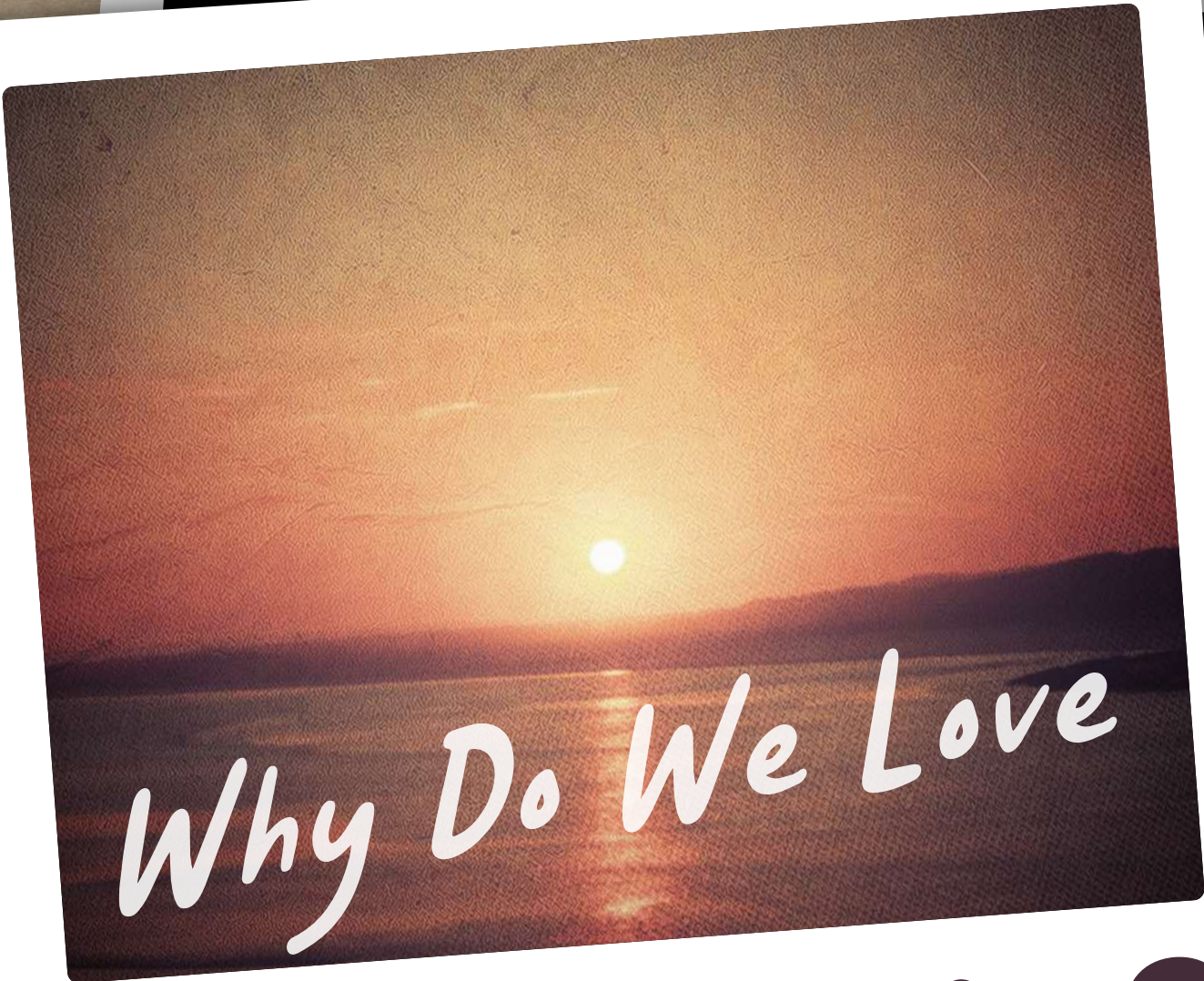


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It's a feeling humans have been having – and needing – for as long as we've been around. Laura Simmons asks: What is nostalgia?

