, and Kurella Tamura, MD, MPH, note: "The decision to initiate dialysis or focus on active alleviation of symptoms, known as conservative care...is likely one of the consequential decisions [patients] will face."

"[But] in reality, dialysis is viewed as the default treatment for kidney failure and the option to forgo dialysis treatment is often not explicitly discussed," they add.

"We believe it is time to broaden the scope of kidney replacement therapy registries to include persons who receive conservative treatment of kidney failure...and we need to address the

conservative care information gap so that lack of awareness is no longer a barrier to informed decision making," Liu and Tamura, both from the Stanford University School of Medicine, California, note.

The work by Wong and colleagues "dispels the notion that conservative care for kidney failure means a grim and near-immediate death. The study advances the idea that a conservative care approach can provide time and sustain quality of life to support patients' life goals," they emphasize.

### Conservative Care Assessed in 41 Studies

The review included 41 studies involving 5102 patients with a mean age ranging from 60 to 87 years conducted in the UK, Europe, and Asia.

Median survival of cohorts ranged from 1 to 41 months as measured from a baseline mean estimated glomerular filtration rate (eGFR) ranging from 7 to 19 mL/min/1.73m<sup>2</sup>.

Younger patients between 70 and 79 years of age had a median survival of 7 to 41 months, the authors note, while cohorts consisting of patients 80 years of age and older had a median survival of 1 to 37 months despite overlapping ranges of baseline mean eGFRs.

During an observation period of 8 to 24 months, mental well-being improved, and physical well-being and overall quality of life were largely stable until late in the course of illness.

"Ten studies...provided information on the use of healthcare resources during follow-up," the researchers say. Patients generally experienced one to two hospital admissions, six to 16 in-hospital days, seven to eight clinic visits, and two emergency department visits per person-year. Use of acute care services was "therefore common," they note.

Not all studies provided information about end-of-life care, but those that did reported rates of hospice enrollment that ranged from



20% to 76%; hospitalization rates during the final month of life from 57% to 76%; in-hospital death rates of 27% to 68%, and in-home death rates ranging from 12% to 71%.

This indicates substantial disparity in access to supportive care near the end of life across cohorts, the authors observe.

Nevertheless, "Most patients survived several years after the decision to forgo dialysis was made," they stress.

"These findings not only suggest that conservative kidney management may be a viable and positive therapeutic alternative to dialysis, they also highlight the strengths of its multidisciplinary approach to care and aggressive symptom management."

"Collectively, our findings demonstrate the need to implement systematic and unified research methods for conservative kidney management and to develop models of care and the care infrastructure to advance practice and outcomes of conservative kidney management," they conclude.

*Wong has no financial ties to industry. Tamura has reported receiving personal fees from the American Federation for Aging Research.*

*JAMA Netw Open.* Published online March 14, 2022. [Full text](#), [Commentary](#)

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

## **Low Folate (Vitamin B9) May Be Linked to Heightened Dementia and Death Risks in Older People**

*Levels should be routinely monitored, especially given that blood levels of folate tend to tail off with age*

Low levels of folate (vitamin B9) in the blood may be linked to a heightened risk of dementia and death from any cause in older people, suggests research published online in the journal *Evidence Based Mental Health*.

Levels should be routinely monitored and deficiencies corrected in older age, especially given that blood levels of folate tend to tail off with age, with up to 1 in 5 older adults estimated to be folate deficient, say the researchers.

The evidence to date suggests that folate deficiency affects cognition and nerve signaling in the brain, making it a possible risk factor for subsequent dementia.

But the few studies that have looked at this have included small numbers of participants and produced mixed results.

And because of the time it takes for dementia to develop, it's been difficult to rule out reverse causation, whereby folate deficiency could be a consequence of pre-clinical dementia rather than its cause, they add.

They therefore wanted to see if serum folate deficiency might be linked to the risks of incident dementia and death from any cause in a large national sample of older adults, and to include the potential role of reverse causation.

They drew on the medical records of 27,188 people served by one national healthcare provider in Israel.

All the participants were aged between 60 and 75, and had had no pre-existing dementia for at least 10 years before blood folate checks began in 2013.

Their records were monitored for a diagnosis of dementia or death up to the end of 2017.

Some 3418 (just under 13%) participants were folate deficient, defined as levels below 4.4 ng/ml. Folate deficiency was associated with a substantially heightened risk of both dementia and death from any cause.

Among those who were folate deficient, the incidence of dementia was estimated at 7.96 per 10,000 person years, while death from any cause was estimated at 19.20 per 10,000 person years.

This compares with an estimated dementia incidence of 4.24 and of death from any cause of 5.36 per 10,000 person years among those who weren't folate deficient.

In percentage terms, rates of dementia were almost 3.5% and of death from any cause just under 8% among those with folate

deficiency. This compares with dementia rates of just over 3% and of death from any cause of almost 4% among those who weren't folate deficient.

After accounting for potentially influential factors, including co-existing diabetes, depression, cognitive decline, vitamin B12 deficiency, smoking, and the use of folic acid supplements, the folate deficient were 68% more likely to be diagnosed with dementia and nearly 3 times as likely to die from any cause.

Further analyses didn't significantly weaken the observed associations, but when stratified by length of monitoring period, reverse causation couldn't be ruled out.

This is an observational study, and as such, can't establish cause, particularly in light of the potential role of reverse causation, acknowledge the researchers.

But it's possible that folate deficiency might affect homocysteine levels and therefore the vascular risk of dementia, and/or compromise DNA repair of neurons, making them vulnerable to oxidative damage, which in turn might speed up brain cell aging and damage, they explain.

They conclude: "Serum concentrations of folate may function as a biomarker used to modify the risks of dementia and mortality in old age," adding that older adults should be routinely screened for folate deficiency.

"The implications for public health policy appear to be to reliably monitor serum concentrations of folate in older adults and treat deficiency for preventative measures and/or as part of implemented therapeutic strategies while regularly reviewing patients' clinical outcomes," they write.

*Reference: "Serum folate deficiency and the risks of dementia and all-cause mortality: a national study of old age" 15 March 2022, Evidence Based Mental Health.*

*DOI: 10.1136/ebmental-2021-300309*

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

## **New Experiments Hint Human Language Likely Didn't Start With Grunts**

***Researchers tested to see whether gestures or non-verbal sounds were more effective for communicating***

[Tessa Koumoundouros](#)

Our ability to elaborately communicate is one of humanity's greatest superpowers. It allows us to retain and build knowledge across generations, cooperating at a global scale unlike anything else seen on Earth. But much about how this ability evolved is still a mystery, including its origins.

Recently, a team of researchers set up some experiments to explore the trope that our early human ancestors grunted at each other as a means of communication.

As the main function of language is to convey meaning across people, the researchers tested to see whether gestures or non-verbal sounds were more effective at getting meaning across.

Two groups of 30 volunteers across different cultures (Australian and Vanuatuan) had to try and convey specified meanings using either gestures or non-verbal vocalizations – a bit like a game of charades. The same exercise was repeated with 10 sighted and 10 blind volunteers, who were tasked with producing the gestured or non-verbal communications, while a group of undergraduates tried to understand what they meant.

Successful communication was twice as high when the producers were gesturing than vocalizing, both cross-culturally and when blind or sighted, University of Western Australia cognitive scientist Nicolas Fay [explained on Twitter](#).

