

CURIOUS?

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One of the few places on Earth where, if you forget your paints, the land provides.

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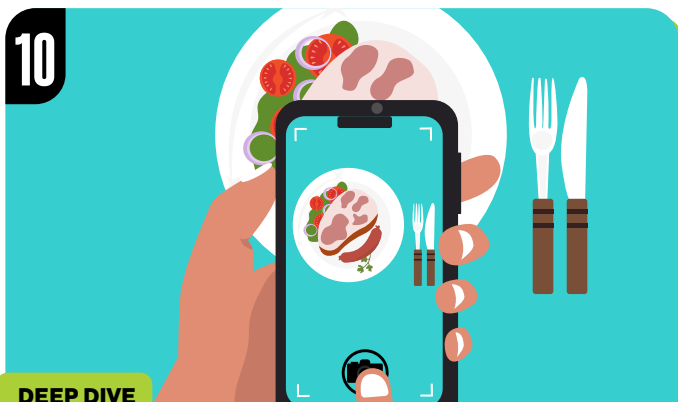


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EDITORS

Katy Evans
Rachael Funnell

CONTRIBUTING WRITERS

Ben Taub
Rachael Funnell
Holly Large

ART & DESIGN

James Rodrigues

NEWSBITES



We're Going To The Moon!

After 54 years, this year we are finally, **FINALLY**, going back to the Moon! NASA appears confident that Artemis II, which will fly the first woman and person of color to the Moon, is a go. Currently scheduled for February, with a second launch window in April, Artemis II will be the first crewed mission to return to the Moon since Apollo 17 in 1972. This will be the 10th time humans have flown to the Moon; all previous missions were between 1969 and 1972, so it's about time. The 10-day test flight will be NASA's first mission with crew aboard the Space Launch System (SLS) rocket and Orion spacecraft. The four astronauts will be testing the craft's operations systems in a real-world setting in preparation for Artemis III, which will see humans set foot on the Moon's surface again (don't hold your breath for a date yet, though, it's a moving goalpost). As we have seen with Artemis already, deep space missions are not easy, so keep your fingers crossed that this is one Moon trip we will get to witness this decade.

Earth Perihelion

Earth will reach perihelion in early January, when its orbit brings it closest to the Sun. This annual event occurs because Earth's path is slightly elliptical rather than perfectly circular. On January 3, the distance between Earth and the Sun will decrease to about 147 million kilometers (91 million miles), roughly 3 percent closer than at aphelion, its furthest distance, which will occur in July. Despite the reduced distance, temperatures in the Northern Hemisphere remain wintery cold because seasons are driven by axial tilt, not orbital proximity. Earth's closest approach does, however, subtly increase solar radiation so sunlight can be up to 7 percent stronger.

100 Years Of TV

In a post-holiday season funk with no plans to leave your sofa and the telly until spring? It might interest you to know then that January 26 is the 100th anniversary of the world's first public demonstration of television. Throughout the late 19th and early 20th century, many attempts were made to create "true" television following on from telegraphs, telephones, and radio, but it was inventor John Logie Baird who was the first to successfully demonstrate his television system, which he did to the members of the Royal Institution of Great Britain in January 1926. So, if anyone asks why you haven't moved in days, tell them you are paying your respects to one of the greatest inventions of all time.

Challenger Disaster 40th Anniversary

This year marks the 40th anniversary of the Challenger disaster, one of the worst space disasters ever recorded due to the loss of all seven astronauts' lives as the space shuttle Challenger blew up 73 seconds into its ascent on January 28, 1986. The seven astronauts were memorialized on the Moon with craters in the Apollo basin named after them: Gregory Jarvis, Christa McAuliffe, Ronald McNair, Ellison Onizuka, Judith Resnick, Dick Scobee, and Michael Smith. In a new TV series, *The Challenger*, timed to come out this year, Kristen Stewart is set to play Sally Ride, the first American woman and LGBTQ+ person to fly into space, who was also the only astronaut to be part of the investigation into the disaster. It was Ride who pinpointed the problems with the Challenger's O-ring rubber seals that became brittle and exploded due to record-low temperatures on launch day, which ultimately turned out to be the reason for the explosion.





Science Fiction Day

Get your 2026 reading and watch list inspiration from Science Fiction Day on January 2, famed science fiction writer Isaac Asimov's 126th birthday. Sci-fi allows us to explore "what if" scenarios, and is as relevant today as ever, with topics like space travel, alien contact, future tech, and existential and social themes. If you want some nice anniversaries to hat tip, it's the 75th anniversary of Asimov's *Foundation*, the 130th anniversary of H.G. Wells' *The Island of Dr Moreau*, and the 140th anniversary of Robert Louis Stevenson's *Strange Case of Dr Jekyll and Mr Hyde*. Or *The Fly* premiered 40 years ago, *Logan's Run* 60 years ago, and the original *Star Trek* celebrates its 60th anniversary. Of course, modern sci-fi is alive and well; check out this month's **Science in Media** for inspiration. Don't forget to share #NationalScienceFictionDay with millions around the world.



What To Watch This Year

2026 is being touted as one of the best years for sci-movies ever, with a wealth of big-budget, big-screen releases. Yes, there are new *Avengers*, *Spiderman*, and something something *Star Wars*-related, BUT for anyone who fancies something new and a little different, we have the epic-looking adaptation of *Project Hail Mary* by *The Martian* author Andy Weir, the first Supergirl-centric movie in 42 years, an untitled UFO-themed Steven Spielberg vehicle (co-written with the original *Jurassic Park* screenwriter), the intriguing *Flowervale Street* from producer JJ Abrams described as "a mystery thriller with dinosaurs set in the '80s", and a *Hunger Games* film starring a character people actually like.

WHAT'S UP?

40TH ANNIVERSARY OF OUR ONLY TRIP TO URANUS

And what a visit it was!

Name: Voyager 2

Appearance: Shiny space bug with a dinner plate for a hat

Location: Uranus (stop it)

Why was this visit such a big deal?

Because Voyager 2's trip to Uranus was the first – and only – time that humanity had visited the ice giant. Given that Uranus is, on average, around 2.9 billion kilometers (1.8 billion miles) away from Earth, that's no small feat.

Guessing it took a while to get there then?

You guessed correctly. Voyager 2 launched on August 20, 1977, and it would take another eight Elton John albums and flying past gas giants Jupiter and Saturn before it made its closest approach to Uranus nearly nine years later on January 24, 1986. At this point, it was just 81,500 kilometers (50,600 miles) away from the planet's cloud tops – that's about a fifth of the distance between the Moon and the Earth.

Did Voyager 2 discover anything cool about Uranus when it flew past?