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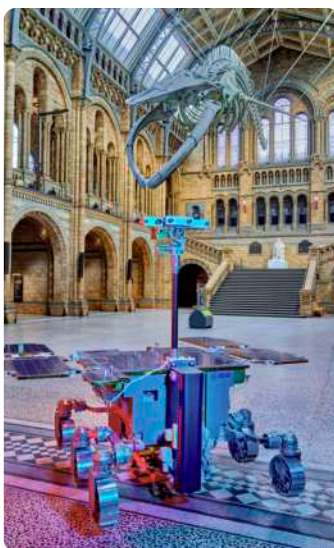
Happy 99th Birthday, David!

A new film is being released worldwide this month to celebrate the legendary broadcaster and global treasure Sir David Attenborough's 99th birthday, which falls on May 8. *Ocean with David Attenborough* delivers Attenborough's most powerful message yet, taking viewers on a journey through the wild, surprising, awe-inspiring oceans filled with life and utterly vital for our survival and keeping planet Earth stable and thriving. Attenborough shows how his lifetime coincides with the great age of ocean discovery – with new science and technologies, we've learnt more about it in the last 100 years than hundreds of years previously – and yet humanity is its greatest threat, from destructive fishing practices to mass coral bleaching caused by human-caused climate change. However, Attenborough is keen to highlight inspirational stories to deliver his message: the ocean can recover, but it needs action to protect it. The film will be released in cinemas in select countries and will be available globally on National Geographic, Disney+, and Hulu later this year.

Claim A Note Sent To Space

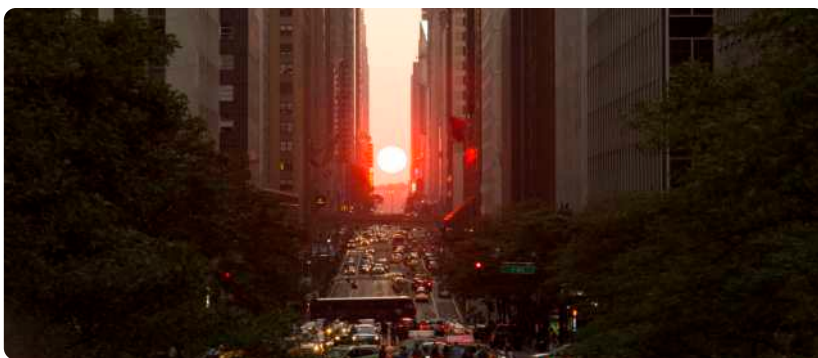
Asked to think of *The Blue Danube Waltz* by Johann Strauss and there's a good chance you're thinking of the docking scene in Stanley Kubrick's 1968 *2001: A Space Odyssey* – yet for a song so synonymous with the idea of space, it's curious it never made it on to the Voyager golden records in 1977. Now, to celebrate

Strauss's 200th birthday and the European Space Agency's 50th, Vienna is making up for it by sending a version by the Vienna Symphony Orchestra into space on May 31 to be broadcast to the cosmos – and they want you to claim a note. Find out how [here](#).



Could Life Exist Beyond Earth?

Get ready for the latest blockbuster exhibition at London's iconic Natural History Museum – it'll be out of this world. Opening from May 16, *Space: Could Life Exist Beyond Earth?* explores the big question “**Are we alone in the universe?**”, along the way letting you sniff **what a planet smells like**, touch a piece of Mars and the Moon, snap a selfie with an asteroid older than Earth, listen to the sounds of Mars, and even design your own space mission. This is the first space exploration-themed exhibition in the museum's 144-year history, so many of its extraordinary and rarely seen items will be on display, including the type specimen of the rarest kind of meteorite known. Book your tickets [here](#).



Manhattanhenge

Want to see a freaky phenomenon that only occurs briefly at certain times of year despite being in one of the most famous, busiest cities in the world? We give you Manhattanhenge! OK, it may sound like a dodgy disaster movie, but it's actually real and pretty interesting. Twice a year, around late May and mid-July, the setting Sun perfectly aligns with Manhattan's east-west streets, creating a perfect frame for the extremely photogenic sunset. Although other cities with a grid system experience this phenomenon, nowhere in the world lines up as perfectly as this. This year catch it on May 28 and July 12.



