

CURIOS?



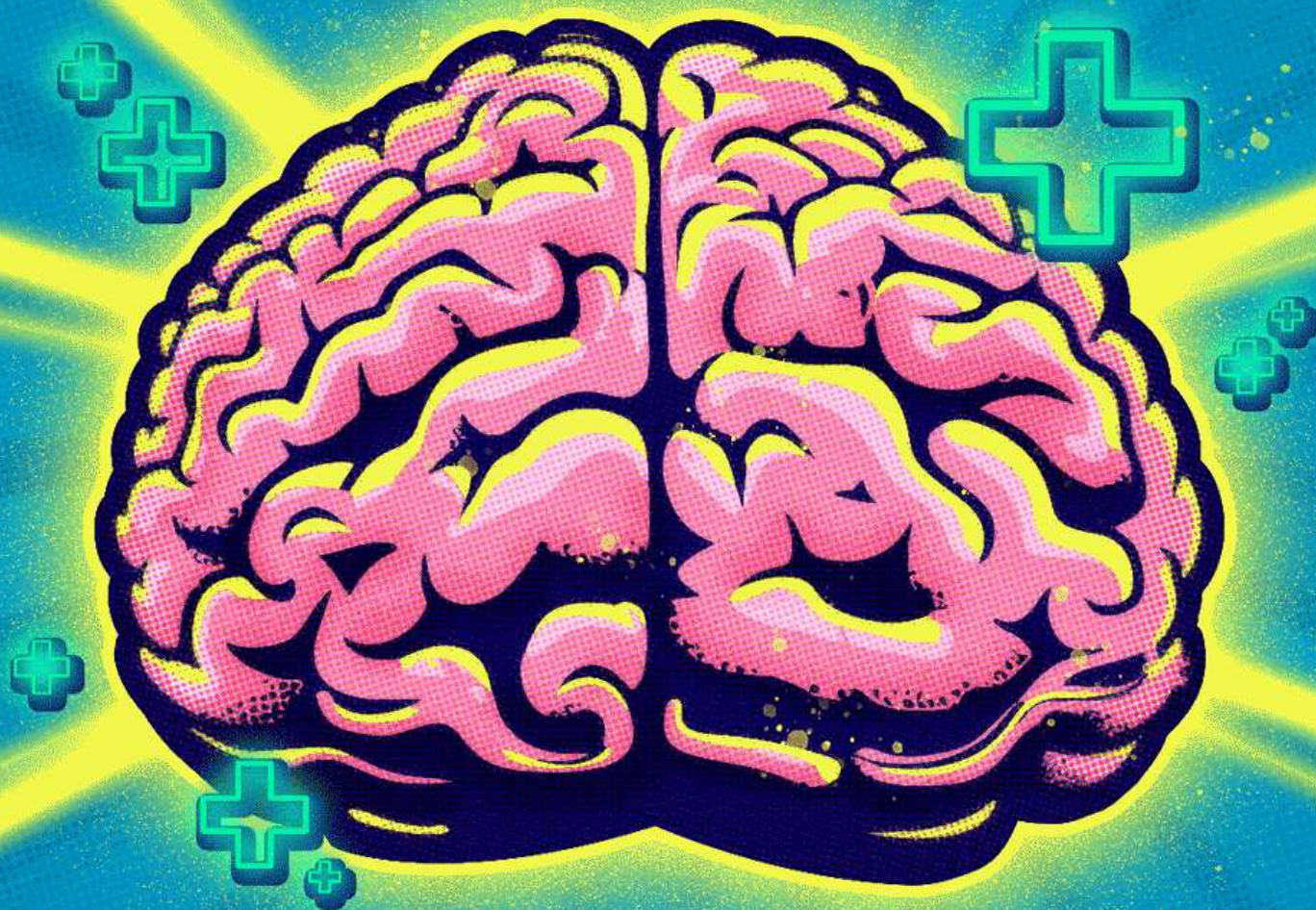
DO ANCIENT NAVIGATION
METHODS STILL STAND UP?

WHAT ATTACKS YOU IN THE MOST
REMOTE PLACE ON EARTH?

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CAN YOU THINK



YOURSELF WELL?

16



WHERE ON EARTH

NEW YORK'S ETERNAL FLAME FALLS

A logic-defying flame burns year-round beneath this waterfall in New York's Chestnut Ridge Park.

10



DEEP DIVE

DO ANCIENT NAVIGATION METHODS STILL STAND UP?

How do ancient techniques that helped humans find their way for millennia fare in the modern world? Benjamin Taub investigates.

4



OUR COVER STORY

CAN YOU THINK YOURSELF WELL?

How we think and feel can have far-reaching consequences for the body. Maddy Chapman explores how we could harness this to fight disease.

June 2024

CONTENTS

News Bites | page 2

What's new, what's weird, what's happening?

What On Earth | page 7

Picasso Bug

We Have Questions | page 8

What Attacks You In The Most Remote Place On Earth?

Book Bites | page 14

The Birth Of Insects

Meet The Author | page 15

Dr Erica McAlister and Adrian Washbourne on *Metamorphosis*

Science In Media | page 18

What to watch, read, and listen to this month

Dates To Remember | page 19

What to look out for this month

Dark Vs. Light | page 20

How will you end the issue?

IFLSCIENCE

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NEWS BITES



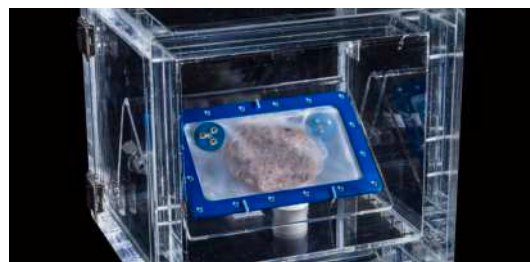

CURIOUS Podcast!

IFLScience is launching its first CURI0US podcast! *We Have Questions* takes the conversations CURI0US co-founder Rachael Funnell puts to experts in the magazine and reveals the conversations behind them that can't be condensed on the page. Who gets to claim sunken cities? What does it take to recover a "lost" species? What is it like working in a human tissue bank? We have plenty more questions, and expect you do too – email us at curious@iflscience.com and let us know! Follow IFLScience's flagship podcast **The Big Questions** or our weekly science news podcast **Break It Down** on all your favorite platforms to be the first notified when *We Have Questions* launches this month.



First Commercial Spacewalk

This month may see the first-ever commercial spacewalk – a trip outside a spacecraft by private civilians rather than trained astronauts. The Polaris Dawn mission, part of the private Polaris program backed by billionaire Jared Isaacman, will attempt to reach the highest Earth orbit a crewed spacecraft has ever flown at around 1,400 kilometers (870 miles). The previous record was set by Gemini 11 in 1966 at 1,373 kilometers (853 miles). This will be the first test of **SpaceX's new extravehicular activity (EVA) suits**, which could one day be used on missions to Mars. As the five-day flight plan takes the mission through portions of the Van Allen belts, the crew will also carry out around 40 experiments and scientific research on the effects of spaceflight and space radiation on human health. It will also be the first test of in-space communications using SpaceX's Starlink satellite constellation.