It sure did – several cool things, in fact. Providing our closest glimpse of the

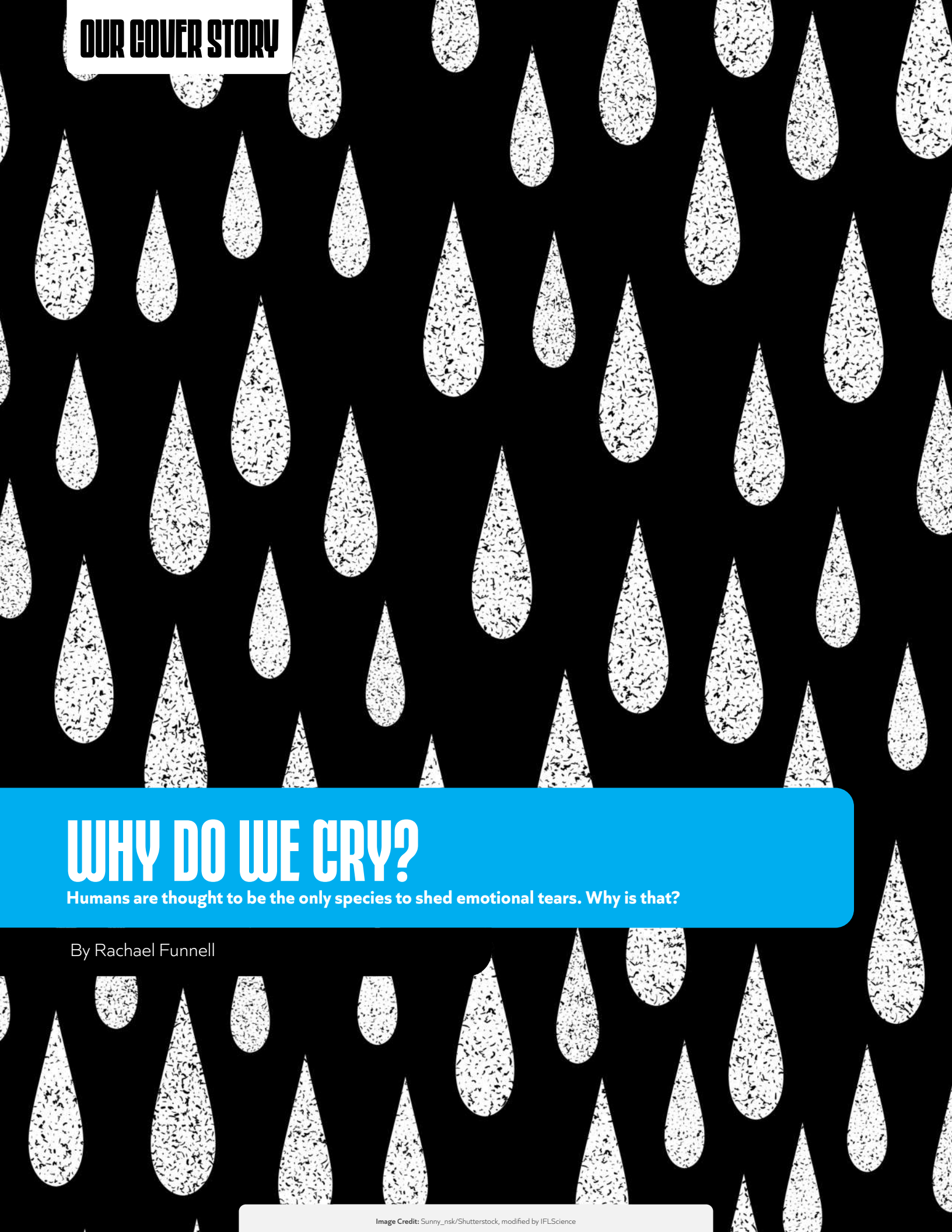
planet and its surroundings yet, the spacecraft revealed 10 new moons – all with names from characters in Shakespeare's works – two new rings, and an off-axis, off-center magnetic field. On top of these new discoveries, Voyager 2 took some pretty spectacular images of the planet, its rings, and moons, capturing them in previously unseen detail.

How come we haven't been back since?

Traveling to the outer planets is easier said than done. The main reason Voyager 2 was able to get to Uranus – and the other planets that it visited – in this relatively short timeframe was thanks to a rare planetary alignment that only occurs once every 175 years. This meant that it could use **gravity assists** to speed up the trip from one planet to the next.

Where's Voyager 2 now?

Following its visit to Uranus, Voyager 2 took a trip to Neptune – and then carried on going. Right now, it's in interstellar space, having left the Solar System on November 5, 2018. In November next year, it will become the first human object to **reach 1 light-day away**.



OUR COVER STORY

WHY DO WE CRY?

Humans are thought to be the only species to shed emotional tears. Why is that?

By Rachael Funnell

The human eye is, let's be honest, a bit weird. A big ball of jelly with a pretty ring of color wrapped around a black dot that waxes and wanes, capturing all that we experience of the world around us (visually, at least).

It's quite fussy, too. Insistent on remaining wet to clear debris and swerve infection. Fortunately, we've evolved an inbuilt screenwash – tears. Thing is, they don't only get wet in response to irritation. As anyone who's ever watched the Jurassic Bark episode of *Futurama* will tell you, it's when you **get in your feelings** that the waterworks really get going.

Emotional crying is, at time of writing, thought to be unique to humans. Your pet may whimper and whine when their favorite human is absent, but as far as leaking profusely from your sight organs goes? That's all us, baby.

So, where does emotional crying come from? And why does it stay with us into adulthood? Turns out, there are actually quite a few benefits (and some perplexing side effects) to shedding emotional tears.

An acoustical umbilical cord

In the battle of the babies, human infants would come off pretty poorly. Unlike baby turtles who hatch ready for *The Hunger Games*, we come into the world unable to even hold our heads up. We can't move, feed, or defend ourselves. Big squishy sitting ducks.

Thankfully, we score very highly for parental care. Parents risk life and limb as we spend around a quarter of our total lifespan getting to grips with the basics, and this exceptional development appears to be pivotal in why we evolved emotional crying.

"Our prolonged childhood is a period during which we have developed the motor skills to move independently, and we can specifically turn our attention to an individual from whom we expect advice, support, or comfort (often our parent or intimates; the preferred persons in whose company we want to cry)," clinical psychologist **Ad Vingerhoets**, who focused his

career on stress and emotion, told IFLScience. "Acoustical or vocal crying is a most useful signal when we cannot move toward a specific person, i.e., during our infancy (crying as an acoustical umbilical cord)."