Dream Chaser Makes History

Everybody's favorite flying orca is set to finally make its inaugural flight to dock with the International Space Station (ISS) this month, making it the first-ever winged commercial space plane to fly to the ISS. Sierra Space's Dream Chaser will be the first spacecraft to dock with the ISS and return to the former Shuttle Landing Facility in Florida since the space shuttle program was closed in 2011. Operating as part of NASA's commercial resupply service to the ISS, Tenacity, the first Dream Chaser vehicle, will fly its first uncrewed mission taking 3,530 kilograms (7,782 pounds) of supplies and science to the space station, and could be docked there for up to 75 days. The reusable space plane is designed to be used 15 times, taking off on a rocket, docking with the ISS, and landing on a shuttle runway back on Earth, just like the space shuttles – and if you've never seen a shuttle land, you are in for a treat.



Black Hole Week

Black holes really suck at making friends, but that doesn't mean we can't appreciate and celebrate them from afar, which is what NASA's annual Black Hole Week is all about. Every May, NASA blows our minds with a new visualization of how we might experience a black hole – if we could see it or we wouldn't get spaghettified (yes, that's a real thing) instantly by being near it. Now in its fifth year, Black Hole Week will be held on May 5-9, 2025. From videos on what one would look like in all its **crystal-clear glory** to what it would be like to **plunge into one**, plus downloadable posters, postcards, and "field guides", check out **NASA's website** for more.

WHAT'S UP?



GARDEN FOR WILDLIFE

It's time to get planting

Name: Garden For Wildlife Month

Appearance: A yard full of native plants and fingers crossed, some very happy wildlife

Location: Your yard, local allotment, or even a workplace green space if you're allowed

gardening anyway (at least if you're in the Northern Hemisphere), with the arrival of the sunnier, warmer days that help plants spring back to life.

Can I just plant any old thing?

This month is definitely a chance to go ham at the garden center, but there's some degree of strategy required. It's important, for example, to have native plants; some animals can only survive on certain native species.

Does this mean I need to get rid of my lawn entirely?

Nope – again, it's just thinking about how you could change your lawn to be more supportive. You could swap out non-native turf grass for a native grass species, or native mosses and clovers.

But what if I don't have much time or money?

That's absolutely fine! There's still one easy way to participate in this month by doing something even less than usual – mowing your lawn. By mowing less frequently, or cutting grass a bit longer, it gives a chance for plants like wildflowers to grow, providing that bit of extra nectar and pollen for pollinators like bees and butterflies.

Don't all gardens attract wildlife?

Not necessarily – some gardens aren't very wildlife-friendly at all. The stereotypical "lush" lawn made up of turf grass might seem like a better alternative than concrete slabs, and we might be tempted to plant all kinds of exotic flowers along its borders, but animals rely on a diverse range of native plants for both food and shelter. This kind of yard doesn't do much to provide that, which keeps wildlife away.

So "Garden For Wildlife" month is an opportunity to change that?

You've got it! Gardening for wildlife means creating a yard that is designed with the intention of being an inviting and supportive space for all kinds of native wildlife, ranging from insects like bees and butterflies to bigger critters like birds and amphibians. Plus, May is a great time to get



WHY DO WE LOVE NOSTALGIA?

It has Millennials and Gen Z in a chokehold, but it's a feeling humans have been having – and even needing – for as long as we've been around.

By Laura Simmons

Got a comfort show you could rewatch every day? Is your workout playlist full of the **songs** you danced to in high school? Personally, I have a *Friends* quote for every occasion, my “continue watching” is exclusively ‘90s *Star Trek*, and you’ll wrestle my skinny jeans from my cold, dead hands.

Nostalgia, in its many forms, is an indulgence lots of us enjoy. While some decry this as yet another “annoying” thing Millennials and Gen Z are obsessed with, nostalgia is an important psychological experience that comes with real benefits – and maybe some downsides too.

As a self-confessed “chronic rewatcher”, this topic hit home for me, so I went to the experts to find out more.

What is nostalgia anyway?

The term “nostalgia” was coined in **1688** by Swiss soon-to-be doctor Johannes Hofer. He noticed the intense feelings of homesickness experienced by foreign soldiers and domestic laborers and gave it a name that comes from the Greek words *nostos*, meaning homecoming, and *algos*, meaning pain.

The idea of nostalgia being a kind of disorder persisted for some time, but the tides eventually started to turn. Carl Jung was one influential thinker who took a more positive view, considering it a way of reconnecting with our past and accessing the “**collective unconscious**” that he believed was shared between all people.