See A Space Cookie

You can now officially visit the (off) world's first space cookies, cookies baked in an oven in space! The first cookies – the first *anything* – to be baked in microgravity were **made by astronauts** aboard the International Space Station (ISS) in 2019 after an experimental oven was sent to the space station. Since hot air doesn't rise in space, the Zero-G oven used electric heating elements similar to a toaster plugged into the ISS's power system – basically a high-tech Easy-Bake oven. The cookies survived their trip back to Earth (alas, no astronaut got to try them) and now, after being thoroughly tested and investigated, one has taken pride of place at the US's National Air and Space Museum's Steven F. Udvar-Hazy Center in Virginia. According to museum curators, it even still smells like a baked cookie.

Rare Rhino Good News

It's been a good couple of months for those working in rhino conservation as two rare rhino babies have been spotted thriving in the wild. **Javan rhinos** once roamed southeast Asia but are now only found in Ujung Kulon National Park on Java island in Indonesia, where just 76 are thought to live. So spotting a new 3- to 5-month-old calf on camera traps has boosted morale for the most threatened rhino species. Over in Kenya, camera traps picked up a critically endangered baby eastern black rhino, thought to be around 6 months old. There are only eight known individuals in the Chyulu Hills in southern Kenya, so the new addition has surprised and delighted wildlife researchers.



Jurassic World: Chaos Theory

Jurassic World's little sister, *Camp Cretaceous*, is back with a new series, *Jurassic World: Chaos Theory*, in this excellent Netflix animated spin-off. After the events of *Jurassic World* left the kids on Isla Nublar to fend for themselves against dinosaurs – and more sinister foes – for nearly a year, they were finally rescued, only to find themselves in a world overrun by dinosaurs. Now, six years later, the Nublar Six are once again dragged into a mystery when one of their own disappears and they find themselves unveiling a global conspiracy that threatens dinosaurs and humans alike. Out now on Netflix.



Ariane 6 Launch – IFLS Reporting Live!

Another heavy-lift rocket is about to join the fray with the European Space Agency's (ESA) Ariane 6 due for inaugural launch some time between June 15 and July 31. The latest in next-generation rockets, Ariane 6 has been a long time coming and is mostly comparable to SpaceX's Falcon Heavy. The versatile rocket comes in two versions, capable of launching multiple satellites in a single flight or providing the heavy lift to launch a mission to the Moon. Ahead of launch, IFLScience spoke to ESA director Dr Josef Aschbacher about plans for the rocket, and IFLScience will be reporting live from the launchpad in French Guiana when it flies for the first time. Follow us on socials to be there when it happens.

WHAT'S UP?



Summer Solstice

Get ready for the longest day of the year

Name: Summer / June solstice, Midsummer (not to be confused with the differently spelled 2019 folk-horror movie)

Appearance: That big ball of fire in the sky at its absolute highest

Location: Northern Hemisphere

First things first – what actually is a solstice?

It's the point in time when the Earth's poles are at their most inclined toward or away from the Sun – all thanks to the planet's 23.5° tilt as it orbits around our star. From the ground, this gives the appearance of the Sun being at either its highest or lowest point in the sky, giving us the longest or the shortest day.

How many are there?

Two... or four, depending on how you look at it. Each hemisphere has a summer and a winter solstice, so sometimes it's simpler to refer to them by the month in which they occur to know what's happening and where.

When is the next one?

You guessed it (hopefully,

considering this is a column about timely events) – June. This marks the winter solstice in the Southern Hemisphere, or the summer solstice for the Northern Hemisphere-centric among you.

June 21, right?

Actually, no, not always. It usually does happen around this time, but because the astronomical year is 365.25 days long, the dates shift. This year's summer solstice is due on June 20 and it doesn't last the entirety of that day; it occurs at an exact moment during 8:51 pm UTC.

So, we know you're expecting it... what's the deal with Stonehenge?

Honestly? No one really knows for sure. What we do know is that the stones in the monument are aligned – purposefully or not – with the movements of the Sun. On the summer solstice, this means that the Sun rises and is picturesquely framed by the stones. It's thought this may have formed part of rituals or ceremonies marking the changes of the seasons.

OUR COVER STORY



CAN YOU THINK YOURSELF WELL?

**How we think and feel can have far-reaching consequences
for the body – can we harness that to fight disease?**

By Maddy Chapman

Image Credit: Imran Chowdhury

When you get sick, it's easy to point the finger elsewhere. Maybe the fault lies in your genes; perhaps it was that sniffing lady on the bus; what about the last thing you ate? In reality, it could have been any number of things. Don't get us wrong, **genetics** has a lot to answer for – as does that dodgy burrito – but our minds may be inextricably tied up in it all too.

Burgeoning research appears to be suggesting that the way we think and feel could influence our health. But is this the case? And, if so, could we exploit it to “think ourselves well”?

Body vs brain

It's easy to think of the body and brain as pretty disparate, but they are far from separate entities. In fact, they're incredibly interconnected, as **Dr Monty Lyman**, a research fellow at the University of Oxford and author of *The Immune Mind*, recently told IFLScience at **CURIOUS Live**. Lyman works in the emerging field of immunopsychiatry, which explores how the immune system can influence mental health – but also how mental health can influence the immune system.

“[Previously] the idea was that the brain focused on defending us against big threats – macro threats – like a lion or [...] another human trying to attack you, and the immune system was more for the microscopic threats. But actually, in the last 10 or so years, we've discovered that that's completely not the case and there's some really exciting science [...] that shows how they are completely interlinked. You could say that they are a combined defense system.”

Anecdotal, Lyman references his own experience of eczema, which would flare up during periods of high stress, as an example of how the mind can affect the immune system. It's well known that stress can have **far-reaching consequences** on the body, affecting all systems from respiratory and cardiovascular to gastrointestinal and reproductive.

There's also some research to suggest that **personality** may have a part to play. Back in 2003, one study **hinted at this**. In a group of over 300 healthy volunteers infected with the common cold, those with more positive emotional styles demonstrated greater resistance to developing a cold.

“IT'S BECOMING VERY CLEAR THAT THERE'S NO MENTAL HEALTH THAT ISN'T ALSO PHYSICAL AND THERE'S NO PHYSICAL HEALTH CONDITION THAT DOESN'T HAVE A MENTAL ASPECT.”

This link between personality and health is something that **C. Robert Cloninger**, Professor Emeritus of Psychiatry at Washington University in St. Louis, has studied extensively. As he told IFLScience of his **most recent research**, “We found that our personality strongly accounts [for] the way our brain and other organs in our body function by regulating gene expression and adaptations to changing life conditions.”

“Specifically, we found that our level of self-awareness – our insight into what habits, goals, and values provide satisfaction and meaning in our life – predicts how well we are able to regulate the functioning of our body and mind, and so our health and well-being.”