***"These findings are consistent with a gesture-first theory of language origin," the team [wrote in their paper](#).***

The producers' gestured signals were far more similar to each other than vocal signals – even those produced by the blind volunteers.

For example, everyone used the action of turning a key to represent the word 'lock', whereas there was no common sound they could use to embody the meaning in absence of the word itself.

"Gesture is more successful than vocalization because gestured signals are more universal than vocal signals," the researchers [concluded](#).

However, as there were [Ni-Vanuatans](#) in the study who had relatively little understanding of Western culture, some differences did emerge:

"'Chain' was communicated differently: by manually simulating a pulling action (attached to something heavy) by an Australian Producer, and by manually simulating a throwing action (that represented a chain as an anchor) by a Ni-Vanuatans Producer," wrote Fay and team.

The study makes the assumption that our cognitive systems involving language did not significantly change in the up to 500,000 years since it's [thought we developed language](#); of course, it may be that both forms of communication could have evolved simultaneously, the researchers note.

Simple things like screaming would be pretty universal too, so it's possible humans always used a combination of both.

But Fay and colleagues explain there is mixed evidence for this, with some small studies showing [vocalization can impede](#) the success of gestured communication. Other evidence also suggests we may have relied more on gestures first, including that gestures are [used more in non-human primates than vocalizations](#), and young children and chimpanzees [use similar gestures](#).

So it's possible that early on, before we came up with actual words, more complex meanings may have been articulated better by our [very clever hands](#) rather than our vocal cords.

This research was published in the [Proceedings of the Royal Society B: Biological Sciences](#).

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

## **Ancient ice reveals scores of gigantic volcanic eruptions**

### *Ice cores drilled in Antarctica and Greenland have revealed gigantic volcanic eruptions during the last ice age.*

Sixty-nine of these were larger than any eruption in modern history. According to the University of Copenhagen physicists behind the research, these eruptions can teach us about our planet's sensitivity to climate change.

For many people, the mention of a volcanic eruption conjures up doomsday scenarios that include deafening explosions, dark ash billowing into the stratosphere and gloopy lava burying everything in its path as panicked humans run for their lives. While such an eruption could theoretically happen tomorrow, we have had to make do with disaster films and books when it comes to truly [massive volcanic eruptions](#) in the modern era.

"We haven't experienced any of history's largest [volcanic eruptions](#). We can see that now. Eyjafjallajökull, which paralyzed European air traffic in 2010, pales in comparison to the [eruptions](#) we identified further back in time. Many of these were larger than any eruption over the last 2,500 years," says Associate Professor Anders Svensson of the University of Copenhagen's Niels Bohr Institute.

By comparing ice cores drilled in Antarctica and Greenland, he and his fellow researchers managed to estimate the quantity and intensity of volcanic eruptions over the last 60,000 years. Estimates of volcanic eruptions more than 2,500 years ago have been associated with great uncertainty and a lack of precision, until now.

### **Sixty-nine eruptions larger than Mount Tambora**

Eighty-five of the volcanic eruptions identified by the researchers were large global eruptions. Sixty-nine of these are estimated to be larger than the 1815 eruption of Mount Tambora in Indonesia—the largest volcanic eruption in recorded human history. So much [sulfuric acid](#) was ejected into the stratosphere by the Tambora

eruption that it blocked sunlight and caused global cooling in the years that followed. The eruption also caused tsunamis, drought, famine and at least 80,000 deaths.

"To reconstruct ancient volcanic eruptions, ice cores offer a few advantages over other methods. Whenever a really large eruption occurs, sulfuric acid is ejected into the [upper atmosphere](#), which is then distributed globally—including onto Greenland and Antarctica. We can estimate the size of an [eruption](#) by looking at the amount of sulfuric acid that has fallen," explains Anders Svensson.

In a previous study, the researchers managed to synchronize ice cores from Antarctica and Greenland—i.e., to date the respective core layers on the same time scale. By doing so, they were able to compare sulfur residues in ice and deduce when sulfuric acid spread to both poles after globally significant eruptions.

### When will it happen again?

"The new 60,000-year timeline of volcanic eruptions supplies us with better statistics than ever before. Now we can see that many more of these great eruptions occurred during the prehistoric Ice Age than in modern times. Because large eruptions are relatively rare, a long timeline is needed to know when they occur. That is what we now have," says Anders Svensson.

One may be left wondering when the next of these massive eruptions will occur. But Svensson isn't ready to make any concrete predictions:

"Three eruptions of the largest known category occurred during the entire period we studied, so-called VEI-8 eruptions (see fact box). So, we can expect more at some point, but we just don't know if that will be in a hundred or a few thousand years. Tambora sized eruptions appears to erupt once or twice every thousand years, so the wait for that may be shorter."

### How was climate affected?

When powerful enough, volcanic eruptions can affect [global](#)

[climate](#), where there is typically a 5-10- year period of cooling. As such, there is great interest in mapping the major eruptions of the past—as they can help us look into the future.

### FACT BOX: SELECTION OF KNOWN VOLCANIC ERUPTIONS

*Volcanic eruptions are classified by their size on the so-called Volcanic Explosivity Index (VEI), which ranges from 1-8.*

**Etna, Italy (1669):** 3 on the VEI scale

**Eyjafjellajökul, Iceland (2010):** 4 on the VEI scale

**Vesuvius, Italy (year 79):** 5 on the VEI scale

**Laki, Iceland (1783):** 6 on the VEI scale

**Krakatau, Indonesia (1883):** 6 on the VEI scale

**Tambora, Indonesia (1815):** 7 on the VEI scale

**Lake Taupo, New Zealand (26,500 years ago):** 8 on the VEI scale

**Toba, Indonesia (74,000 years ago):** 8 on the VEI scale

"Ice cores contain information about temperatures before and after the eruptions, which allows us to calculate the effect on [climate](#). As large eruptions tell us a lot about how sensitive our planet is to changes in the climate system, they can be useful for climate predictions," explains Anders Svensson.

Determining Earth's climate sensitivity is an Achilles heel of current climate models. Svensson concludes:

"The current IPCC models do not have a firm grasp of climate sensitivity—i.e., what the effect of a doubling of CO<sub>2</sub> in the atmosphere will be. Vulcanism can supply us with answers as to how much temperature changes when Earth's atmospheric radiation budget changes, whether due to CO<sub>2</sub> or a blanket of sulfur particles. So, when we have estimated the effects of large volcanic eruptions on climate, we will be able to use the result to improve climate models." The research was published in *Climate of the Past*.

*More information:* Jiamei Lin et al, *Magnitude, frequency and climate forcing of global volcanism during the last glacial period as seen in Greenland and Antarctic ice cores (60–9 ka)*, *Climate of the Past* (2022). [DOI: 10.5194/cp-18-485-2022](https://doi.org/10.5194/cp-18-485-2022)



<https://bit.ly/3L2fhuX>

## Nerve Repair “Glue” – Molecule Identified for Regulating the Repair of Injured Nerves

*Researchers at The University of Queensland have identified a molecule essential for regulating the repair of injured nerves, which could help people recover from nerve damage.*

The finding was made using the nematode worm *C. elegans* which has long been studied by researchers for its ability to self-repair nerve cells. Professor Massimo Hilliard and his team at UQ’s Queensland Brain Institute (QBI) have identified that the enzyme ADM-4 is an essential protein regulating the molecular glue, or fusogen, needed for nerve repair.