Our current understanding of the term was reached in the late 20th century. One researcher who helped lay the groundwork was sociologist **Fred Davis**, who recognized that people associated warmer feelings with nostalgia than they did with homesickness.

“A bridge to the past”

So many things can trigger nostalgia – it can be books, movies, the first notes of a beloved TV theme tune... but also scents, objects, or places. For the protagonist of Proust’s famous novel *À la recherche du temps perdu*, it was a **madeleine**.

“If you’ve got a collection, something you enjoy collecting, a lot of the time these do go back to early childhood, you know, important connections that we form,” **Anjum Naweed**, a professor at CQUniversity Adelaide in Australia, told me. “Maybe that’s also a bridge that you sort of formed to the past.”

“It’s a **sensory** experience – it’s sight, it’s auditory, it’s smell, and it’s also taste.”

“I’M NOT SURE IF GEN Z IS MORE NOSTALGIC, BUT THEY ARE CERTAINLY MORE FREQUENTLY EXPOSED TO OLD MATERIALS THROUGH SOCIAL MEDIA COMPARED TO OTHER GENERATIONS.”

Inspired by his own tendency to return to much-loved TV shows in times of stress, Naweed explored the power of nostalgia in a 2024 piece for **The Conversation**. Understanding its importance also helps explain why we may be drawn to share our nostalgia triggers with others.

“We form nostalgic experiences with other people at a time, but we also like to invite people into that experience, and it’s part of our storytelling, because it’s so meaningful, and because you’ve got that bridge from the past to the present,” Naweed told me.

Neuroscience research also shows us how nostalgia is tied up with our sense of self. “Nostalgia involves brain regions implicated in self-reflection, autobiographical memory, emotion regulation, and reward processing,” reads a 2023 review that appeared in a special issue of **Current Opinion in Psychology**.

This has been demonstrated in multiple studies using brain scanning methods like **functional magnetic resonance imaging** (fMRI) and **positron emission tomography** (PET).

Are we getting more nostalgic?

I’m not sure what your algorithm is like, but I can hardly scroll for 10 seconds without being reminded of some niche aspect of British culture from my 1990s childhood. My perception is that this trend is becoming ever more present in the generation after mine, but is that true?

“I’m not sure if Gen Z is more nostalgic, but they are certainly more frequently exposed to old materials through social media compared to other generations,” **Kuan-Ju Huang**, a graduate student at Kyoto University, told me.

Naweed agreed. He told me that the ways we engage with our nostalgia triggers have evolved over time, but those triggers were just as present for older generations.

“I THINK COVID WAS A GLOBAL EVENT THAT BROUGHT TO THE SURFACE, FOR MANY PEOPLE, THEIR IMPORTANT NOSTALGIA DETECTIONS THEY DIDN’T KNOW THEY HAD.”

“I do think now that more and more people are searching for nostalgia, given a lot of the uncertainty that we’re seeing in the world geopolitically as well,” Naweed added. “It did become apparent to me that the brain is really wired up to really draw on nostalgia as a form of a coping mechanism.”

And more of us than ever – including Huang – turned to nostalgia to help us get through arguably the most tumultuous collective experience of our lifetimes so far.

“During the COVID-19 pandemic, I noticed that myself and people around me were listening to a lot of old music and watching nostalgic videos. This made me wonder about the psychological mechanisms behind the phenomenon of ‘pandemic nostalgia’.”

This wondering led to a **scientific study**, published in 2023.

"At the time, I analyzed data from Spotify and human mobility data, which showed that people were more likely to listen to nostalgic music when they were unable to leave their homes to interact with others during the pandemic," Huang continued.

The study concluded that people were using nostalgia as a coping mechanism, rather than simply a way to relieve boredom.

"This is why I continue to work on this topic – I want to understand how nostalgia exactly influences our social relationships and well-being," said Huang.

What can nostalgia do for us?

We've explored a bit about how nostalgia can help us get through dark times – sometimes without us even realizing it. Naweed described it as "a protective mechanism that can kick itself in to help us cope but also help us survive."