"THERE IS AN INHERENT RISK IN VOCAL CRYING: IT IS AN EFFICIENT BEHAVIOR IN CERTAIN SITUATIONS, BUT DON'T DO IT IF IT ISN'T REALLY NECESSARY, BECAUSE IT CAN ATTRACT PREDATORS."

"When a mother lost an infant, the vocal crying facilitated the reunion of mother and child, even in dense vegetation and in darkness. However, a major disadvantage could be that not only the mother but also predators hear the cries, which might lure them. So, there is an inherent risk in vocal crying: it is an efficient behavior in certain situations, but don't do it if it isn't really necessary, because **it can attract predators.**"

How we cry

Crying is like an acoustic alarm for young children. If you run and trip and bonk your head on the corner of the coffee table, a healthy dose of screaming is likely to get you the medical attention you require. But humans, we took our personal alarm system one step further.

"What is also unique about human infants is that they put strong pressure on their eyeballs when they cry, due to the strong contraction of the eye muscles," said Vingerhoets. "This pressure may stimulate nerve endings on the eyeball (much as dust particles, wind, and tear gas do), which in turn stimulate the lacrimal gland to produce tears. In this way, a link has been established between vocal crying and tear production."

Why we cry

Tears come in different varieties. You've got

your reflex tears that come in response to an irritant, continuous tears that act like a shield, and emotional tears. The latter group can be divided further still, into attachment tears, societal tears, sentimental/moral tears, and compassionate tears.

Different kinds are triggered by different feelings, but Vingerhoets' work has revealed that we are most likely to cry when we feel helpless or hopeless. "Crying is a social trigger for empathy," he told the **British Psychological Society**. "A communication system that signals to others 'I need your help and support'. There may be an element of sadness along with the feelings of helplessness – indeed the loss of or separation from loved ones, such as through death and divorce or in homesickness, are among the strongest triggers of crying."

Is crying... good?

I used to think I had a bit of a weird relationship with crying. I don't like to do it, but if life is kind and I go a few weeks without shedding a tear, it's like I feel a need. Pent-up anxious energy, and what better way to let it out than watching *Forrest Gump* (again).

Your breath catches. Shoulders shake. You can't open your eyes forget being able to see anything. Throat aching, brain unspooling, and then – clarity. Tell someone you make yourself cry on purpose and they might gently slide the number of a therapist across the table, but in its own way, crying kind of *is* a form of therapy.

According to **Harvard Health Publishing**, emotional crying flushes our bodies with oxytocin, a feel-good hormone produced by the brain (specifically the hypothalamus). It's often touted as the "love drug" because it can help us form bonds, but research has found it may even help heal hearts after a **heart attack**.

Crying also releases endorphins, which are a kind of endogenous opioid. These hormones are connected to relief from emotional and physical pain, giving you a sense of **euphoria** while increasing stress resilience. It's possible, then, that crying acts as a self-soothing behavior. The release of endorphins increases our tolerance for pain, **dulling its intensity** much like opioid drugs do.

That feeling of tension and release I described

has been documented, too. A **2007 study** measured the heart and breathing rates of 60 female students watching neutral and sad films. The data revealed that while the heart rate increased in the lead-up to crying, it quickly slowed down after crying began. Crying also led to slower breathing that lasted for about 4 minutes, indicating that while crying acts as a distress signal, it also may be pivotal in restoring the crier's emotional and physical state.

A PECULIAR STUDY THAT MADE WOMEN CRY AND MEN SNIFF THE RESULTING FLUID FOUND THAT SMELLING TEARS HAD A CURIOUS EFFECT ON MEN'S AROUSAL: THEY REPORTED FEELING LESS TURNED ON.

A secret signal

In babies, crying is usually associated with a fair amount of screaming, but as a means of communication, there may be something more nuanced at play when we cry emotional tears. "Recent research suggests that tears contain a pheromone that may lower testosterone in men, possibly resulting in the inhibition of sexual arousal and aggression," said Vingerhoets.

We've yet to find hard evidence of human pheromones, but that's not to say we don't have them. The fact that as children we don't smell of much and then develop all sorts of smells after puberty would suggest that there's probably something being said that isn't coming out of our mouths. But as for isolating a human pheromone? We're **not there yet**.

Sweat might seem like the most obvious pheromone source, but it's possible there's a

message in our tears, too. A peculiar **study** that made women cry and men sniff the resulting fluid found that smelling tears had a curious effect on men's arousal: they reported feeling less turned on looking at images of women, and those reports were supported by salivary testosterone levels and brain scans.

The effects were present even though the men didn't actually see the women crying and had no knowledge of why they were crying. A follow-up **study** questioned the strength – or indeed existence – of this inter-personal effect of crying, but as the search for human pheromones continues, it raises interesting questions about emotional tears as a candidate.

Don't hold it in

Another interesting area of Vingerhoets' research is crying proneness, essentially how likely one person is to cry compared to another. Some of us (*raises hand*) cry easily and openly, while others are much harder to crack.

Neither one is right or wrong, it's just natural variation. Twin studies indicate this is more strongly determined by your genes than how often you like to watch sad movies or listen to emotional music. Where problems can arise, however, is when we fight our feelings.

Repressive coping is the scientific name given to "bottling it up," and it's been found to carry several negative consequences.

A **2012 study** that carried out a meta-analysis of 22 studies, encompassing 6,775 participants, "revealed significant associations between repressive coping, cancer, and cardiovascular diseases, especially hypertension. These results add to the notion of repressive coping as a consequence of cancer as well as to its important role for the issue of hypertension."

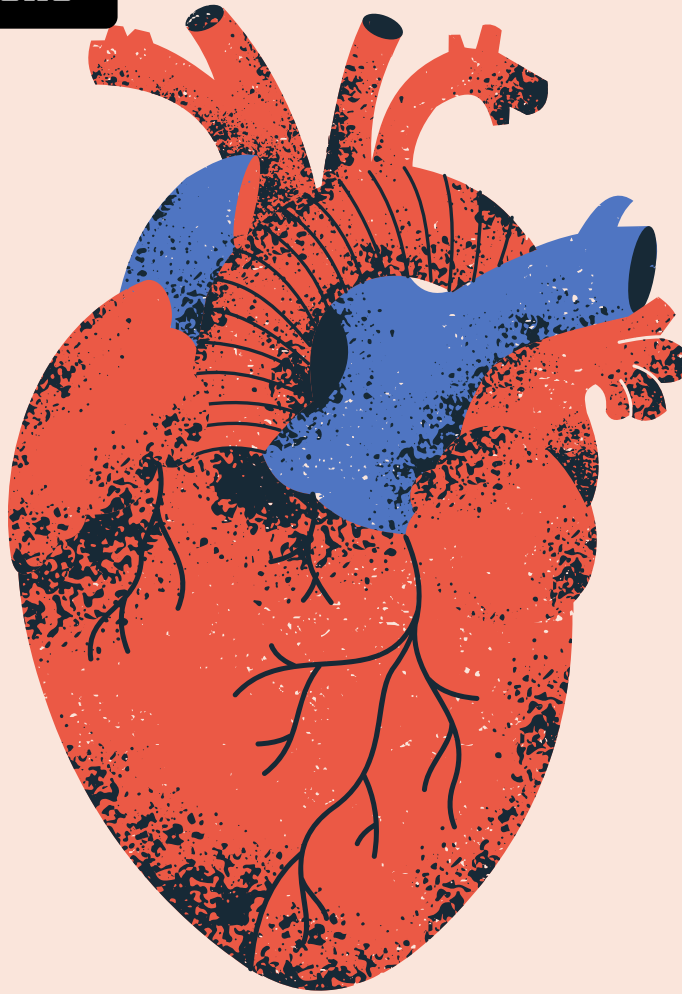
Crying might well be for babies, but it's for adults, too. If we've got to lug around brains the size of planets and the breadth of emotion they contain, don't you think we're entitled to a little self-soothing now and then? 🌿