“We have shown that animals lacking ADM-4 cannot repair their nerves by fusion,” Professor Hilliard said. “ADM-4 must function within the injured neuron to stabilize the fusogen EFF-1 and allow the membranes of the separated nerves to merge. “An exciting part of this discovery is that ADM-4 is similar to a mammalian gene, opening up the possibility that one day we may harness this process in humans.”

Study first author, Dr. Xue Yan Ho, said the nematode provided a great platform for these studies. “Our goal is to uncover the molecules and understand their role in nerve repair in *C. elegans*,” Dr. Ho said. “If we can understand how to control this process, we can apply this knowledge to other animal models. “The hope is that one day, we can induce the same mechanical process in people who have had a nerve injury. We are still a long way from this goal, but the discovery of ADM-4’s role is an important step forward.”

Nerve cells communicate using long, cable-like structures called axons. As they are long and thin, they are very susceptible to breaking, which stops nerve cells from communicating and leads to issues like paralysis.

A few years ago, Professor Hilliard and his team [discovered](#) that *C.*

*elegans* could spontaneously re-join two separated axon fragments, a process called axonal fusion.

QBI’s Associate Professor Victor Anggono helped the team define the molecular mechanisms of this process. “Using neurosurgery to stitch together damaged nerves has limited success,” A/Professor Anggono said. “A different approach using gene technology to directly provide the molecular glue, or activate the fusogen regulator ADM-4, or using pharmacology to activate these components, may facilitate complete regeneration.”

This latest research was published in *Science Advances*.

Reference: “The metalloprotease ADM-4/ADAM17 promotes axonal repair” 16 March 2022, *Science Advances*. DOI: 10.1126/sciadv.abm2882

<https://bit.ly/3N68FOc>

## Bacteria in the Nose Can Sneak Into the Brain – May Increase Risk of Alzheimer’s Disease

*New research from Griffith University has shown that a bacterium commonly present in the nose can sneak into the brain and set off a cascade of events that may lead to Alzheimer’s disease.*

Associate Professor Jenny Ekberg and colleagues from the Clem Jones Centre for Neurobiology and Stem Cell Research at Menzies Health Institute Queensland and Griffith Institute for Drug Discovery, in collaboration with Queensland University of Technology, have discovered that the bacterium *Chlamydia pneumoniae* can invade the brain via the nerves of the nasal cavity. nuclei of cells of the brain. Credit: Griffith University

While this bacterium often causes respiratory tract infections, it has also been found in the brain which has raised the question of whether it causes damage to the central nervous system.

The research team has performed extensive research in animal models to show not only how the bacteria gets into the brain, but also how it leads to Alzheimer’s disease pathologies.

“Our work has previously shown that several different species of bacteria can rapidly, within 24 hours, enter the central nervous system via peripheral nerves extending between the nasal cavity and the brain,” Associate Professor Ekberg said.

“With this background knowledge we were able to track how this new bacterium, *Chlamydia pneumoniae* can also sneak past the blood-brain barrier and quickly enter the brain.”

The new study shows that once the bacteria are in the central nervous system, the cells of the brain react within days by depositing beta amyloid peptide, the hallmark plaque of Alzheimer’s disease.

After several weeks, numerous gene pathways that are known to be involved in Alzheimer’s disease are also dramatically activated.

The research also showed that when the bacteria invade the olfactory nerve, peripheral nerve cells (glial cells), become infected and these cells may be how the bacteria can persist within the nervous system. “These cells are usually important defenders against bacteria, but in this case, they become infected and can help the bacteria to spread,” Associate Professor Ekberg said.

“We have suspected for a long time that bacteria, and even viruses, can lead to neuroinflammation and contribute to initiation of Alzheimer’s disease, however, the bacteria alone may not be enough to cause disease in someone. Perhaps it requires the combination of a genetic susceptibility plus the bacteria to lead to Alzheimer’s disease in the long term. “Now that we have this new evidence, it gives us the drive to urgently find treatments to stop this contributing factor to Alzheimer’s disease.

While the studies were conducted in mice, humans have the same nerves and can be infected by the same bacteria, so the researchers believe the results are translatable to humans.

“We are already working on treatment options. With the Griffith Institute for Drug Discovery, we are identifying potential drugs that

can help the glial cells to destroy the bacteria which are already in the brain. “In addition, Professor Ken Beagley at QUT is working on a vaccine against *Chlamydia* which may reduce the ability of the pathogen to enter the brain”.

*Reference: “Chlamydia pneumoniae can infect the central nervous system via the olfactory and trigeminal nerves and contributes to Alzheimer’s disease risk” by Anu Chacko, Ali Delbaz, Heidi Walkden, Souptik Basu, Charles W. Armitage, Tanja Eindorf, Logan K. Trim, Edith Miller, Nicholas P. West, James A. St John, Kenneth W. Beagley and Jenny A. K. Ekberg, 17 February 2022, Scientific Reports.*

[DOI: 10.1038/s41598-022-06749-9](https://doi.org/10.1038/s41598-022-06749-9)

*The study, published in the journal, Scientific Reports, was funded by the Clem Jones Foundation, the Goda Foundation, the Australian Research Council and the Menzies Health Institute Queensland.*

<https://bit.ly/3ik61WK>

## **Ancient seafarers built the Mediterranean’s largest known sacred pool**

*A big pool on a tiny island helped Phoenicians track the stars and their gods*

By [Bruce Bower](#)

On a tiny island off Sicily’s west coast, a huge pool long ago displayed the star-studded reflections of the gods.

Scientists have long thought that an ancient rectangular basin, on the island of Motya, served as an artificial inner harbor, or perhaps a dry dock, for Phoenician

mariners roughly 2,550 years ago. Instead, the water-filled structure is the largest known sacred pool from the ancient Mediterranean world, says archaeologist Lorenzo Nigro of Sapienza University of Rome.



*Shown after excavations, a sacred pool built by Phoenicians around 2,550 years ago on a tiny Mediterranean island includes a replica of a statue of the god Ba’al at its center. Sapienza University of Rome Expedition to Motya*

Phoenicians, who adopted cultural influences from many Mediterranean societies on their sea travels, put the pool [at the center of a religious compound](#) in a port city also dubbed Motya, Nigro reports in the April *Antiquity*.

The pool and three nearby temples were aligned with the positions of specific stars and constellations on key days of the year, such as the summer and winter solstices, Nigro found. Each of those celestial bodies was associated with a particular Phoenician god.

At night, the reflecting surface of the pool, which was slightly longer and wider than an Olympic-sized swimming pool, was used to make astronomical observations by marking stars' positions with poles, Nigro suspects. Discoveries of a navigation instrument's pointer in one temple and the worn statue of an Egyptian god associated with astronomy found in a corner of the pool support that possibility.

It was an archaeologist who explored Motya around a century ago who first described the large pool as a harbor that connected to the sea by a channel. A similar harbor had previously been discovered at Carthage, a Phoenician city on North Africa's coast.

But excavations and radiocarbon dating conducted at Motya since 2002 by Nigro, working with the Superintendence of Trapani in Sicily and the G. Whitaker Foundation in Palermo, have overturned that view.

"The pool could not have served as a harbor, as it was not connected to the sea," Nigro says. He and his team temporarily drained the basin, showing that it is instead fed by natural springs. Only after Greek invaders conquered Motya in a battle that ended in 396 B.C. was a channel dug from the pool to a nearby lagoon, Nigro's group found.