LITERATURE ABOUNDS WITH WARNINGS ABOUT WHAT CAN HAPPEN TO THOSE WHO SPEND TOO MUCH TIME DWELLING ON THE PAST AND IGNORING THE PRESENT.

"I do think that there's this kind of dormant, vestigial nature of stored information in our psyche, if you will, that perhaps is brought forth when you need it. Sometimes it might just be under extreme conditions. [...] And I think COVID was a global event that brought to the surface, for many people, their important nostalgia detections they didn't know they had."

Huang agrees. "In times of uncertainty, reminiscing about moments of order and safety can help restore a sense of

control. Nostalgia is a powerful emotion, serving important psychological functions when individuals are in an undesirable mental state."

Huang's **latest paper** suggests that another way in which nostalgia is helpful is in maintaining our social relationships.

"Reflecting on shared past experiences is important for long-term relationships, as it can help individuals build a sense of connection and commitment to their relationship. Previous research has shown that nostalgia can promote feelings of warmth and connection, but my research shows that it can have a real impact on our social network, including the number of close friends."

Huang and co-author Ya-Hui Chang from the University at Buffalo found that people who value nostalgia appear to be more aware of the need to nurture strong interpersonal relationships and thus have more success at maintaining them.

As Huang notes, other research backs up the idea that nostalgia helps with social bonding. "Nostalgia makes people feel socially connected. Nostalgia-induced social connectedness breeds meaning, self-continuity, optimism, and inspiration," reads a **2023 review**.

The concept of self-continuity – the way nostalgia helps us understand our current selves by keeping open a highway to the past – was also suggested in one **2019 study** to be the mechanism by which nostalgia promotes meaning in life, another important psychological benefit.

Are there any downsides?

You can always have too much of a good thing. Literature abounds with warnings about what can happen to those who spend too much time dwelling on the past and ignoring the present.

Naweed theorized that this may be why some are skeptical about those who revel in nostalgia.

"If you end up spending a lot of time [...]

staying in the realm of the past, that will create more **loneliness**, more detachment. [...] I think that the stigma associated with [nostalgia] might be that you've come across people, or you've seen people, or you've overemphasized this notion of [losing] a sense of reality, [losing] touch with the present."

If you spent all day every day hunkered down in front of your comfort show, at the expense of doing anything else, that would clearly indicate that it's become an unhealthy **habit**. But Naweed believes nostalgia is much more often a conduit to the past rather than gateway to getting lost in it.

What's more, he told me that he's equally curious about those who refuse to engage in nostalgia altogether.

"What is it you're shutting yourself off from? Is it because nostalgia is being misconstrued for escapism, and escapism is seen as a negative thing? [...] It could be that that's a reaction to perhaps trauma or something else in childhood, or other years that they don't want to sort of revisit, or maybe they just don't really understand their relationship with [their triggers]."

"I don't know," he continued, "but there is the idea of, if you cut yourself off from what is a protective mechanism, where else are you getting your protection from?"

Of course, when we're talking about a concept so inextricably linked with memory, we have to recognize that **memories play tricks**.

Books, movies, objects, and places from our childhoods might remind us of a simpler, more carefree time, and that can certainly be beneficial in the face of adult stresses, but memory is **fallible** – for instance, research has shown **there's a good chance you're misremembering 9/11**.

But it's not even just that we could be mistaking key details of our own lives. We can also fall into **anemoia**, a new word coined by John Koenig for his project **The Dictionary of Obscure Sorrows**. It

OUR COVER STORY

describes a yearning for a time that you didn't personally live through – think Gen Z fans of shows like **Stranger Things** wishing they had had a (largely imaginary) **1980s childhood**.

“IT'S VERY FUNDAMENTALLY A HUMAN THING, I THINK, TO REMINISCE AND THINK AND REFLECT IN BOTH THE PAST AND THE FUTURE.”

According to psychologist Dr Krystine Batcho, who discussed what she called “historical nostalgia” on the **Speaking of Psychology** podcast, this is different from personal nostalgia.

“Historical nostalgia, [my research suggests], is more likely triggered by dissatisfaction with the present,” Batcho said.

Every **period** in human history had its **share of problems**; but media portrayals and family lore can lead us to romanticize the past. “We pick and choose. The memory process not only is selective, but it also distorts to some extent. We do idealize things on occasion,” Batcho continued.