WHAT ON EARTH

THE WORLD'S BIGGEST FLOWER

Meet *Rafflesia arnoldii*, commonly known as the corpse flower. Looking fresh off the set of *Super Mario*, it claims the title as the world's largest flower, and it's seriously weird. Its pollinators are meat-loving insects that it lures in with a corpse-like odor when in bloom. The bloom is fleeting, lasting just a few days, but at its biggest, it can be **1 meter** (3 feet) across and weigh 9 kilograms (20 pounds). Crikey.



WHERE IS THE HUMAN HEART LOCATED?

Think it's on the left?
You're almost right.

By Rachael Funnell

New to anatomy? Locating your heart is a good start. Thing is, many people when asked will be pointing somewhere in the region of the left side of their body. It's an easy mistake to make, not least because when we go to the doctor, that's where they stick the stethoscope to have a listen.

For the most part, it's actually in the dead center, but with a lean. There are several good reasons for this, but a few conditions can mean your heart and its apex can shift around slightly. To find out where the heart is and how it got there, we sat down with Professor of Anatomy and Director of the Clinical Anatomy Learning Centre at Lancaster University, **Adam Taylor**. Turns out your ticker goes on quite a journey to wind up where it is.

Where is the heart?

AT: Well, it's meant to be in our chest. You've got your ribs and your sternum, and they're there to protect your heart. People often learn about it at school, and they hear it's on the left. There is some truth to that, but it's not all the way on the left.

There's a little bit of it that sticks out onto the left-hand side, but the heart is central. There's just a chunk of it hanging over to the left-hand side, which is why your left lung is slightly smaller than your right lung.



Why do doctors listen on the left?

AT: When we want to listen to the beat of the heart, we can listen to the spaces between the ribs and pick up what we call the apex beat of the heart. That's really important. It's much harder to listen for those beats behind the sternum, because the sound is insulated.

That's why, when you go to the doctor and they use the stethoscope, they're not listening at the sternum. They're listening to the sides of the sternum, because that's where the sound waves from the closing of the valves can be heard – that's what you're hearing as the heart's beating, the opening and closing of the valves.

So, it's tilted?

AT: It's a fallen over pyramid, basically. If you think of the pyramids in Egypt, you've got that apex, the point of it, and that's over to the left-hand side. It's not tilted. The base of it, the flattest bit, is actually towards the back and to the right-hand side in the chest, pointing a little bit towards the ribs and the spine.

Why?

AT: It's a result of the way that the heart forms. Our heart starts off as a piece of pipe, but then it folds. Instead of being a straight up and down piece, it forms a U-shape. Then, it begins to twist and rotate, and as it develops, it begins to increase in size, and that leads it to having this kind of fallen over shape where the point of it is actually over on the left-hand side of our chest.

Is there any benefit to this?

AT: A lot of people are interested in this, in the kind of biomechanics and pumping mechanisms of the heart. One of the pretty well-evidenced theories is that actually this is the most optimal and efficient position for the heart to be in to pump blood.

If it was a completely upside-down pyramid with the point at the bottom, it would be competing against gravity. Being on its side and being able to kind of compress and point sideways before the blood goes up and out of the heart gives it a little bit less of a challenge.

Is it always there?

AT: The heart, like many organs, begins much

higher up. It begins in the head region of the embryo, very early on in development, and then descends into the chest through the neck.

Because of the size of the heart (it's a big chunk of muscle relative to what else is around it), it usually doesn't take any prisoners in kind of boshing everything else out of the way. So, it's not often that we find anything else really influencing it in terms of kind of encroaching on its space.

There are instances where it may kind of be on the wrong side or in the wrong position, and that's typically driven by signaling molecules and growth factors and other things that are expressed during development. So, it's very rare to see the heart anywhere that it shouldn't be.

When is it on the wrong side?

AT: **Situs inversus** is a relatively rare congenital condition where, as the name suggests, everything is inverted. So, our heart would point over to the right-hand side. Many of the other organs in the abdomen are also affected. Usually, we expect the liver to be on the right-hand side. For somebody with situs inversus, it would switch over to the left.

The condition itself is often harmless on its own. So, some people might not realize that they've got the condition until somebody comes to listen to their heart and it's like, oh, hang on a sec.

Can it move?

AT: The heart actually sits on the diaphragm, which is the big muscle sheet between our abdomen and our chest that we use when we take a deep breath. That muscle pulls down and actually starts in our neck, so as that goes down, it's also contributing to pulling the heart down with it. 🌟



SCIENCE FACT OR FICTION:

WHAT WOULD HAPPEN IF WE ATE LIKE OUR ANCESTORS?

The paleo diet may be all the rage for online influencers, but are they even close to the real thing? Ben Taub investigates.





adapted to eating particular types of food. Under scientific analysis, however, these claims simply don't stand up.

For example, the primitive hominin species *Paranthropus boisei* possessed massive, flat molars that earned it the nickname "Nutcracker Man" and led to the widely accepted idea that it used its dental hardware primarily for this purpose. Yet when Ungar looked at microwear traces on some of these molars, he found marks more consistent with **chewing grasses** than breaking nutshells.

The lesson here is that while morphology might provide some clues as to what a species *could* eat, it doesn't tell us what it *did* eat. "Your anatomy doesn't determine what you eat," says Ungar. "Availability is more important."

And because what's available varies from place to place, ancient humans had to continually come up with new solutions to ensure they received all the nutrients they needed. Neanderthals, for example, are often depicted as mammoth-slaying carnivores, yet the reality is that humans can't eat more than about 300 grams (10.6 ounces) of meat per day without developing a type of protein poisoning known as rabbit starvation. To avoid this, our extinct relatives had to supplement their diets with fat, which they may have obtained by making **bone broth**.