In addition, our outlook on life can be important, and, according to Cloninger, “influences all aspects of health, including physical, emotional, social, and cognitive well-being. [...] It affects our longevity and risk of the full range of diseases of the body and mind.”

But it's a **two-way street**, and just as the brain can impact the body, the body can impact the brain. “It's becoming very clear that there's no mental health that isn't also physical and there's no physical health condition that doesn't have a mental aspect,” Lyman added.

Mind over medicine?

With our body and brain so deeply entwined, how we think, feel, and act can indeed influence the way our bodies function, but what does that mean in terms of “thinking ourselves well”?

“We all can observe that when we are stressed and worried, we experience mental problems with negative emotions like anxiety, depression, and anger. Then we are also more likely to develop physical problems, like catching a cold or the flu,” Cloninger told IFLScience.

“It is less clear to people from their own observations that their thoughts and feelings also make them vulnerable to developing many severe chronic diseases as they age, including cardiovascular diseases, chronic lung diseases, cancer, diabetes, and arthritis.”

At the moment, medical specialties tend to be very divided: if what's ailing you is hormonal you might seek out an endocrinologist; if you're struggling mentally, perhaps you'd visit a psychiatrist. But maybe, in light of what we now know about the overlap between mental and physical health, the best solution might lie somewhere in the middle.

IT'S BEEN SUGGESTED THAT MEDITATION MAY REDUCE STRESS AT A CELLULAR LEVEL AND THAT TIBETAN BUDDHIST MONKS WHO PRACTICE IT DAILY MAY HAVE HEALTHIER GUT MICROBIOMES AS A RESULT.

A growing body of research is accruing, in which scientists are attempting to investigate how we could harness the power of the mind to help treat some physical health conditions and vice versa.

Therapy, for example, might benefit more than just our brains. **Promising research**

has suggested that cognitive behavioral therapy (CBT) could help relieve some symptoms of irritable bowel syndrome, and so could be a useful addition to current treatment programs.

There are even some who tout **meditation** as an option. While the practice has been claimed to help reduce chronic pain and improve blood pressure, high-quality studies supporting this are few and far between.

Despite these limitations, some studies have hinted at its potential impact beyond the brain: It's been suggested that meditation may **reduce stress** at a cellular level and that Tibetan Buddhist monks who practice it daily may have **healthier gut microbiomes** as a result. It's still early days, but with more robust research, such practices could have their place in medical interventions.

"THIS IDEA OF HAVING A MORE GENUINELY HOLISTIC IDEA OF MIND AND BODY IS HOPEFULLY GOING TO PERMEATE MEDICINE MOVING FORWARD."

"Because we can learn to better understand ourselves, we can change our personality and improve our health," Cloninger added. "Consequently, psychotherapy with meditative practices can improve personality organization and, in turn, health and well-being. In other words, health is a creative learning process."

Beware the power of positivity

But that's not to say that you could fight off an illness solely by willing it so. While there's undoubtedly power in positivity – research suggests that sick people's quality of life can be improved with a bit of positive thinking,

and even that optimistic people are more likely to turn up for regular treatments – some things can't simply be thought away.

And in some cases, enforcing an expectation of positivity could actually be detrimental to patients. In a 2013 piece for **The Conversation**, Dr Michael Vagg, now an Affiliate Associate Professor at Deakin University's School of Medicine, makes the point that people with, say, a cancer diagnosis may be made to feel unduly anxious if they've had that rhetoric forced upon them, when they – quite justifiably – feel scared, sad, or anything less than peachy about their prognosis.

Similarly, no patient should be made to feel like a condition is "all in their head" or that their diagnosis was their fault in the first place.

"You don't need to feel that you should be completely positive 100 percent of the time, because not only does that not happen, it's not healthy either. Coping the best way you know how to is all you should be aiming to do," Vagg writes.

At the end of the day, positivity is only part of the picture. "A positive mindset is one aspect of personality that is needed to optimize health," Cloninger told us. However, there are a multitude of other factors that influence our susceptibility to disease: our genetics, lifestyle, and environment, for example, are not to be overlooked.

From a clinician's standpoint though, embracing psychological therapies as part of physical interventions could have a lot of merit for certain conditions. In that sense, it may be possible to "think ourselves well", at least to some extent, and with the help of medical professionals – and it might just be the future, Lyman hopes.

"This idea of having a more genuinely holistic idea of mind and body is hopefully going to permeate medicine moving forward." •





Image Credit: Bat via flickr, Public Domain

PICASSO BUG

Say hello to the Picasso bug, *Sphaerocoris annulus*. This colorific critter gets its nickname for the beautiful combination of pigments splashed across its back like paint on canvas. It is a member of the Scutelleridae, a group of true bugs known as shield backed bugs or jewel bugs for their brilliant coloration. However, they are also known as stink bugs due to their habit of releasing pungent smells when bothered. It's giving "you can look, but you better not touch."



Image Courtesy of Chris Brown

WHAT ATTACKS YOU IN THE MOST REMOTE PLACE ON EARTH?

EXPLORERS WHO SWAM AT POINT NEMO FOUND OUT.

By Rachael Funnell

Point Nemo is the **most remote place** on Earth, the coordinates where – most of the time – the nearest humans are those occasionally whizzing overhead on the International Space Station. They sail by at a lofty 408 kilometers (253 miles) above the water's surface, but recently a father-son explorer duo went splashing through the waters of Point Nemo.

Chris Brown is on a mission to become the first person to tick off traversing all of the "Poles Of Inaccessibility", and on his latest adventure, he brought along his son, Mika. It would take them 2,688 kilometers (1,670 miles) from the nearest land – a journey that brought with it enormous swells, incredible sea sickness, and a surprise attack from an animal just as they reached the finish line.

How does it feel to be back on land?

Mika Brown: Amazing, can't get enough of it.

What is Point Nemo?

Chris Brown: It's one of the world's Poles Of Inaccessibility. A Pole Of Inaccessibility is a point that's furthest from the ocean in any direction. Point Nemo is the oceanic Pole Of Inaccessibility, which is the point furthest from land in any direction. There's three islands; Easter Island, Pitcairn Island, and Maher Island in the Antarctic, and it's 2,688 kilometers [4,326 miles] from each of those islands.

What was it like swimming there?

MB: I don't like deep water, so I didn't put any goggles on. I'm not putting my head in the water, just keep your head up, breathe, smile through it, because it's 4 kilometers [2.5 miles] deep, apparently. I think there's plenty of people [who wouldn't be] a fan of that. But it was cool to be there for sure, and a bit surreal after the ordeal of the 10 days that we'd had getting there.

"I'M NOT JOKING WHEN I SAY ANY TIME WE STOOD UP WE WOULD THROW UP STRAIGHTAWAY."

What were the sailing conditions like?

MB: I'm not joking when I say any time we stood up we would throw up straightaway, and it wasn't even like a little delay. It was pretty much: stand up, you need to start walking to the toilet.