Phoenicians settled on Motya between 800 B.C. and 750 B.C. The sacred pool, including a pedestal in the center that originally supported a statue of the Phoenician god Ba'al, was built between

550 B.C. and 520 B.C., Nigro says. Two clues suggested that the pedestal had once held a statue of Ba'al. First, after draining the pool, Nigro's team found a stone block with the remnants of a large, sculpted foot at the basin's edge. And an inscription in a small pit at one corner of the pool includes a dedication to Ba'al, a primary Phoenician god.

Gods worshipped by Phoenicians at Motya and elsewhere were closely identified with gods of other Mediterranean societies. For instance, Ba'al was a close counterpart of the divine hero Hercules in Greek mythology.

An ability to incorporate other people's deities into their own religion "was probably one of the keys to Phoenicians' success throughout the Mediterranean," says archaeologist Susan Sherratt of the University of Sheffield in England, who did not participate in the new study.



*A block with a carved foot found on the edge of Motya's sacred pool probably was part of a statue of a Phoenician god that originally stood on a pedestal at the pool's center, researchers say. L. Nigro/Antiquity 2022*

[Seafaring traders now called Phoenicians](#) lived in eastern Mediterranean cities founded more than 3,000 years ago (*SN: 1/25/06*). Phoenicians established settlements from Cyprus to Spain's Atlantic coast. Some researchers suspect that [Phoenicians lacked a unifying cultural or ethnic identity](#).

Nigro disagrees. Phoenicians developed an influential writing system and spoke a common Semitic language, key markers of a common eastern Mediterranean culture, he contends. As these seafarers settled islands and coastal regions stretching west across the Mediterranean, they created hybrid cultures with native groups, Nigro suspects.

Motya excavations indicate that Phoenician newcomers created a



distinctive West Phoenician culture via interactions with people already living there. Pottery and other artifacts indicate that groups from Greece, Crete and other Mediterranean regions periodically settled on the island starting as early as around 4,000 years ago. Metal objects and other cultural remains from various stages of Motya's development display influences from all corners of the Mediterranean.

Though much remains unknown about political and social life at Motya, its Phoenician founders oversaw an experiment in cultural tolerance that lasted at least 400 years, Nigro says.

#### Citations

L. Nigro. [The sacred pool of Ba'al: a reinterpretation of the 'Kothon' at Motya](#). *Antiquity*. Vol. 96, April 2022. doi: 10.15184/aqy.2022.8.

J. Quinn. [Were there Phoenicians?](#) *Ancient Near East Today*. Vol. VI, July 2018.

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

## Your dog might be anxious for the same reasons you are

*Our canine pals are good models for human psychiatric disorders, study argues*

By [Tess Joosse](#)

My family's dog Teddy, a wide-eyed, brown and white spaniel, was a nervous wreck when a thunderstorm rolled in. To calm his shaking and panting, the vet prescribed him lorazepam, a benzodiazepine marketed as Ativan that's also used to treat anxiety in humans.

Lorazepam is just one of many drugs that dogs and humans take for similar psychiatric problems. Canine compulsive behavior resembles human obsessive-compulsive disorder, for example, and impulsivity or inattention in dogs can resemble attention deficit hyperactivity disorder in us. The risk for these conditions can even be influenced by the same sets of genes. Indeed, a new study based on a survey of dog owners suggests we're so similar to our canine companions that dogs can—and should—be used to better

understand human mental health.

"Dogs are probably the closest model to humans you're going to get," says Karen Overall, an animal behaviorist at University of Prince Edward Island, who was not involved with the work.

Many psychologists group human personality into five "factors": extraversion, neuroticism, openness, agreeableness, and conscientiousness. These traits can be influenced by genetics and can affect a person's mental health—especially neuroticism, or the tendency to feel negative emotions such as distress and sadness. Research has shown neurotic personalities are more vulnerable to depression or anxiety, whereas traits such as conscientiousness and agreeableness protect against these disorders.

Any dog owner will tell you that our canine pals have distinct personalities just like you and me. Some are bold and others are cautious; some are lazy and others are highly active.

Milla Salonen, a canine researcher at the University of Helsinki, and other researchers have proposed seven personality factors for grouping dogs: insecurity, energy, training focus, aggressiveness/dominance, human sociability, dog sociability, and perseverance. Some of these factors overlap with those in people, Salonen explains. Insecurity in dogs parallels neuroticism in humans, for example.

Twenty years ago, Overall and other experts began to suggest the dog be used as a model for human psychiatry. The same types of mental illness don't occur naturally in rodents; researchers have to induce them.

In the new study, Salonen and her colleagues wanted to assess how a pooch's personality might impact its behavior and how this compares with what's seen in humans. So they [devised a 63-question survey for dog owners](#). It asked about an animal's health and history, fears, sensitivity to noises, separation anxiety, impulsivity and inattention, and aggression toward humans or other



dogs.

Owners used a sliding scale to rate statements like “My dog barks when meeting a stranger,” “My dog hides when she hears fireworks,” or “My dog appears to be ‘sorry’ after she has done something wrong.”

The scientists sent the survey to the homes of 11,360 Finnish dogs from 52 breeds, comprising everything from mastiffs to Jack Russell terriers. They grouped the responses for each dog into the seven canine personality traits. Then they used a set of equations to assess whether dogs that tended to have the same personality traits also shared common unwanted behaviors.

The team found that in dogs, like in humans, personality closely correlates with behaviors. In particular, [pups with an “insecure” personality were more likely to exhibit all of the surveyed unwanted behaviors](#) (such as the aversion to strangers, or fear of fireworks), Salonen and her colleagues report in *Translational Psychiatry*.

“This is quite similar to neuroticism and anxiety in humans,” Salonen explains. Other personality traits were also implicated. Dogs with a low training focus were more likely to have impulsive behaviors such as fidgeting or abandoning tasks quickly, resembling symptoms of attention deficit disorders in humans.

It can be hard for dog owners to provide a clear-eyed assessment of their pet’s problems in survey studies, says Emma Grigg, an animal behaviorist at the University of California, Davis. “How you’re asking the questions is so important,” and respondents can still misconstrue their dog’s behaviors even in the most carefully worded surveys, she says. “But this is a well-done paper with a lot of data.”

The researchers say their results could be used study the genetic basis of psychiatric disorders. Dogs are well suited for genetic research, as they’re nearly genetically identical within breed groups,

Salonen says. Looking at the genes of a certain breed that is known to be more insecure or less focused might reveal genetic factors underlying anxiety or attention deficit disorders in both dogs and humans.

But the scientists acknowledge most dog owners just care about keeping their pet happy, healthy, and safe. If your dog barks a lot or is scared of strangers, “that doesn’t necessarily mean that they have serious issues,” Overall says. She suggests taking your pup to a specialist if you’re really worried about its behavior—just like we did with Teddy, who can now make it calmly through a summer storm.

<https://bit.ly/3tq95aj>

## **There's One Simple Aspect of Daily Life Tied to Better Wellbeing, Study Hints**

*Just visiting a variety of different locations associated with a higher sense of wellbeing*

[Carly Cassella](#)

A variety in everyday movements is linked to better wellbeing, according to a small study of psychiatric patients released in 2021. Staying active during a global [pandemic](#) has been quite difficult, especially when many people have been afraid to even go outside. Some have taken to exercising at home, and yet in a normal world, spontaneous outings are important health factors that we tend to underestimate.