Stone-Age hunter-gatherers and social media influencers are about as far apart as you can get on the human spectrum, so there's an obnoxious irony about the fact that so many internet personalities seem to be peddling "paleo" diets. Stick to their curated caveman menu, they say, and you'll lose weight, reset your biology, and avoid disease.

"That's all nonsense, that's all made up," paleoanthropologist **Peter Ungar** from the University of Arkansas tells IFLScience, pulling no punches. "The biggest misconception is that we evolved to eat specific types of food," he says. "The reality is, we evolved for dietary versatility and flexibility, and to make use of whatever was available to us at the time."

So while your Instagram feed might be urging you to gorge on animal organs and nuts, Ungar insists that "there is no natural human diet, there never has been, and there never will be."

What did prehistoric people eat?

Like today's vastly varied culinary practices, diets in the Stone Age were characterized by their diversity as human populations sought to sustain themselves on whatever resources their environment provided. For hunter-gatherers in the Arctic, this meant chowing down on calorific seal blubber, while foragers in the Kalahari may have obtained more of their energy and nutrients from mongongo nuts or tubers.

However, according to Ungar, analyses of prehistoric dental calculus simply aren't capable of reconstructing ancient diets with any kind of precision, so we have no idea what our ancestors actually ate on a day-to-day basis – despite what paleo diet proponents might tell you. Typically, these regimes claim to be based on our evolutionary biology, with the shape of our gut and the size of our teeth often singled out as proof that our ancestors were

"I KNOW INTERMITTENT
FASTING IS ALL THE RAGE,
BUT I'M NOT A FAN. SURE,
OUR BODIES CAN DEAL WITH
IT – THAT'S WHAT THEY'RE
BUILT FOR – BUT THAT
DOESN'T MEAN IT'S THE
RIGHT WAY TO LIVE TODAY."

As it happens, bone broth is sometimes touted as a constituent of the paleo diet.

However, there's also evidence to suggest that Neanderthals got the fat they needed by consuming rotting meat that was **riddled with maggots** – though you're unlikely to find that particular fad being endorsed on Instagram.

Could we mimic the diets of our ancestors?

While there's no way to be sure what any prehistoric human actually ate, the generalist and opportunistic nature of human foraging means that essentially nothing was off the table – as long as it could be obtained from the natural environment. To imitate this diet, then, you'd need to ditch everything that comes from a store and start extracting nutrients from your surroundings.

Anything you can get your hands on that hasn't been modified or processed by humans counts as paleo, regardless of whether you end up with an animal-based diet or a

plant-heavy intake. Bear in mind that most meat and vegetables sold in butchers, green grocers, and supermarkets come from farmed plants and animals that have been selectively bred over centuries, and don't therefore resemble the foods that our ancestors would have consumed.

This leaves you with wild meat and fish, foraged greens, edible roots dug up from the soil, fruits, berries, and nuts at certain times of year, and maybe even some honey every now and then if you're really skilled. Obviously, the exact composition of your paleo diet will depend on your location and will change with the season, so it's impossible to provide any kind of one-size-fits-all ancestral menu.

What we can say, though, is that you'll be eating only whole foods, which is a pretty massive shift from the processed – and **ultra-processed** – ingredients that typify the modern

diet. This means that you'll be getting more fiber and less calories per mouthful, and are likely to feel more satisfied so will probably eat less overall.

To demonstrate this, the authors of a 2019 study split a cohort of 20 volunteers into two groups, one of which ate ultra-processed foods for 14 days while the other spent the fortnight consuming only unprocessed foods. The two groups' meals were matched for calorific content, yet those on the ultra-processed diet consistently ate more than those on the unprocessed diet, and ended up ingesting **around 500 more calories per day** than those who stuck to whole foods.

There are many reasons for this, with the high sugar, fat, and salt levels in ultra-processed foods possibly responsible for hijacking diners' reward circuits and causing them to indulge beyond the point of satiety. Regardless of the

IFL SCIENCE



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THE SCIENCE OF MAGIC

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cause of this calorie binge, though, it's clear that adopting a paleo-informed diet can be a good call, and will almost certainly lead to weight loss while also reducing the risk of obesity, heart disease, and other metabolic disorders.

Risks and benefits

Speaking of metabolic disease, it's widely acknowledged that many of these conditions are triggered by modern lifestyles and diets – and the fact these are so poorly matched to our evolutionary biology. For instance, Ungar explains that “we evolved for the kind of feast-and-famine cycles that our ancestors experienced,” and that “our bodies are built to take advantage of calorically dense foods when they're available, because you didn't know when the next famine was going to hit.”

It's therefore likely that our ancestors may have involuntarily fasted – or at least reduced their calorie intake – during lean periods. Interestingly, there's a growing body of evidence suggesting that intermittent fasting may help to stave off obesity and diabetes, lower blood pressure, and even enhance brain health. However, at this stage, there's no clear evidence that these benefits stem from an evolutionary adaptation to famine, so while the occasional fast might make your paleo diet more realistic, Ungar doesn't recommend incorporating intentional calorie restriction.

“I know intermittent fasting is all the rage, but I'm not a fan,” he says. “Sure, our bodies can deal with it – that's what they're built for – but that doesn't mean it's the right way to live today.” Instead, he says the overall goal should be to “eat less, move more”, with a steady intake of unprocessed foods helping to keep our calorie count in check.

Yet the benefits of eating like a caveman extend further than this; your gut would change, too. Studies have shown that modern hunter-gatherers like the Hadza of Tanzania have **more diverse microbiomes** than westerners, largely thanks to their high-fiber, seasonal diets. Separate research has demonstrated how switching to a more traditional diet that is high in fiber and low in fat triggers a **shift in**

gut bacteria after just two weeks, causing a proliferation in microbial communities that are linked to improved metabolic health.

However, unlike modern paleo-disciples, groups like the Hadza really know what they're doing when it comes to foraging wild foods, and understand how to diversify their diets in order to cover all their nutritional needs. Conversely, the uninitiated run the risk of missing out on certain vital nutrients – as highlighted by a 2018 study that revealed **iodine deficiency** in postmenopausal women who had spent two years on a “Palaeolithic-type diet”.