We were in these waves which were 7 or 8 meters [23 or 26 feet], which is bigger than a house. It's bigger than your diving board at your local pool. And the swell was 13 seconds. So, every 13 seconds, you're going down 8 meters, and then up 8 meters, for two days straight, which was awful to be perfectly honest with you. Just awful.

CB: One of the crew confided in me near the end, he said he'd been working on boats for nine years, but more than that, he grew up on a small island where just going

to school he went in a boat. And he did say that the first few days of that voyage was the first time he was ever feeling ill on a boat.

"WE TRIED TO SCARE IT AWAY, I TRIED TO KICK AT IT, BUT I HAD FLIPPERS ON."

Any wildlife?

CB: There were quite a few albatrosses, and one took a particular interest. By particular interest, I mean, really close interest. He came down, and you know when geese take off in the water? They kind of run across it? This thing did that across the sea towards Adam the videographer. He was looking the other way at the time.

Was it attacking you?

CB: Without a doubt, it was a kind of attack. This thing came within a meter of us and just wasn't bothered, it was looking very menacing. Do you know the wingspan of an albatross? It's more than 3 meters [10 feet], so they're quite big birds. The huge, big beak was what was bothering me; 15 centimeters [6 inches] long, hooked, and serrated because it's plucking fish out.

To it, we're just football-sized things bobbing on the top of the ocean. We tried to scare it away, I tried to kick at it, but I had flippers on, so I couldn't get my feet up properly. In the end, the Zodiac [dinghy] came across to chase it away. ●



Want to hear more from the Browns' adventures to Point Nemo? Check out our full interview on IFLScience's YouTube or stay tuned for the We Have Questions podcast episode coming out in June.

Image Courtesy of Chris Brown

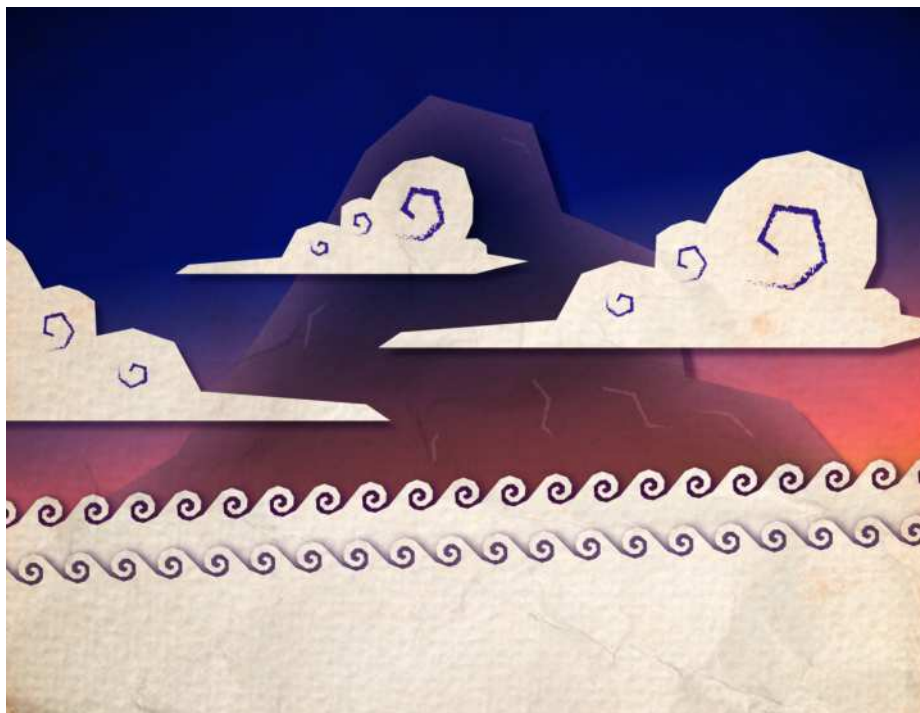


SCIENCE FACT OR FICTION:

DO ANCIENT NAVIGATION METHODS STILL STAND UP?

They facilitated the dispersal of our species across the globe for millennia, but how do ancient wayfinding techniques fare in the modern world? Benjamin Taub investigates.





On May 1, 1976, a traditional Polynesian canoe called Hōkūleʻa left Honolulu Bay in Hawaiʻi and began the 3,800-kilometer (2,400 mile) journey to Tahiti. However, unlike all other modern expeditions, this voyage was to be completed without compasses, maps, satellite navigation, or any other wayfinding tools, relying instead on traditional knowledge about the stars, swells, and signs to reach its destination.

Despite widespread pessimism about the possibility of achieving such a feat, Hōkūleʻa completed its trip in just over a month before returning to Hawaiʻi using the same ancient navigation methods before the end of July. Crewed by members of the Polynesian Voyaging Society, the Hōkūleʻa sparked a revival in the lost art of **wayfinding** and has been in constant use for the past five decades, completing multiple long-distance voyages including a round-the-world trip – all without the assistance of modern apparatus.

The techniques that have safely guided the vessel across vast oceans take a lifetime to learn, and are the same as those that facilitated the dispersal of our species across the globe throughout most of human history.

A journey through the sky

The stars have guided navigators across land and sea since time immemorial, with the art of astronomical navigation receiving its first mention in Homer's *Odyssey* sometime around the eighth century BCE. More than a millennium earlier, the Minoans used **"star paths"** to create a flourishing trade empire, calculating their course by learning where in the sky certain stars rise and set.

The same concept forms the basis of the **Hawaiian star compass**, which provides the cornerstone of traditional Polynesian navigation and divides the sky into families of stars occupying 32 houses. The different houses correspond to the positions of the stars as they emerge from the horizon when they rise and descend back into the ocean as they set.

"YOU DON'T NEED TO KNOW 5 BILLION STARS IN THE SKY, BUT YOU NEED TO KNOW IMPORTANT ONES THAT ARE GOING TO HELP DIRECT YOU TO PARTICULAR DIRECTIONS AROUND THIS COMPASS THAT'S IN YOUR MIND."

Sailing towards the right stars when they are low in the sky is a surefire way to maintain a correct course, although it becomes necessary to switch to a new target once a celestial point rises too high. To plot a route, therefore, sailors need to memorize a specific sequence of guiding stars, each rising and setting at different times of the night.

"You don't need to know 5 billion stars in the sky, but you need to know important ones that are going to help direct you to particular directions around this compass that's in your mind," **Lehua Kamalu**, Hōkūleʻa crew member since 2009, told IFLScience. "The easiest example is the North Star... although another would be the first star on the Belt of Orion, which rises due east consistently."

Overall, Kamalu says a navigator typically has about 200 stars in their mental compass at any given time and will start learning the celestial pathways required for a given voyage a full year before setting sail. Despite all this training and preparation, however, she estimates that the stars are only usable "about 10 percent of the time", as bad weather and full moons block out many of these distant guiding points.