When most of us think of mental-boosting activities, we imagine deliberate and strenuous exercise, like a jog, a bike, or a swim, but it seems that just visiting a variety of different locations is associated with a higher sense of wellbeing in people with [depression](#) or anxiety.

A study published last year by researchers at the University Psychiatric Clinics in Basel, Switzerland found the more varied locations people visit, the better they feel about their emotional and

psychological wellbeing – even if their mental health symptoms are still there.

The study was conducted before the pandemic hit and it looked at 106 patients with mental health issues, including affective disorders, anxiety disorders, mood disorders, personality disorders, and obsessive-compulsive disorders. Some were inpatients at hospitals and others were outpatients, living at home but seeking regular care at medical institutions.

For a week, these patients carried an extra phone around with them to track their movements with GPS. They also completed several surveys on their subjective wellbeing, their psychological flexibility, and their mental health symptoms.

Comparing GPS maps to the results of these surveys, the authors found greater movement in space and time appeared to coincide with a greater sense of wellbeing, even though the symptoms of mental health issues remained largely the same.

Outpatients spent nearly a third of their day at home but understandably showed considerably greater movement than inpatients, who spent most of their time within the hospital.

As expected, those patients with phobias or anxieties about leaving safe spaces were strongly linked to much lower mobility and a much smaller activity area. Yet no other symptoms of mental health issues appeared to have the same effect on a patient's daily movements.

In contrast, higher levels of emotional wellbeing and, to a lesser extent, psychological flexibility were consistently associated with more movement and a greater variety of movement.

"Our results suggest that activity alone is not enough to reduce symptoms of mental disorders, but can at least improve subjective wellbeing," [explained](#) clinical and health psychologist Andrew Gloster from the University of Basel.

The findings add to a limited body of research on the effects of

everyday activities among those with mental health issues. In fact, this is one of the first studies to use GPS tracking as a measure of spontaneous movement.

Obviously, in the real world, such data could be seen as a breach of patient privacy, but in a study setting, it allows researchers to examine the effects of simple activities that often go overlooked.

Physical activity has been shown to substantially improve wellbeing and mental health, but most research on this topic has so far focused on deliberate exercise. It's unclear how spontaneous movement in daily life impacts patients who are seeking mental health treatment.

In 2020, a [small study](#) of 67 participants found everyday activities, like walking to the tram stop or climbing a flight of stairs, made people feel more alert and energetic.

Further [magnetic resonance imaging](#) of participants' brains showed those who felt more energetic after movement had a larger volume of gray brain matter in the subgenual cingulate cortex – a part of the brain associated with emotional regulation.

Figuring out how to apply this knowledge to prevent and treat mental health issues is a whole other matter, but simple movements might be a harmless place to start.

"Currently, we are experiencing strong restrictions of public life and social contacts, which may adversely affect our well-being," [said](#) neuroscientist Heike Tost in November 2020.

"To feel better, it may help to more often climb stairs."

Merely getting outside may also play a contributing role. Physical activity in nature as a kid has [been tied](#) to better mental health outcomes as an adult, and doctors in some places of the world have begun '[prescribing](#)' time in nature as a boost for mental and physical health.

The 2021 GPS study is small and limited, but the findings suggest movement may be a predictor of how well patients with mental

health issues are coping overall.

"The results point to the fact that patterns of movement (e.g., distance, number of destinations, variability of destinations, etc.) may serve as a marker of functioning and wellbeing," the authors of the study [concluded](#).

Far more research needs to be done to confirm and expand on these findings, but the authors suggest using GPS could be a non-intrusive way to better examine simple, daily activity and its effect on mental health and wellbeing.

The study was published in *BMC Psychiatry*.

<https://wb.md/3wj1Bu9>

## Intermittent Fasting Good for Weight Loss, at Least Short Term

*The health benefits of intermittent fasting are slowly being clarified as more evidence continues to emerge, say the authors of a new review of 21 studies.*

Marlene Busko

Initial findings suggest that fasting might be effective for mild to moderate weight loss for certain groups of people, at least in the short term.

And data so far at least dispel the myth that "people are going to feel weak and not be able to concentrate during fasting," lead researcher Krista A. Varady, PhD, professor of nutrition in the University of Illinois at Chicago, noted in a press release from her university. "We've shown it is the opposite," she said. "They actually have a better ability to concentrate."

Yet much longer-term data are needed on issues such as safety, Varady and colleagues note in their review in *Nature Reviews: Endocrinology*. The trials so far have only been conducted in adults — generally with overweight or [obesity](#) and sometimes [hypertension](#), dyslipidemia, and/or diabetes — but some have been performed in those of normal weight.

Varady and colleague recommend that those with [type 1 diabetes](#), [type 2 diabetes](#), or other comorbidities, or patients who need to take medications with meals at certain times of the day, should seek clinical supervision when considering intermittent fasting.

And currently, based on existing evidence, intermittent fasting is contraindicated for children under age 12 and those who have a history of an eating disorder or a body mass index <18.5 kg/m<sup>2</sup>. Opinions vary about the safety of supervised fasting in adolescents with obesity. Also, safety has not been evaluated in those older than age 70, and in women who are pregnant or lactating.

## "A Few Studies" Show 3% to 8% Weight Loss Over 2 to 3 Months

Despite the recent surge in the popularity of intermittent fasting, "only a few studies have examined the health benefits of these diets in humans," Varady and coauthors emphasize. They identified 21 clinical trials of three types of intermittent fasting strategies:

\* *Alternate day fasting (alternating between consuming 0 to 500 kcal on "fasting" days, followed by unlimited food on "feasting" days), six trials.*

\* *5:2 diet ("feasting" on 5 days and "fasting" on 2 days), seven trials.*

\* *Time-restricted eating (eating during a 4- to 8- hour window), nine trials.*

The trials were short (mostly 5 to 12 weeks long) and small (10 to 150 participants), and mostly conducted in the United States.

They found these strategies can all produce a mild to moderate 3% to 8% weight loss during 8 to 12 weeks, similar to that attained with a calorie-restricted diet.

Some studies found that patients had improvements in blood pressure, LDL-cholesterol, [triglycerides](#), [insulin resistance](#), and [A1c](#). These weight-loss strategies produced few gastrointestinal, neurological, hormonal, or metabolic adverse effects; "however, as adverse outcomes are not regularly assessed in human trials of

fasting, definitive conclusions regarding the safety of these diets are difficult to draw at present," the researchers caution.

### **Practical Advice, Great Anecdotes**

Typically, 1 to 2 weeks of adjustment is needed when individuals start intermittent fasting, the researchers say.

While following this eating pattern, patients should be encouraged to consume plenty of fruits, vegetables, and whole grains to boost their fiber and micronutrient intake.

On fasting days, they should consume at least 50 g of lean protein to help control hunger and prevent excessive loss of lean mass. On those days, alcohol is permitted but not recommended. Energy drinks and coffee or tea without sugar, milk, or cream are allowed, and diet soda should be limited to two servings a day because they can increase sugar cravings.

Ideally, clinicians should regularly assess patients for adverse effects during the first 3 months of intermittent fasting. They should also monitor patients for deficiencies in [vitamin D](#), vitamin B<sub>12</sub>, and electrolytes, as well as for changes in medications for blood pressure, [lipids](#), and glucose that may be needed if patients lose weight.

Patients who reach their weight-loss goals and wish to stop intermittent fasting need to transition to a weight maintenance program, possibly by increasing energy intake on fasting days to 1000 to 1200 kcal/day or widening the eating window to 12 hours in time-restricted eating.