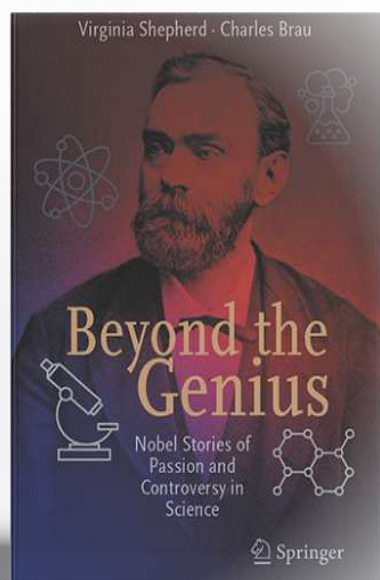
Ultimately, then, eating like a true ancestor involves more than simply cutting out ultra-processed foods, and requires a deep understanding of one's dietary needs as one moves through the various stages of life, as well as a knowledge of how to obtain all the necessary micronutrients. Hit these targets, and your blood sugar might stabilize, your gut bacteria may bloom, and you might even shed a pound or two.

Yet if there's one takeaway here, it's that there is no magic diet that our ancestors ate in order to achieve this. Instead, prehistoric humans consumed anything they could find that helped them meet their nutritional needs, and it's this ability to freestyle that led to our evolutionary success.

After all, species that depend on a specific food source for their survival are highly vulnerable to changes in climate, habitat, and biodiversity. Humans, on the other hand, survived by broadening their diet and finding something to eat in just about every landscape.

The problem these days, of course, is that our landscapes now include supermarkets with their endless supplies of packaged calories. Luckily, though, you don't have to adopt a prehistoric lifestyle to break the cycle of metabolic overload. Simply lay off the ultra-processed junk and eat more whole foods, and you'll be well on your way to a healthier future – even if your diet isn't really from the past. 🌱





In this excerpt from *Beyond The Genius: Novel Stories Of Passion And Controversy In Science*, authors Dr Virginia Shepherd and Dr Charles Brau dive into Germany's slow start in the race to create the first atomic bomb.

Although they had a head start at the beginning of World War II, the German program to develop an atomic bomb never succeeded in achieving even the smallest steps toward building the bomb. Set in the chaos of the war, the program was beset with infighting, inept management, uncertain support, and scientific missteps, some attributable to Heisenberg himself. Since they were certain that if the Germans couldn't do it, then no one else could do it either, the German program lacked the sense of urgency that energized the Allied program. While they were interned at Farm Hall after the war, the German scientists were shocked and disbelieving when they

THE URANIUM CLUB

heard about the bombs dropped on Japan. This is how it happened.

When Rutherford discovered the nucleus in 1911, it was immediately obvious that the nucleus must contain enormous energy to hold all the positive charges together in a such a tight volume, but no one thought that this energy would ever be available. More than 20 years later, on September 11, 1933, while he was addressing a meeting of the British Association for the Advancement of Science, *The Times* (London) quoted Rutherford as saying that "anyone who looked for a source of power in the transformation of atoms was talking moonshine." In his address, Rutherford was describing his discovery that bombarding nuclei with artificially accelerated protons could split light elements like lithium into smaller particles, in which case more energy was released than was provided by the proton. Due to electrical repulsion, however, the positively charged protons Rutherford was using couldn't reach nuclei heavier than lithium, which is just the third element in the periodic table. In any event, proton bombardment would be a slow and inefficient way to produce nuclear energy.

The next morning, reacting to the article in *The Times*, Leo Szilard, a Hungarian Jew who had fled to London when Hitler became Chancellor, realized that since neutrons, which had been discovered by Chadwick only

the year before, have no charge, they would not be repelled by the positive charge of a nucleus, and unlike Rutherford's protons, neutrons could reach, and potentially react with, any nuclei, even heavy nuclei. Since nuclei contain both protons and neutrons, he conceived the idea that if further neutrons were liberated by the neutron bombardment, this would cause a self-sustaining chain reaction. If, for example, two neutrons are liberated by the first collision, these two neutrons will cause reactions that liberate four neutrons, and so on, releasing energy at each step. Energy, potentially enormous energy, would be released with no need for any initial energy input. If all this takes place in microseconds, the result will be a tremendous explosion, a bomb. Szilard had, of course, no idea that a heavy nucleus could break into two smaller nuclei, since fission hadn't been discovered yet, but any nuclear process that released energy and neutrons would work. He immediately applied for a patent on the idea of a nuclear chain reaction. It was granted in 1936, but recognizing the possibility of a monstrous bomb, Szilard assigned the patent to the British Admiralty and kept it secret until 1949. It's interesting that Szilard conceived these ideas shortly after reading H. G. Wells' futuristic novel *The World Set Free*, in which nuclear power and atomic bombs were first mentioned. But it would take 12 years, and the largest scientific undertaking in history, to create the first successful atomic bomb. 🌟



Q&A WITH

DR VIRGINIA SHEPHERD AND DR CHARLES BRAU

AUTHORS OF:

BEYOND THE GENIUS: NOVEL STORIES OF PASSION AND CONTROVERSY IN SCIENCE

The Nobel Prize is considered one of the most celebrated accolades a person can achieve, but what about the people behind the awards? Brilliance, after all, isn't immune to controversy. Dr Virginia Shepherd and Dr Charles Brau explore it all in *Beyond the Genius: Novel Stories Of Passion And Controversy In Science* through the tales of eight laureates and Alfred Nobel himself.

How did you choose which stories to include?

Our goal in selecting the scientists that we highlighted was to focus on outstanding scientific contributions that were clouded by controversy surrounding the scientist. For example, Fritz Haber's awarded discovery was how to combine nitrogen from the air with hydrogen to produce ammonia. The synthesis of ammonia, used to make fertilizer that feeds half the world, has been hailed as one of the most impactful discoveries in chemistry.

However, what many people remember about Haber is his development of poison gas, used

during World War I, ultimately killing thousands of soldiers. Unfortunately for Haber, Germany lost the war, and Haber's personal life from that point on was filled with tragedy; as Hitler gained power, Haber's military efforts were forgotten and he was forced to escape Germany as a Jew.

What did you set out to achieve?

The individuals we've examined in the book are all different, but taken together they illustrate the notion that progress in science is more complex than just the science itself. They're all brilliant scientists, acknowledged geniuses, if you like. But they're much more than that; genius isn't the whole story.

Their lives are beset by crosscurrents of war and nationalism, passion and jealousy, competition and ambition, perseverance and luck. The object of this book is to pull back the curtain to illuminate the factors that led them to their discoveries, the impact of those discoveries on science and society, and what they did with their discoveries and with their Nobel fame.

Did you learn anything through the course of your research that surprised you?

The Nobel Prize is the most prestigious prize in all the sciences, but at times its respect has been tarnished by allowing politics to enter into the selection of awardees. For example, although

Sweden tried to remain apolitical and neutral in the early 20th century, many on the committees were clearly pro-German.