"Most of the time you're not going to get this stunning full dome [with] no cloud and no moonlight disrupting your vision," she says. "It's always probably going to be pretty hard to see, and you're going to be picking stars out in the middle of clouds with very difficult visual conditions."

Added to that, it's also worth pointing out the stars are of no use whatsoever during the daytime. Of course, that's no biggie for the GPS-tracked modern sailor, but traditional navigators need to really know their onions if they want to stay on course with no help from the heavens.

Reading the surroundings

The weather is so often the scourge of the stargazing wayfinder, yet can also provide vital clues about which direction to head. Clouds on the horizon, for example, can sometimes indicate a coastline, since the air tends to heat up faster over land than

it does over the ocean, thus rising higher and condensing into clouds.

Birds are also important messengers for sailors looking for land, although you have to be pretty familiar with the avian inhabitants of your destination to interpret their signals. For instance, seabirds that always sleep on the shore act as signposts for keen ornithologists as they reliably fly out to sea at dawn before returning to land at dusk. Noting their direction of travel at different times of the day can therefore reveal the location of the nearest coastline.

Other birds have less rigid routines but can still be relied upon to feed their chicks, who are usually waiting in their nest back on dry land. Depending on whether these birds have a full beak or are empty-mouthed as they fly past, sailors can guess whether they're heading out to sea in search of food or back to land to puke into the mouths of their young.

***FOR THE MOST SKILLED NAVIGATORS,
THE WINDS AND THE WAVES CAN OFTEN
YIELD THE MOST DETAILED INFORMATION
ABOUT WHICH WAY THEY'RE HEADING.***

Thanks to the usefulness of these flying beacons, Kamalu says that "very traditional navigators know a lot about the birds that live on their islands – about what their patterns of feeding are, how far [out to sea] they go." And if you know how to read the signals that surround you at sea, "you start to see signs of land long before you can actually see an island itself on your horizon."

"We call it expanded landfall," she says.

Even for those still too far out in the ocean to detect these early traces of solid ground, there are still plenty of essential clues in the

air. But you have to know which way the wind blows if you want to make head or tail of the currents drifting by. For instance, Kamalu explains that "[in Hawai'i] we have a dominant east-northeast wind, I would say. And as you get closer to the equator, it's more of an east wind. And then as you go down to Tahiti, it's more of a southeast wind."

"And so one of the features that is pretty consistent throughout is that we have east winds, and we have east waves created by these east winds." For the most skilled navigators, the winds and the waves can often yield the most detailed information about which way they're heading.

Riding the wave

"If you talk to the most experienced navigators... they would say the wave is the most critical thing," says Kamalu. Sometimes referred to as **wave piloting**, the art of deciphering the churning water can reveal vital data about changes in swells, currents, and other key elements of

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ocean dynamics. This, in turn, can be used to estimate the direction of faraway islands and plot a course to remote destinations.

OFTEN, THE MOST ADEPT WAVE PILOTS WOULD RESORT TO SIMPLY LYING DOWN IN THEIR CANOE AND FEELING THE RHYTHM OF THE OCEAN IN ORDER TO GET A LOCK ON A WAVE PATTERN.

Traditionally, Micronesian wave pilots would train with the assistance of “stick charts”, which use strips of coconut husk and cowrie shells to model wave patterns and currents. Armed with only these abstract-looking diagrams, ancient sailors successfully conquered vast stretches of the Pacific Ocean, regularly voyaging thousands of miles to reach distant islands.

Unsurprisingly, however, learning to read the waves is not easy and requires an incredible amount of practice. “There’s usually just a bunch of waves coming from a bunch of different places that are all converging at your location, all throughout the day, and you want to try and find some consistent ones that are following a pattern,” says Kamalu. “And if you can find one, and you can get a reliable direction on it, you can use that to navigate.”

Often, the most adept wave pilots would resort to simply lying down in their canoe and feeling the rhythm of the ocean in order to get a lock on a wave pattern. According to Kamalu, developing this remarkable skill “requires you to have a good feel for it, and that’s not the most

natural thing if it’s not something that you learned pretty early on.”

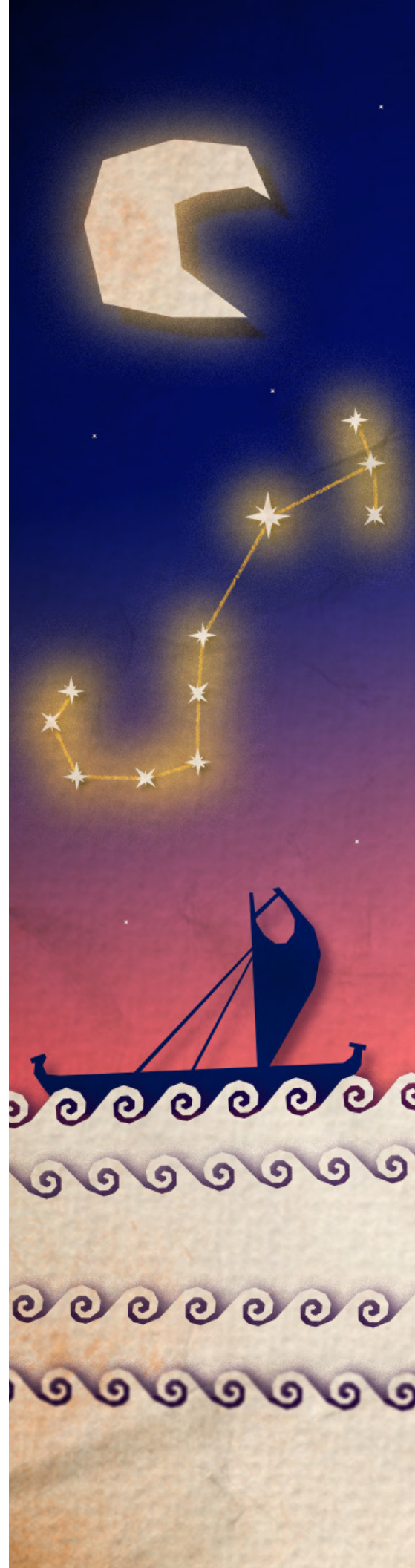
“In the traditions, they would train at two years old, three years old, four years old, and you just kind of develop this natural instinct,” she says.

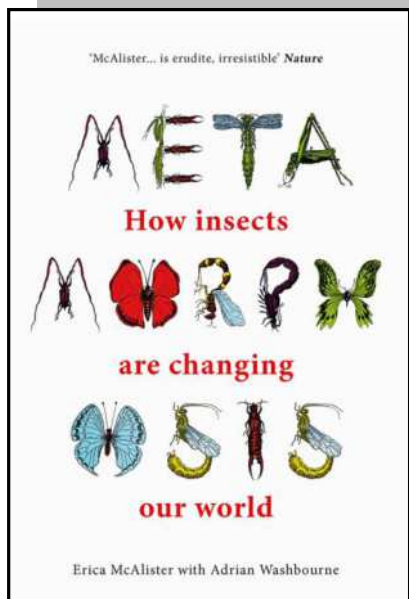
Ultimately, then, it’s clear that ancient navigation methods can still be used to accurately navigate across the world. The Hōkūle’a – and the revival of traditional wayfinding it has inspired – is irrefutable evidence for that. However, becoming sufficiently aligned with the ocean to be able to read its secrets may be unattainable for those who haven’t been initiated in their infancy.