"I get lots of emails from people saying that they have been on the diet for 10 to 15 years, and it reversed their type 2 diabetes, and they lost 60 pounds, and it was the only diet they could stick to," Varady noted.

"That is always nice to hear, but we really do need long-term data to see if people can do intermittent fasting for the long term," she reiterated.

*The review was funded by the National Institute of Diabetes and Digestive and Kidney Diseases. Varady received author fees from the Hachette Book Group for the book, "The Every Other Day Diet." The other authors have declared no relevant financial relationships.*

*Nat Rev Endocrinol.* Published online February 22, 2022. [Article](#)

<https://bit.ly/3N6ssNt>

## **We Finally Have a Genetic Link Between Ovarian Cancer And This Common Disorder**

*Scientists have found a genetic link and a potentially causal relationship between [endometriosis](#) and some types of ovarian [cancer](#).*

[Carly Cassella](#)

The [absolute risk](#) of an endometriosis patient developing cancer is still very low, but these overlapping genetic markers could help researchers understand and treat both illnesses better in the future.

"We don't want women with endometriosis to worry, but rather we want them to be aware and know that the purpose of this study was to increase our understanding of both of these diseases by understanding the genetic link between them," [explains](#) molecular bioscientist Sally Mortlock, from the University of Queensland, Australia.

Endometriosis is a highly common and notoriously underdiagnosed condition. It occurs when cells similar to the lining of the uterus grow elsewhere in the body, sometimes causing pain or infertility.

Similar to other female pain conditions, endometriosis, or 'endo' for short, has been historically overlooked by medicine, and thanks to that setback, today, we still know very little about it, including how it's caused.

Recent research suggests endo holds a [strong genetic component](#), often clustering in families. Epidemiological studies have [also shown](#) those with endo are more likely to develop ovarian cancers later in life.

To further investigate the relationship between these two conditions,



researchers in Australia gathered together data from several genome-wide association studies.

In the end, they found 19 genetic locations in female DNA that appear to predispose people to endo while also predisposing them to epithelial ovarian cancer (which is the kind that [develops in the lining outside the ovary](#)).

"Overall, studies have estimated that 1 in 76 women are at risk of developing ovarian cancer in their lifetime, and having endometriosis increases this slightly to 1 in 55," [says](#) Mortlock.

We still don't know how to predict which endo patients are more likely to develop ovarian cancers, but Mortlock's recent research gives us a few clues.

The study used genomic data from several large and recent meta-analyses on endometriosis and epithelial ovarian cancer. Unlike previous studies, however, the authors were able to causally associate the genetic components of endometriosis with some types of ovarian cancer.

In simple terms, this means researchers found the genes responsible for endometriosis were driving the development of tissue that increase the risk of developing ovarian cancer, but not the other way around.

This directionality suggests that endometriosis and epithelial ovarian cancer (EOC) are biologically related, and that "a genetic variant's effect on endometriosis is likely to cause its effect on EOC for the variants highlighted in this study", [according to the authors](#).

The genetic regions shared by endometriosis and EOC could help experts figure out what mechanisms are driving this causal relationship and what biological pathways might contribute to the risk.

Such research could provide potential drug targets and treatment options for both illnesses, halting their progression.

In the current study, for instance, some shared genetic variants were

found in regions known to host hormone-responsive genes.

This suggests hormone regulation might help block the causal pathway between endometriosis and a type of EOC known as [clear cell ovarian cancer](#) (CCOC), which is associated with abnormal tissue growth outside the uterus.

The authors also [note](#) that cell adhesion pathways were "significantly enriched" for some genetic variations shared between endo and CCOC. This suggests the ability of endometriosis lesions to adhere to tissue might be an important part of disease development for both illnesses.

[Endometrioid ovarian cancer](#) (ENOC) was also similarly associated with endometriosis, and, to a lesser extent, [high-grade serous ovarian cancer](#) (HGSOc), which is one of the deadliest human cancers with few predictive biomarkers.

Some of the genetic markers for endo and EOC identified in the current study are also shared with other reproductive diseases, like polycystic ovary syndrome and uterine fibroids.

The authors, therefore, [suspect](#) the "perturbation of underlying pathways important for the development and regulation of the reproductive and endocrine systems may predispose women to a variety of diseases", depending on their genetic and environmental risk factors.

Endometriosis itself is *not* cancerous, but over the years, researchers have compared the way endometrial lesions metastasize, spread, invade and damage tissue [to that of cancerous cells](#).

Some [case studies](#) have even shown that on very rare occasions, endometrial lesions can transform into malignant tissue.

There are still so many avenues to explore when it comes to understanding endometriosis, but genetic studies like these can help experts whittle down the numerous options in front of them, pushing future research in the right direction.

The study was published in [Cell Reports Medicine](#).

<https://bit.ly/37FC813>

## Ferocious 'Ocucaje Predator' was a sea serpent-like mammal with knives for teeth

*The creature is probably a new species of basilosaurus, a ferocious ancestor of modern whales.*

By [Brandon Spektor](#)

Researchers digging in Peru's Ocucaje desert have uncovered the skull of an enormous marine predator thought to be the ancestor of modern whales and dolphins.

Four feet long (1.2 meters) and lined with knife-like teeth, the skull appears to be a new species of *Basilosaurus* — a genus of ferocious marine mammals that lived some 36 million years ago during the Eocene epoch, researchers from the National University of San Marcos (UNMSM) in Lima told [Reuters](#). From snout to tail, the creature probably measured about 39 feet (12 meters) long, or about the size of a city bus.

For now, researchers are calling this ancient beast the "Ocucaje Predator." It won't be formally named until the team publishes a scientific description of the species in a peer-reviewed journal.

"It was a marine monster," Rodolfo Salas, founder and director of the paleontology department at the

Museum of Natural History at UNMSM, told Reuters and other media outlets at a news conference on March 17. "When it was searching for its food, it surely did a lot of damage."



*The skull of the newfound Basilosaurus species sits on display at the National University of San Marcos in Lima, Peru. (Image credit: Getty)*

According to the researchers, the Ocucaje Desert was once the bottom of an ancient ocean. *Basilosaurus* and its ferocious cousins swam these seas as apex predators from 41 million to 34 million

years ago, gliding through the water with bodies that resembled enormous [snakes](#), but with a large pair of flippers near their heads.

"*Basilosaurus*" means "king lizard," and the creature's serpentine skeleton was once mistaken for a marine reptile, according to [Smithsonian](#).

Scientists now know that *Basilosaurus* was a mammal — a fully aquatic cetacean, like the whales and dolphins that would follow it millions of years later.



*An artist's rendering of what Basilosaurus looked like in the Eocene seas (Image credit: Dominik Hammelsbruch/ CC 4.0)*

Earlier whale ancestors were mammals who lived on land full-time, then gradually [evolved](#) to be semi-aquatic over millions of years, [Live Science previously reported](#). Beginning about 55 million years ago — 10 million years after the mass extinction that killed the [dinosaurs](#) — whale ancestors finally became fully aquatic, giving rise to the first cetaceans. Today, there are more than 90 species of cetaceans.

The Ocucaje desert is abundant in fossils, some dating back more than 42 million years, according to the researchers. Previous excavations have uncovered other early whale ancestors, dolphins, sharks and other creatures of the ancient deep.