A recent example of this is the idea of lockdown nostalgia – not using nostalgia to cope with COVID-19 lockdowns, as we explored above, but actually reminiscing fondly about the lockdowns themselves.

“It makes sense [...] that some people, especially those for whom the spring of 2020 wasn't all that bad in the first place, have a romanticized memory of it,” writes Paul Rogers for **WebMD**. Presumably, that'll be the people whose main worry was their sourdough starter, rather than how they were going to get three kids to engage with Zoom school and still get through that big presentation to the CEO.

But despite these potential pitfalls, based on her research, Batcho still concluded that nostalgia is an overwhelmingly beneficial thing for most of us.

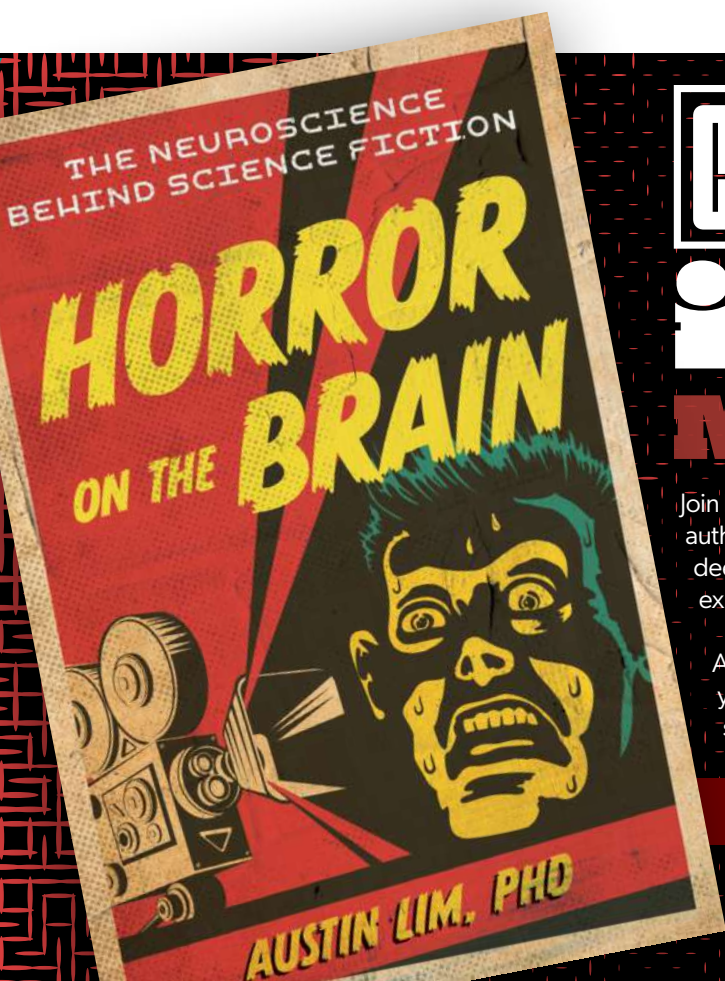
“My argument is that it's almost never, at least the research suggests it would be extremely unlikely for someone to want to remain in the past,” she explained.

“In fact, when we revisit our memories, we try to remember how other people in our lives solved problems in the past and then use that as a role model for how we want to solve the problems we're experiencing today so it's generally healthy.”

My conversation with Naweed ended on an equally optimistic note: “It's very fundamentally a human thing, I think, to reminisce and think and reflect in both the past and the future,” he said.

“I do believe that based on what I've read and seen and through my own lived experience, and also all those that contacted me after my piece went out, that it resonated – and it [...] taps into sort of our core sense of who we are.”

So, keep rewatching those shows, listening to those songs, and collecting obscure pieces of memorabilia if that's your thing. I know I will – it's psychologist-approved. 🌟



CURIOS LIVE

is BACK!

May 24th

Join IFLScience writer and host Rachael Funnell and neuroscientist Dr Austin Lim, author of *Horror On The Brain: The Neuroscience Behind Science Fiction*, for a deep dive into horror and science fiction from a neuroscience perspective, exploring some of the most loved and haunting stories in the genre.