Shortly after WWI ended, Fritz Haber feared that he would be tried for war crimes, but instead he won a Nobel Prize for his ammonia work; the committee completely ignored his gas warfare and synthesis of nitrates to prolong the war. In the years just following Haber's award, four more Germans were awarded prizes. Laureates from across the globe protested loudly, but of course the prizes could not be retracted.

Another example is the prize given to Stanley Prusiner in 1997. Prusiner had been actively and publicly campaigning for the award, and the committee gave him the prize for prions before there was any convincing evidence for the role of prions in mad cow disease from other researchers. The haste to award him the Prize may have been due to the raging pandemic and the weak government response in England.

What could the Nobel Prizes learn from their own past?

The members of the Nobel committees should avoid letting their personal biases cloud their judgement. For example, Lise Meitner was probably denied the 1945 Physics Prize at least in part because she was a woman and a Jew. Likewise, Einstein's theory of relativity never received a Prize because the committee members were experimenters and couldn't accept his theory. On the other hand, Nils Gustaf Dalén was awarded the 1912 Physics Prize for a lighthouse gas regulator because the Swedish committee members apparently wanted a Swede to win the prize.

What do you hope readers will take away from the book?

These scientists were certainly geniuses in their fields, who had personal lives clouded by controversy and scandal. Their lives and discoveries shed light on the complexity of science and how it really works, and show that despite its faults and missteps, science is arguably the most successful human enterprise ever undertaken. ✨

Beyond the Genius: Novel Stories Of Passion And Controversy In Science is published by Springer Cham and is out now.

WHERE ON EARTH

Ah, what a beautiful place, but nuts! I've forgotten my paints. You're in no short supply at Paint Mines Interpretive Park, where humans have been gathering pigments from the landscape for around 9,000 years. Home to hoodoos, spires, gullies, and canyons, it's a treasure trove of archaeological and geological discovery.

By Rachael Funnell



PAINT MINES INTERPRETIVE PARK



Welcome to El Paso County's Paint Mines Interpretive Park. Also known as the Calhan Paint Mines Archaeological District, it's a colorful window to the past that's captured layers of ancient soils – known as paleosols – in all their technicolor wonder.

The site has been open to the public since 2005, but it's also a wildlife preservation park that's home to some fascinating archaeological and geological features. It sits about a mile south of the town of Calhan in Colorado.

Around 9,000 years ago, Native Americans were drawn to this area of the Colorado eastern plain. Here, they found a precious resource: brightly colored bands of clay. Reddish-yellows, pinkish-purple, and blueish-whites. A decent start for any painter's palette.

The colors come from deposits of iron and **manganese** oxide. Back then, large samples of the mineral layers would've been retrieved using stone tools and then broken down into a fine powder. This powder was then combined with some kind of binder to make paint. That could've been anything from animal fats to blood or water, with different paint types serving different purposes. Body paint, pottery paint, ceremonial paint – you name it.

With a rich array of colors and some rather peculiar rocky formations, it's a bit of a playground for geologists in the modern era. Hoodoos and spires are dotted across the landscape, adding to the drama of its many canyons and gullies.

The uneven ground is the result of millions of years of erosion through wind, water, and freezing that have stripped away layers of sedimentary rock. The composition of that rock decides what parts disappear quickly and what lingers on, giving rise to extreme ups and downs that wouldn't be out of place in a skate park (do not, however, take your skates – they'll kick you out for those kind of shenanigans).

"Paint Mines Interpretive Park is one of many paleosol outcrops around the Denver Basin, but its hoodoo geology is possibly one of only four such areas in Colorado," according to an El Paso County Colorado 2024 **report**. "Hoodoos typically consist of relatively soft rock topped by harder, less easily eroded stone that protects each column from the elements."

"The white sandstone capstone found at Paint Mines Interpretive Park is part of the Dawson Arkose Formation within the Denver Basin Group's D2 Sequence and was formed out of material created when Pikes Peak Granite was uplifted and later eroded. The white capstone protects soft clay columns of vibrant paleosols from erosion, creating the fanciful formations known today. These landforms represent 65 million years of geologic processes from the dinosaurs and creation of the Rocky Mountains to the present." 🌟

READ DETOUR

Book by Jeff Rake and Rob Hart

Cop Ryan Crane gets invited on a journey of a lifetime after rescuing a billionaire from an attempted assassination, becoming one of a handful of civilians to join three astronauts on the first crewed mission to Saturn's moon, Titan. Will they make it back to Earth? And what will be waiting for them when they do? – **Available Jan 13.**

READ THE SCORE: HOW TO STOP PLAYING SOMEONE ELSE'S GAME

Book by C Thi Nguyen

Philosopher, gamer, and author Nguyen nearly gave up teaching after university metrics required to validate his work stripped his practice of all joy. His despair inspired a question: Why do we play games? Here, he presents a new theory about how our gamified world has fundamentally changed our value systems, forcing us to prioritize what can be measured and monetized over what is truly meaningful. – **Available Jan 13.**



LISTEN

WE HAVE QUESTIONS

IFLScience Podcast

In 2022, a new world record was set in the waters off Grand Cayman in the western Caribbean Sea. Some might wear that achievement like a badge of honor, but environmentalist Oly Rush would rather talk about plastic. That's because his 36-hour-and-59-minute test of endurance was about raising awareness of one of the greatest threats to marine life. You can hear all about his adventure in this episode of *We Have Questions* hosted by Rachael Funnell, including why face-planting a jellyfish can be as good as a cup of coffee.

– **Available Jan 19.**



PLAY ROUTINE

Game from Lunar Software

Imagine you've woken up on an abandoned lunar base. Feeling panicked? Yeah, it's not great. In order to survive this first-person sci-fi horror, you're going to need to figure out what, or who, is going to kill you first.

– **Available now.**

WATCH

THE GREAT FLOOD

Movie on Netflix

A researcher trapped in an apartment building fights for answers after an enormous flood brings society to its knees. – **Available now.**

WATCH

THE WAR BETWEEN THE LAND AND THE SEA

TV series from the BBC

Have you been missing the Whoniverse? Well, good news. It's back, and as perilous as ever. An ancient species has emerged from the ocean, triggering an international crisis. Who will conquer in *The War Between the Land and the Sea*?

– **Available now.**



LEARN

DISCORDANCE: THE TROUBLED HISTORY OF THE HUBBLE CONSTANT

Book by Jim Baggott

The Hubble Constant is a very important parameter that expresses the expansion rate of the Universe today. Thing is, **we don't exactly know how to measure it.** – **Available now.**

1

VEGANUARY

Veganuary is the annual January campaign encouraging people to try a vegan lifestyle, even just for a month. Science shows that cutting down red meat in your diet is better for personal health, animal welfare, and the environment. Even a part-time vegan diet can lead to more sustainable habits and ethical, climate-friendly food choices, so why not try it?