<https://bit.ly/3imrz59>

## AstraZeneca Covid-19 drug neutralises Omicron sub-variants, says lab study

*Therapy reduced viral load of tested sub-variants in mice lungs; Evusheld contains lab-made antibodies designed to linger in body for months*

AstraZeneca said on Monday its antibody-based cocktail to prevent and treat Covid-19 retained neutralising activity against Omicron

coronavirus variants, including the highly contagious BA. 2 sub-variant, in an independent lab study.

This is the first data looking at the impact of AstraZeneca's Evusheld treatment on "cousins" of the Omicron variant following a recent global spike in cases. The Anglo-Swedish drug maker said in December that another lab study found that Evusheld retained neutralising activity against Omicron.

Data from the latest study by Washington University in the United States showed the therapy reduced the amount of virus detected in samples – viral load – of all tested Omicron sub-variants in mice lungs, AstraZeneca said. The study has yet to be peer reviewed.

Evusheld was tested against the BA. 1, BA. 1.1, and BA. 2 sub-variants of Omicron and it was also shown in the study to limit inflammation in the lungs, a critical symptom in severe [Covid-19](#) infections.

"The findings further support Evusheld as a potential important option to help protect vulnerable patients such as the immunocompromised who could face poor outcomes if they were to become infected with Covid-19," said John Perez, head of Late Development, Vaccines & Immune Therapies at AstraZeneca.

Last week the World Health Organization said figures showing a global rise in Covid-19 cases could herald a much bigger problem, as the Omicron and BA. 2 variants spread amid the easing of restrictions and testing.

Evusheld was found to cut the risk of developing symptomatic Covid-19 by 77 per cent in trials, Britain's drug regulator said last week, after approving the therapy for preventing infections in adults with poor immune response.

Evusheld has also been shown to save lives and prevent disease progression when given within a week of first symptoms.

While [vaccines](#) rely on an intact immune system to develop targeted antibodies and infection-fighting cells, Evusheld contains

lab-made antibodies designed to linger in the body for months to contain the virus in case of an infection.

The therapy is currently under a European review. It has already been authorised in the United States.

<https://nyti.ms/3tn6z4B>

### **'He Goes Where the Fire Is': A Virus Hunter in the Wuhan Market**

*For years, Edward Holmes worried about animal markets causing a pandemic. Now he finds himself at the center of the debate over the origins of the coronavirus.*

By [Carl Zimmer](#)

As soon as Edward Holmes saw the dark-ringed eyes of the raccoon dogs staring at him through the bars of the iron cage, he knew he had to capture the moment.

It was October 2014. Dr. Holmes, a biologist at the University of Sydney, had come to China to survey hundreds of species of animals, looking for new types of viruses.

On a visit to Wuhan, a commercial center of 11 million people, scientists from the city's Center for Disease Control and Prevention brought him to Huanan Seafood Wholesale Market. In stall after stall of the poorly ventilated space, he saw live wild animals — snakes, badgers, muskrats, birds — being sold for food. But it was the raccoon dogs that made him pull out his iPhone.

As one of the world's experts on virus evolution, Dr. Holmes had an intimate understanding of how viruses can jump from one species to another — sometimes with deadly consequences. The SARS outbreak of 2002 was caused by a bat coronavirus in China that infected some kind of wild mammal before infecting humans. Among the top suspects for that intermediate animal: the fluffy raccoon dog.

"You could not get a better textbook example of disease emergence waiting to happen," Dr. Holmes, 57, said in an interview.

The tall, bald Englishman did his best not to draw attention to himself as he snapped a picture of the raccoon dogs, which look like long-legged raccoons but are more closely related to foxes. He then took a few more pictures of other animals in cages of their own. As a vendor began clubbing one of the creatures, Dr. Holmes pocketed his phone and slipped away.

The photos faded from his mind until the last day of 2019. As Dr. Holmes was browsing Twitter from his Sydney home, he learned of an alarming [outbreak](#) in Wuhan — a SARS-like pneumonia with early cases linked to the Huanan market. *The raccoon dogs*, he thought.

“It was a pandemic waiting to happen, and then it bloody well happened,” he said.

From that day on, Dr. Holmes was swept into a vortex of discoveries and controversies related to the origins of the virus — making him feel like “the Forrest Gump of Covid,” he joked. He and a Chinese colleague were the first to share the genome of the new coronavirus with the world. He then discovered crucial clues about how the pathogen most likely evolved from bat coronaviruses. And in the contentious geopolitical debate over whether the virus may have leaked from a Wuhan laboratory, Dr. Holmes has become one of the strongest proponents of an opposing theory: that the virus spilled over from a wild animal. With colleagues in the United States, he recently published [tantalizing clues](#) that raccoon dogs kept in the very iron cage he photographed in 2014 could have set off the pandemic.

Dr. Holmes’s Covid research has won him international acclaim, including [Australia’s top science prize](#). But it has also garnered claims that his research had been overseen by the Chinese military, along with a flood of attacks on social media and even [death threats](#). Through it all, Dr. Holmes has continued to publish a torrent of studies on Covid. Longtime colleagues attribute his steady output

through unsteady times to an exceptional knack for building big scientific teams, and a willingness to dive into controversial debates if he thinks they are important.

“He’s the right kind of person with the right kind of mind-set, because of the fact that he can be open-minded and engaged and thoughtful, and not become defensive,” said Pardis Sabeti, a geneticist at the Broad Institute of M.I.T. and Harvard who worked with Dr. Holmes on Ebola.

### **Hunting for Viruses**

Growing up in western England, a young Edward Holmes had a biology teacher who put a poster of an orangutan on the wall that read, “I’m not your cousin.”

The teacher told the class not to read the garbage in their textbook about evolution. That made the 14-year-old eager to dive in.

He went on to study the evolution of apes and humans, and then turned to viruses. Over three decades — working in Edinburgh, Oxford, Pennsylvania and finally Sydney — Dr. Holmes has published [more than 600 papers](#) on the evolution of viruses including H.I.V., influenza and Ebola.

When he was invited to come to the University of Sydney, in 2012, he seized the chance to move closer to Asia, where he feared that the wildlife trade could set off a new pandemic.

“He goes where the fire is,” said Andrew Read, an evolutionary biologist at Penn State University, who worked with Dr. Holmes at the time.

As he was preparing for the move, Dr. Holmes got an email out of the blue from a Chinese virologist named Yong-Zhen Zhang, asking if he’d like to study viruses with him in China. Their collaboration quickly expanded into a sweeping search for new viruses in hundreds of species of animals. They studied spiders plucked off the walls of huts and fish hauled up from the South China Sea.



They ultimately [found](#) more than 2,000 virus species new to science, with many surprises among them. Scientists used to think that influenza viruses infected primarily birds, for example, which could then pass them along to mammals like ourselves. But Dr. Holmes and Dr. Zhang found that fish and frogs get the flu, too.

“That’s been quite eye opening,” said Andrew Rambaut, an evolutionary biologist at the University of Edinburgh who was not involved in the surveys. “The diversity of viruses that are out there is just enormous.”

On one of their survey trips in 2014, Dr. Holmes and Dr. Zhang formed a partnership with scientists at the Wuhan Center for Disease Control and Prevention to survey animals in the surrounding Hubei Province. The C.D.C. scientists brought them to the Huanan market to see a worrying case of wildlife trade.

After the visit, Dr. Holmes hoped he and his colleagues could use the genetic sequencing techniques they had developed for their animal surveys to look for viruses in the animals at the market. But his colleagues were more interested in searching for viruses in sick people.