AFTER ALL, THE WINDS, WAVES, WEATHER, AND STARS ARE NEVER STATIC, WHICH MEANS A WAYFINDER CAN NEVER REST.

Even for those who do reach this level of proficiency, the task of navigating without instruments is always a major undertaking. After all, the winds, waves, weather, and stars are never static, which means a wayfinder can never rest. Moreover, having to keep track of these forever-changing elements makes it impossible to ever hand over the reins to another pilot, which is why the Hōkūle’a – like other traditional vessels – typically only has one navigator for each voyage.

Putting all that into a nutshell, Kamalu says that “notoriously, as a navigator, your job is not to sleep, but to pay attention.” ●





THE BIRTH OF INSECTS

In this excerpt from *Metamorphosis: How Insects are Changing our World*, authors Dr Erica McAlister and Adrian Washbourne dive into entomology, nomenclature, and the staggering abundance of insect life.

Their presence has shaped our cultures for thousands of years. The larvae of moths, the workers of bees, and the defence mechanisms of true bugs have provided the silks, waxes, and dyes with which we have documented our progress through time. They have been a part of our diet for millennia – any readers who are currently on a palaeo diet, go ahead and munch on some migratory grasshoppers. We can dwell on the negatives – their perceived filth, or their key role in disease transmission – but these tiny but mighty creatures have led to extraordinary discoveries, from robotics to genetics to forensics, transforming our knowledge of agriculture, evolution, medicine, aerospace, artificial intelligence, biodiversity, and ourselves. Just one species of fly has helped us both look after ourselves on Earth and now

in space. Several species of beetles are helping us live in the most hostile of habitats. And thousands of cockroaches are telling us amazing things about the physiology of all animals.

Our knowledge about insects is as proportionally as small as they are to us. We don't even know how many there are out there. The latest count of mammal species as of September 2022 was 6,495. That may seem like an impressive figure, but it really isn't in comparison to the number of insects. Around 1 million insect species have been described to date but figures for the total number of species is vast – figures range from 5 million to 2.2 billion. That range is enormous, but even if we take the most conservative estimates – that's still a lot of little things.

To understand our environment, we started naming it. And we all know what humans are like at naming things – those in the UK may smile thinking about our recent history of *Boaty McBoatface* for a research vessel (this was deemed not appropriate, and the boat was named *RSS Sir David Attenborough* though the name lives on in the public consciousness as an autonomous underwater vehicle). But names have been problematic since we started using them.

Naming is not new – the scientific field that deals with nomenclature (the assigning of names) is called taxonomy from the

Greek meaning “arrangement method”, and it dates back three millennia. Oddly, the mythical Chinese Emperor Shennong (or Shen Nung), a deity in both Chinese and Vietnamese folk religion who was credited with the invention of agriculture (inventing implements such as the hoe and the plough, as well as the use of boiled horse urine for preserving seeds) and the use of plants for medicine, is also given credit for kick starting us off in organizing the life around us in 3000 BCE. From 206 BCE this knowledge was finally transcribed into a series of books – the *Shennong Bencaojing*. The first book included 120 drugs harmless to humans, the second book 120 substances that are beneficial, while the last book identified 125 drugs that weren't. I feel it may have been better the other way around!

From China across to India, and the naming of animals had kicked off before these publications around 400 BCE with Indian physician and scholar Charaka who was happily classifying “species”. He had divided up the animal kingdom into four groups: those born from the uterus i.e. humans and other placental mammals; those born of an egg; those born of moisture and head e.g. worms and mosquitoes; and those born of vegetable matter.

It was a long time till we understood how insects were “born” (and it is covered in this book). ●

AUTHOR
Q&A

DR ERICA MCALISTER AND ADRIAN WASHBOURNE

AUTHORS OF *METAMORPHOSIS*

Though they be small, the influence of insects on our planet has been mighty, and we're still finding new ways to draw inspiration from some of the planet's most – wrongfully – maligned residents. Dr Erica McAlister and Adrian Washbourne dive into the science in their new book, *Metamorphosis: How Insects are Changing our World*.

What's one of the many ways insects have changed our world?

AW: One of them is understanding evolution and Charles Darwin's theory of natural selection. Insects became a vital tool in providing evidence for that.

Two years after publishing *The Origin of Species*, he published this extraordinary little book called *On The Various Contrivances By Which British And Foreign Orchids Are Pollinated By Insects: And On The Good Effect Of Intercrossing* – very sexy title probably didn't sell very much, but it's incredibly playful. He was studying a lot of orchids in his garden at Dalhousie in Kent, and he was really interested in the way insects form this sort of unique relationship with an orchid.

Do you have a favorite insect species?

EM: I'm going flies, you know I'm going flies. I can't not go to flies.

AW: I think it's probably the vinegar fly, actually...We used to call it at school the fruit fly, because it would always spend its time sort of populating around rotting fruit...

Seventy eight percent of its genome is identical to the human, and so it's been an extraordinarily useful tool. For me, it's

been there all my life as something in the background or as a tool to do everything from A-level biology through to working with Erica.

Any favorite discoveries from your research?

EM: I found it amazing that you can manipulate the diet of the soldier fly larvae to produce such a tailored response in terms of protein-fat ratios. Learning about the impact of space on the nervous systems of flies is another. And the fact that migratory locusts come about by them knocking "knees" together!

What do you like about being a curator?

EM: The collection. It is outstanding – full of scientific curiosity from the species themselves, to where they were collected and by whom. We can ask more from our collection now through developments in technology etc, and it's great to know that they are helping us answer all sorts of current and important environmental issues.

How did you end up working on *Metamorphosis* together?

AW: It began with the BBC Radio series that we put together just before lockdown. The whole idea was to come up with a series that combined a different way of telling stories about insects, really their importance, bit of history, analysis of the insects themselves, but most importantly, the people behind these discoveries. It formed the sort of kernel of the book we've now written together.

What do you hope people will take away from it?

EM: It would be great to get folks to look closer at the small components of this planet. To just focus in on some of the smaller animals that are getting up to wonderful things. ●

Metamorphosis: How Insects are Changing our World is published by Natural History Museum, London, and is available now.

WHERE ON EARTH

Light flickers beneath the Eternal Flame Falls in New York's Chestnut Ridge Park. You might think that slap bang in the middle of falling water is a strange place to find a (near) eternal flame, but a pocket of naturally occurring gas makes this spooky waterfall glow year-round.