26

NEW WHOS PODCAST EP!

A 37-hour swim? Yes, you read that right. You'll just have to listen to the latest episode of *We Have Questions* to find out more.



21

MUSEUM SELFIE DAY

Get yourself down to your favorite museum – or use this as an excuse to visit one you haven't before – for the one selfie day we can get on board with. Pose with your favorite dinosaur skeleton, spacecraft, or inspirational portrait and don't forget to share your #MuseumSelfie!

17

INTERNATIONAL MENTORING DAY

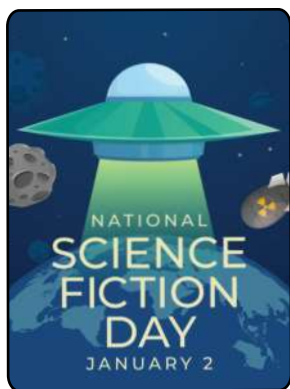
14

WORLD LOGIC DAY

The ability to think logically and rationally is one of humanity's defining features and yet, it appears to be falling out of favor. Challenge your friends, family, school, or co-workers to some logic puzzles and celebrate an important tool in the development of the sciences.

2

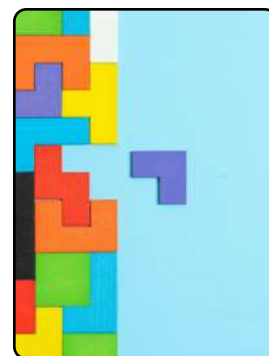
NATIONAL SCIENCE FICTION DAY



2026

JANUARY

New year, new you? Why not try going vegan for Veganuary, become a mentor, let your sci-fi nerd flag fly, or introduce the joys of logic to whoever in your life needs it.



3

EARTH'S PERIHELION

3

FULL WOLF MOON

4

QUADRANTID PEAK

This is one of the most intense annual meteor showers, often producing many bright meteors per hour. It peaks on Jan 4 so find a dark sky, wrap up warm, and relax.



4

ISAAC NEWTON'S BIRTHDAY

Isaac Newton was born on January 4, 1643. Or at least he was according to the modern Gregorian calendar we use today. According to the Julian calendar in use at the time, however, Newton was born on December 25, 1642. It's a whole thing, and you can read more about it [here](#).

8

EARTH ROTATION DAY

8

STEPHEN HAWKING'S BIRTHDAY

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 how a single story about the Black Death led to misinformation that lasted centuries. If you like your science lighter, discover how drones with defibrillators could soon be saving lives in the US.



EXPLORE YOUR SIDE ON FACEBOOK

PLAGUE, POEMS, AND MISINFORMATION

Misinformation about infectious diseases might feel like a modern phenomenon, but a new study investigating our understanding of the spread of the Black Death has revealed that even pathogens that caused pandemics hundreds of years ago are far from immune – and have falsely shaped our beliefs to this day.

The Black Death was one of the most fatal pandemics in human history, with bubonic plague caused by the bacterium *Yersinia pestis* running rampant through Eurasia, killing an estimated 75 to 200 million people between 1334 to 1353. It's largely thought to have originated in Central Asia, and it's also a popular belief that it made it from there to the southern edge of Europe in under a decade.

It's this idea that the **new study** calls into question, with historians from the University of Exeter determining that it stems back not to factual accounts, but a misunderstanding of a popular *maqāma*, a genre of Arabic literature consisting of short, rhymed stories that often follow the character of a traveling trickster. It's not something that's

supposed to be taken as an accurate historical testimony.

This particular *maqāma*, *Risālat al-naba' 'an al-wabā'* or *An Essay on the Report of the Pestilence*, was written by historian and poet Ibn al-Wardī, who also peppered some of the story into his historical writings – and therein lies the problem. The study authors argue that historians in the following centuries took the *maqāma* literally as a result, and this misunderstanding has persisted to the modern day.

"All roads to the factually incorrect description of the spread of the plague lead back to this one text. It's like it is in the centre of a spider's web of the myths about how the Black Death moved across the region," **explained** Professor Nahyan Fancy.

"The entire trans-Asian movement of plague and its arrival in Egypt prior to Syria has always been and continues to be based upon Ibn al-Wardī's singular *Risāla*, which is unsubstantiated by other contemporary chronicles and even *maqāmas*. The text was written just to highlight the fact the plague travelled, and tricked people. It should not be taken literally."

That doesn't mean that the story should be dismissed entirely; as Fancy points out, it can give us clues as to how people may have leaned into their creativity to cope with all the disease and death surrounding them.

Still, it just goes to show that the saying "Don't believe everything you read" really is a tale as old as time.

LIFE-SAVING DELIVERY DRONES

What do you picture when you read the phrase "delivery by drone"? Maybe a faster way to get your coffee pod refills – but getting everyone their caffeine fix ASAP is not all they could be good for. A first-of-its-kind clinical trial in the US is hoping to show that drone tech can be used to save lives, too.

The trial, which is being carried out in Forsyth County, North Carolina, and James City County, Virginia, will see drones carrying automated external defibrillators (AEDs) dispatched during 911 calls where there's a suspected cardiac arrest.

Not only does this mean that potentially life-saving care can be delivered in places that are harder to reach, but it can also be delivered quickly, too – something that is critical to survival.

"Through a lot of research, we've discovered that the first five minutes matter the most for survival," **explained** the trial's principal investigator Dr Monique Starks, an associate professor of medicine at Duke University. "If you can perform CPR and use an AED within the first five minutes, for a patient with a shockable

arrhythmia, survival can average 50 percent."

Speed that up to using an AED within two to three minutes, Starks adds, and the chances of survival can increase to between 60 to 70 percent. With emergency medical services (EMS) averaging 8 to 10 minutes to arrive at the scene, these drones could make a significant difference.

The process begins with a 911 call for cardiac arrest, at which point the AED-fitted drone is dispatched, launched by a drone pilot who is in constant contact with the 911 dispatcher. The drone travels autonomously to the location, flying at around 61 meters (200 feet).

Once it reaches where help is needed, the drone lowers to around 30 meters (100 feet), and then winches the AED down to the ground, where the 911 dispatcher guides the caller on how to use it until EMS arrives.

"Drones can meaningfully shorten the most critical moments between collapse and care," **said** Betsy Sink, battalion chief at James City County Emergency Medical Services. "They won't replace traditional response systems, but they can strengthen them by placing lifesaving equipment in the hands of bystanders when it matters most. This project allows us to better understand how far this innovation can go in improving survival and will shape the future of emergency medicine."



The **Darker** Side of Science



THE **LIGHTER** SIDE OF SCIENCE