Dr. Zhang and Dr. Holmes began working with doctors at Wuhan Central Hospital, fishing for viral RNA in samples of lung fluid from people with pneumonia. Because of this collaboration, he was named a guest professor with the Chinese Center for Disease Control and Prevention from 2014 to 2020.

Last month, Dr. Holmes and his colleagues published their first [report](#) on the project, based on samples from 408 patients collected in 2016 and 2017. Many were sick with more than one virus, it turned out, and some were also infected with bacteria or fungi. The researchers even saw evidence of a hidden outbreak: Six patients were infected with genetically identical enteroviruses.

Dr. Holmes and Dr. Zhang also continued [surveying the virosphere](#), examining soil, sediments and animal feces from across China. But

in late December 2019, that work ground to a halt.

### **Covid’s Arrival**

When Dr. Zhang got wind of a new pneumonia in Wuhan, he asked colleagues at the Wuhan Central Hospital to ship him lung fluid from a patient. It arrived [on Jan. 3](#), and he used the techniques he and Dr. Holmes had perfected to search for viruses. Two days later, Dr. Zhang’s team had assembled the genome of a new coronavirus, SARS-CoV-2.

Other scientific teams in China had also sequenced the virus. But none made it public, because the Chinese government had [barred](#) scientists from publishing information about it.

Dr. Zhang and Dr. Holmes began writing a [paper](#) about the genome, which would later appear in the journal Nature. Dr. Zhang flouted the ban and uploaded the virus genome to a public database hosted by the U.S. National Institutes of Health. But the database requires a lengthy review of new genomes, and so days passed without the information going online.

Dr. Holmes urged his collaborator to find another way to share the genome with the world. “It felt like it had to happen,” Dr. Holmes said.

On Jan. 10, they agreed to share it on a forum for virologists, and Dr. Holmes [put](#) it online.

That decision was a turning point, according to Jason McLellan, a structural biologist at the University of Texas at Austin who worked on the mRNA technology powering the Moderna vaccine. Only with that genetic sequence could researchers start working on tests, drugs and vaccines. Until then, Dr. McLellan said, scientists like himself were like runners in their starting blocks, waiting for a starter’s pistol.

“It fired the moment Edward and Yong-Zhen posted the genome sequence,” he said. “Immediately, Twitter was abuzz, emails were being exchanged, and the race was on.”

But according to Chinese media reports, Dr. Zhang paid a price for defying his country's information ban. The day after the genome sequence went live, his laboratory at the Shanghai Public Health Clinical Center was reportedly ordered to close for "[rectification](#)."

Dr. Zhang later [insisted](#) to a reporter at Nature that the move was not a punishment, and that his lab later reopened. Email requests to Dr. Zhang to comment for this story went unanswered. Dr. Holmes declined to comment about Dr. Zhang's current situation.

After the coronavirus genome was sequenced, Dr. Holmes was puzzled to see some bits of genetic material that looked like they might have been put there through genetic engineering.

On a Feb. 1, 2020, telephone conference, Dr. Holmes shared his worries with other virus experts, including Dr. Francis Collins, the director of the N.I.H., and Dr. Anthony S. Fauci, America's top infectious disease expert. Other scientists explained on the call that those features of the genome could easily have been produced through the natural evolution of viruses.

Soon afterward, Dr. Holmes helped researchers at the University of Hong Kong analyze a coronavirus, found in a [pangolin](#), that was closely related to SARS-CoV-2. The virus looked especially similar in its surface protein, called spike, which the virus uses to enter cells.

Finding such a distinct biological signature in a virus from a wild animal strengthened Dr. Holmes's confidence that SARS-CoV-2 was not the product of genetic engineering. "Suddenly what looks odd is clearly natural," Dr. Holmes said.

Dr. Holmes and his colleagues laid out some of these findings in a [letter](#) published in March 2020. That same month, he published some of his photos of caged animals at the Huanan market in a [commentary](#) he wrote with Dr. Zhang, suggesting that it might have been the site of an animal spillover.

But the idea that the virus had been engineered in a lab continued to

gain traction, and Dr. Holmes came under attack for his work with Chinese scientists.

In May 2020, The Daily Telegraph, an Australian newspaper, [linked](#) him to the Chinese military with an article titled, "How the Red Army Oversaw Coronavirus Research."

The newspaper based its claim on the fact that two scientists involved in the pangolin study had secondary affiliations with a Chinese military lab. Dr. Holmes, who said he never met the scientists, noted that they had helped with sequencing RNA from the pangolin tissue.

The University of Sydney responded on Dr. Holmes's behalf with a [statement](#): "We strongly defend the right of our researchers to collaborate with scientists around the world in line with all relevant Australian laws and government guidelines." The university noted that Dr. Holmes's research was entirely supported by Australian grants.

In late 2020, the World Health Organization organized a group of experts to travel to China [to investigate](#) the origin of the novel coronavirus. Dr. Holmes sent them his 2014 market photos, but they never made it into the [W.H.O.'s report](#).

"Some of the Chinese delegation suggested that I might have fabricated those pictures," Dr. Holmes said. (Peter Daszak, the president of EcoHealth Alliance and one of the investigators of the W.H.O. report, corroborated this account: The Chinese investigators said the photos were "not verifiable, and could have been faked," Dr. Daszak said.)

### **Preventing Future Spillovers**

In reports published last month, Dr. Holmes and over 30 collaborators analyzed early Covid cases, finding that they clustered around the market, and examined the mutations in early coronavirus samples.

Chris Newman, a wildlife biologist at the University of Oxford and

a co-author of one of the studies, said that his Chinese colleagues saw a number of wild mammals for sale at the Huanan market in late 2019. Any of them might have been responsible for the pandemic, Dr. Holmes said.

“You can’t prove raccoon dogs yet, but they’re certainly a suspect,” he said.

Some critics have questioned how sure Dr. Holmes and his colleagues can be that a Huanan animal was to blame. Although many of the earliest Covid cases were linked to the market, it’s possible that other cases of pneumonia have not yet been recognized as early Covid cases.

“We still know far too little about the earliest cases — and there are likely additional cases we don’t know about — to draw final conclusions,” said Filippa Lentzos, an expert on biosecurity at King’s College London. “I remain open to both natural spillover and research-related origins.”

Another problem: If infected animals indeed started the pandemic, they’ll never be found. In January 2020, when researchers from the Chinese C.D.C. arrived at the market to investigate, all the animals were gone.

But Dr. Holmes argues that there’s more than enough evidence that animal markets could spark another pandemic. [Last month](#), he and Chinese colleagues published a study of 18 animal species often sold at markets, obtaining them either in the wild or on breeding farms.

“They were absolutely full of virus,” Dr. Holmes said.

Over 100 vertebrate-infecting viruses came to light, including a number of potential human pathogens. And some of these viruses had recently jumped the species barrier — bird flu infecting badgers, dog coronaviruses infecting raccoon dogs. Some of the animals were sick with human viruses, too.

The simplest way to reduce the odds of future pandemics, Dr.

Holmes has [argued](#), is to carry out studies like this one at the interface between humans and wildlife. His own experience discovering new viruses has convinced him that it doesn’t make sense to try to catalog every potential threat in wildlife.

“You could never possibly sample every virus out there and then work out which one of those can infect humans,” Dr. Holmes said.

“I don’t think that’s viable.”