NEW YORK'S ETERNAL FLAME FALLS

You don't need to be a pyrologist to understand that fire doesn't typically vibe with water, and yet a flame burns in New York that appears to defy all logic. Tucked within a waterfall sits a pocket of gas that ignites with aplomb and burns year-round, able to be relit with a lighter should any passing hikers spot it's been splashed out. This curious phenomenon is seen in New York's Chestnut Ridge Park where the Eternal Flame Falls is found.

Geologists at Indiana University Bloomington found that the gas fueling the eternal flame originates from Rhinestreet Shale, an Upper Devonian formation around 400 meters (1,312 feet) deep. The gases can make it to the surface by seeping through passages carved out from faulting, which is caused by tectonic activity.

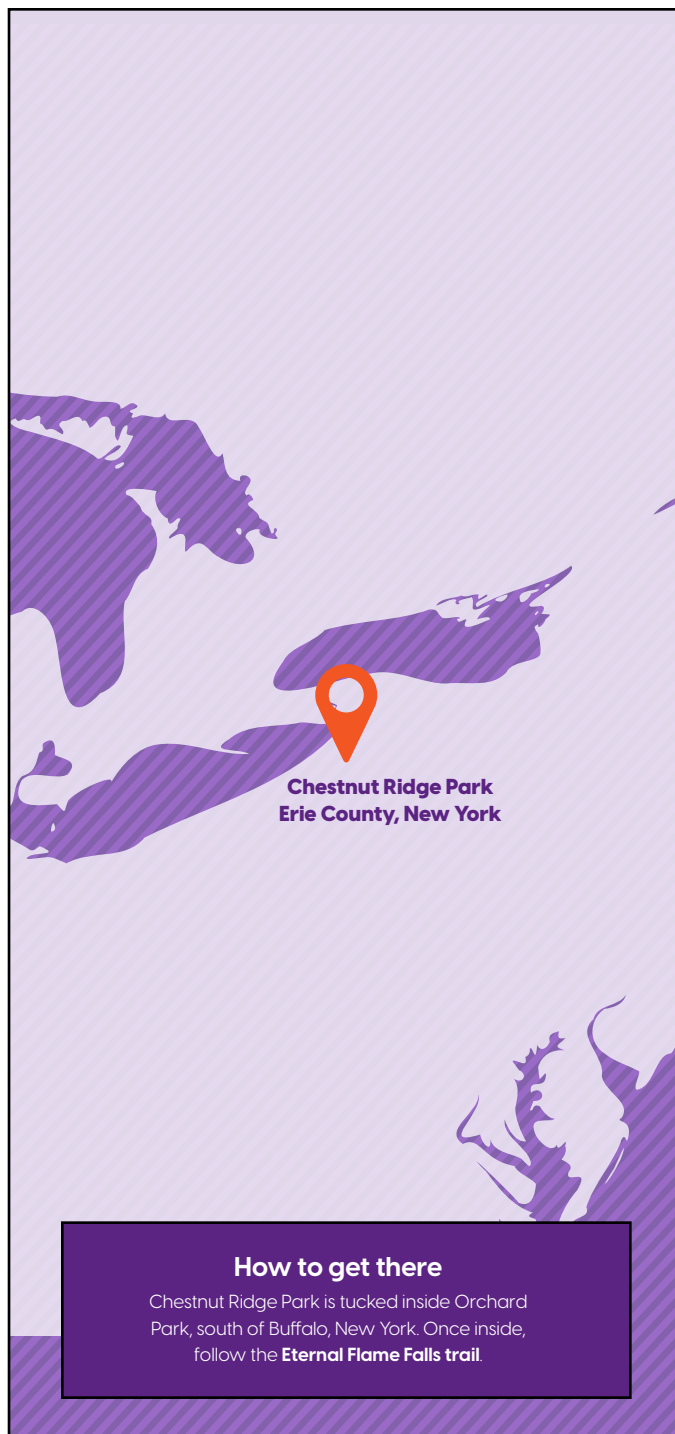
As these natural gases move and concentrate they can form a "macroseep" that ignites, feeding off a fuel that can keep going for decades – just look at **Turkmenistan's "Gates Of Hell"**. The fire at Eternal Flame Falls is pretty mini by comparison, just 20 centimeters (8 inches) tall, but it still burns around a **kilogram of gas a day**. It's also notable for the proportions of ethane and propane in its gassy fuel, which the researchers say may be the highest ever recorded in a natural seep.

It was this gassy composition that led researchers to its point of origin, with the Rhinestreet Shale having acted like a reservoir that's been "naturally fracked" by local tectonic events. As well as the Eternal Flame Falls macroseep, the researchers also identified numerous "micro seeps" of gas in the area. Combined, it's possible these fun-size seeps could be contributing to atmospheric concentrations of greenhouse gases and other pollutants.

There are downsides to a fire that just won't quit, but Eternal Flame Falls is still widely considered the world's most beautiful seep of its kind. Trapped within the clutches of a waterfall, the curious phenomenon is an arresting sight that's celebrated for its beauty, as well as its geology.

The flame lures in tourists far and wide who can visit the falls inside Chestnut Ridge Park by embarking on a short hike. The trail is under a mile long but encompasses some steep climbs, so sturdy footwear and a sprinkling of motivation will help you on your quest to track down the Eternal Flame Falls.

Be warned, though the gas flows freely, being in a waterfall means it isn't always alight. Hikers have been known to flick it back to life with a lighter, but rocks can be slippery when approaching the seep, so take care. The flame might be eternal, but we aren't. ●



WATCH

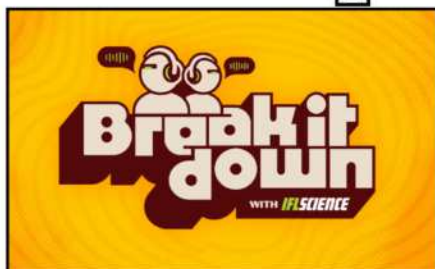


Inside Out 2 Movie from Pixar

Dive inside the human mind as we return to Riley's inner process as she tackles puberty. Becoming a teenager comes with unexpected side effects, including new emotions. Joy, Sadness, Anger, Fear, and Disgust have been running a successful operation up until now, but when Anxiety, Envy, Ennui, and Embarrassment show up, they're subbed to the Suppressed Emotions Jar as Operation New Riley begins.

In cinemas from **June 14**, then available on demand.

LISTEN



Break It Down Podcast from IFLScience

Did you know we have a weekly podcast? Get caught up on the biggest, weirdest, and wildest science from the last seven days each week as IFLScience writers share what they've learned, and who they have been talking to. Come for the fastest and most fun way to get up to date on the latest studies, news, and discoveries, stay to witness the hosts realize pronouncing the names of dinosaurs and asteroids is really hard.

New episodes **every Friday**.

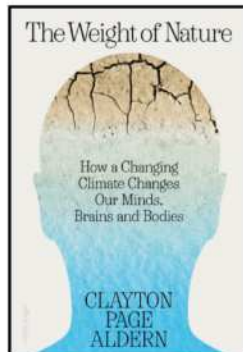
READ

The Weight Of Nature

Book by Clayton Aldern

Neuroscientist turned environmental journalist Clayton Aldern dives into the science that shows the cost of the climate crisis on our neurological health. *The Weight of Nature:*

How a Changing Climate Changes Our Minds, Brains and Bodies explores how a changing planet is making incremental changes to our brains and bodies, drawing on seven years of ground-breaking research demonstrating we're facing a new kind of public health crisis.



Available **now**.

SCIENCE IN MEDIA



MEET



Grizzly 399: Queen of the Tetons

Documentary from Nature on PBS

Meet the most famous bear in Grand Teton National Park, 399. This female bear pulls a crowd each year when she emerges from hibernation, and now she has a litter of four cubs to raise. It's a tough time to be a literal momma bear to grizzlies, facing threats from a warming climate and human encroachment in bear country. To make matters worse, Wyoming, Idaho, and Montana are seeking to remove grizzlies from the endangered species list – which would make it legal to hunt them.

Available now on pbs.org/nature, YouTube, and the PBS App.

WATCH



Why Dinosaurs? Film from Pinto Productions

This Hollywood dinosaur documentary is kicking off its UK tour now before a release in the US next year. Dive into why the world is so dinosaur obsessed through interviews with some of palaeontology's leading experts, including Dr Dean Lomax of the *Rutland Sea Dragon* fame, the field museum's Dr Jingmai O'Connor (who you can look out for in our July issue), and Jurassic Park "dinosaur supervisor" Phil Tippett.

UK screenings available **now**.



DATES TO REMEMBER

This month is crammed full of science celebrations – and we’re over the June. You can help protect our planet this Environment Day, salute women in engineering, educate yourself about asteroids, and more. And if you find yourself in London, don’t miss out on a free science and arts festival.

JUNE

5 World Environment Day

June 5 is World Environment Day – the largest global platform for environmental public outreach celebrated by millions of people across the world. The annual observance strives to encourage awareness and action for the protection of the environment – much needed in these times of climate change. This year, celebrations will be hosted by Saudi Arabia and will focus on land restoration, desertification, and drought resilience under the slogan “Our land. Our future. We are #GenerationRestoration.”



14 World Blood Donor Day

Blood donations save lives and they deserve to be celebrated, as they will be on June 14 – World Blood Donor Day. As well as thanking voluntary donors for their selfless contributions, the day will raise awareness of the need for safe blood and blood products, which are a fundamental component of an effective global health system.



15-16 The Great Exhibition Road Festival

If you want to find out how science and the arts intersect to help people, communities, and nature flourish, head over to The Great Exhibition Road Festival – a weekend of free science and arts events for all ages in London, UK. Including hands-on workshops, fascinating talks, performances, and installations from Imperial College London, the Natural History Museum, Science Museum, V&A, and more, it’s not to be missed. Find out how to book your free tickets [here](#). Not in London? Don’t worry, you can catch up with past events [online](#).



23 International Women in Engineering Day

This year, International Women in Engineering Day will honor the best, brightest, and bravest women in engineering and the amazing work they do every day to enhance people’s lives, all while encouraging more women and girls to pursue careers in the field in which they are still hugely under-represented.



30 Asteroid Day

On June 30, 1908, Earth experienced its largest impact in recorded history – the **Tunguska event** – when an asteroid exploded over the Podkamennaya Tunguska River in Siberia, Russia. Now, on that date, Asteroid Day – co-founded by **Brian May of Queen** – aims to educate the public about asteroids and raise awareness about the potential hazards they pose. Events will be held around the globe to mark the occasion, find one near you [here](#).



ARE YOU DRAWN TO THE DARKER OR LIGHTER SIDE OF SCIENCE?

Choose how you end each issue. For those who prefer the darker side, Holly Large explores why parrots sometimes kill rather than adopt each other's babies. If you like your science lighter, discover the link between the genetics of fruit flies and Kevin Bacon.

BABY PARROT MURDER

If you thought competition over real estate between humans was a bit intense, believe us, it's got absolutely nothing on green-rumped parrotlets.

Back in 1988, a team of biologists began observing a community of these small, unassuming-looking birds, and they unexpectedly came across nests with dead baby parrotlets in them.

"We couldn't tell if something had attacked them, or if they had died from disease, or something else," said team lead Steven Beissinger in a **statement**. "But when we were watching some of the nests, all of a sudden in went a male who didn't belong – who wasn't a parent at that nest – and out he came with a little bit of blood on his beak."

You don't need to be Poirot to figure out that guy was probably a murderer – but why?

Beissinger and the team spent the next 27 years monitoring

the behaviors of the parrotlet population in 346 nests, as outlined in a recent **study**, and discovered that increased competition for nests was the main driver of infanticide.

"At low population levels, it's all love and peace, right? But then when you get to high population densities, it's a bloodbath," said study co-author Karl Berg.

"It's not that everybody's born a killer, but the urge to breed is very strong. When the resources provided by the environment aren't enough for all individuals to breed, they seek out alternative strategies. Unfortunately, that involves killing innocent little offspring."

The team also found that baby killers struck when they wanted to breed with a widowed female who already had offspring – but they were just as likely to adopt and become stepfathers instead, which surprised the authors.

"Adoption may be a lot easier to accept than infanticide, but it's actually more difficult to understand because it challenges Darwin's ideas about natural selection," Berg said.

Who'd have thought murder would be the more normal option?

DEGREES OF KEVIN BACON

As gene names go, *CG14109* doesn't reveal much. Thankfully, a team of geneticists from the University of Toronto have instead dubbed it *degrees of kevin bacon (dokb)* – and with very good reason.

Humans and other animals alike have social networks, full of interconnected individuals that can have roles within the group. One of these roles includes the flow of information, and some individuals will be of greater importance to it than others.

That importance is measured by a property known as "betweenness centrality", giving individuals a kind of "gatekeeper" score for the flow of information. Scientists have long suspected that genetics might influence an individual's score, and took to fruit flies to investigate the possibility.

There, they identified *CG14109* as a possible candidate – it's expressed in a region of the fruit fly brain that's involved in learning and memory, two factors that are pretty

important when it comes to information flow.

They also gave the gene a much more appropriate name, given the circumstances.

"We named this gene *degrees of kevin bacon (dokb)* after the parlor game 'Six Degrees of Kevin Bacon' where participants choose an arbitrary Hollywood actor and determine the shortest path that connects that individual to Kevin Bacon via film roles," write the researchers in the **study**.

To demonstrate its influence, the team took two strains of fruit flies with social networks that had different betweenness centrality, and swapped only the *dokb* gene from one strain to the other. In doing so, they found that they could make the social network of one strain look like the other.

Whether or not the gene named after him is actually in Kevin Bacon, and plays a role in his betweenness centrality, is a different matter. Though fruit flies are often used as a model to investigate human genetics, the researchers couldn't identify *dokb* outside of their scientific order – though they're hopeful the pathways it's involved in might still be there.



The **Darker** Side
of Science



THE **Lighter** Side
OF SCIENCE