As an IFLScience subscriber, your ticket is already secured so keep an eye on your inbox for sign-up details. Interested in writing sci-fi? Lim will be at the screening event for a Q&A session to answer your burning questions, so don't miss it!

Join the Q&A screening on May 24, or view later on demand.

PERFECT PAINTED GRASSHOPPER

Meet *Poekilocerus pictus*, a large and colorful critter known as the painted grasshopper. It can be found clambering around across India, Pakistan, and Afghanistan. We say clambering because it's a bit hefty as grasshoppers go and doesn't move very quickly. Fortunately, its loud coloration tells would-be predators to keep on walking. They're toxic to consume and can even squirt offensive fluid up to 30 centimeters (12 inches) if bothered. Truly a grasshopper that invites you to look, but don't touch.





THE COLOSSAL WOOLLY MOUSE

A surprisingly adorable step on the path to de-extincting the woolly mammoth.

By Rachael Funnell

At IFLScience, it's not uncommon for an email to land in your inbox that makes you sit up straight. Most recently for this writer, that included word of the "Colossal woolly mouse", a stepping stone on the path to de-extincting the woolly mammoth by finding its cold-tolerant genes and putting them in a mouse.

"Surely not," I said to myself. "It's not going to be what I think it's going to be." Oh, dear reader, how wrong I was. The Colossal woolly mouse pretty much does what it says on the tin, being a wild-type mouse given just the right combination of gene edits to bring about long shaggy fur and altered lipid metabolism.

We find ourselves still some way off the mammoth, but according to Colossal Biosciences, that goal is still on the cards for 2028. To find out why making the Colossal woolly mouse along the way was such a pivotal step, we spoke to Chief Science Officer **Dr Beth Shapiro** and CEO and co-founder **Ben Lamm** to find out.



How did you do it?

Beth Shapiro: We didn't just shove mammoth genes into a mouse, that wouldn't make any sense. We found that there was an interesting change in mammoths and also an interesting change in the mouse version of these genes that led to a predictable phenotype. This was the sweet spot, and to test our ability to edit multiple things at the same time, we picked 10 of those genes and we edited all of them at the same time.

In some of our mice, we used different combinations of them, so the most edited mouse has changes to seven different loci. There's actually eight edits, but one of them is edited in two different places, and we have our ultra woolly mice.

Why a mouse?

BS: A whole animal model is really useful for just looking at the ultimate consequences of these DNA edits, but an Asian elephant has a 22-month gestation, and they're an endangered species that we don't want to be doing experiments like this on. A mouse has a 20-day gestation.

It's also a mammal. They're quite distantly related to each other, about 200 million years of evolution [apart], but the same genes and gene families that are associated with traits like wooliness in an elephant and a mammoth occur in mice.

Ben Lamm: The mouse model [is] a great model for us to test some of the editing that we're already currently doing in our Asian elephant cells. They came from our mammoth and Asian elephant comparative genomic analysis.

[We've been] screening our cells to ensure that we're only picking cells with edits that don't have off-target effects that would be detrimental to the welfare of the animals. We're being very, very thoughtful in the selection.

There were no really unintended consequences except adorability. We didn't think that they would be as cute as they are.

Are people after them?

BL: We're already starting to get questions.

Are you going to sell them? Can we have them?
Are you going to release them back in the wild?

We are not going to release them in the wild. We're not selling them. We are just very, very excited that it shows the de-extinction pipeline worked. It worked immediately. We saw the phenotypes that we were expecting from the editing engineering. And we also did it in a way where we produced all healthy, viable mice because of our screening process.

So, it showed that the whole system worked and besides being extra cute, everything else came out as predicted.

And mammoths in 2028?

BL: We're still on track for 2028 for our first mammoth calves. We feel very confident, given where we are in the editing phase.

We're very excited, and you know, we believe that we'll have mammoth embryos by the end of 2026, but it's a 22-month gestation. So, there's always work to be done on that.

We are parallel pathing that and working with Dr Thomas Hildebrand and many folks in the elephant conservation community around you know, how do we create IVF and elephants? How do we create wild-type elephants? How do we build those new technologies for elephants that have reproductive issues? That means we can, at least, help them produce more species on their own, outside of mammoths.

I'm very confident that we will get to our embryos by late 2026, and that puts us on track, if everything goes well, for a 2028 birth. 🌟

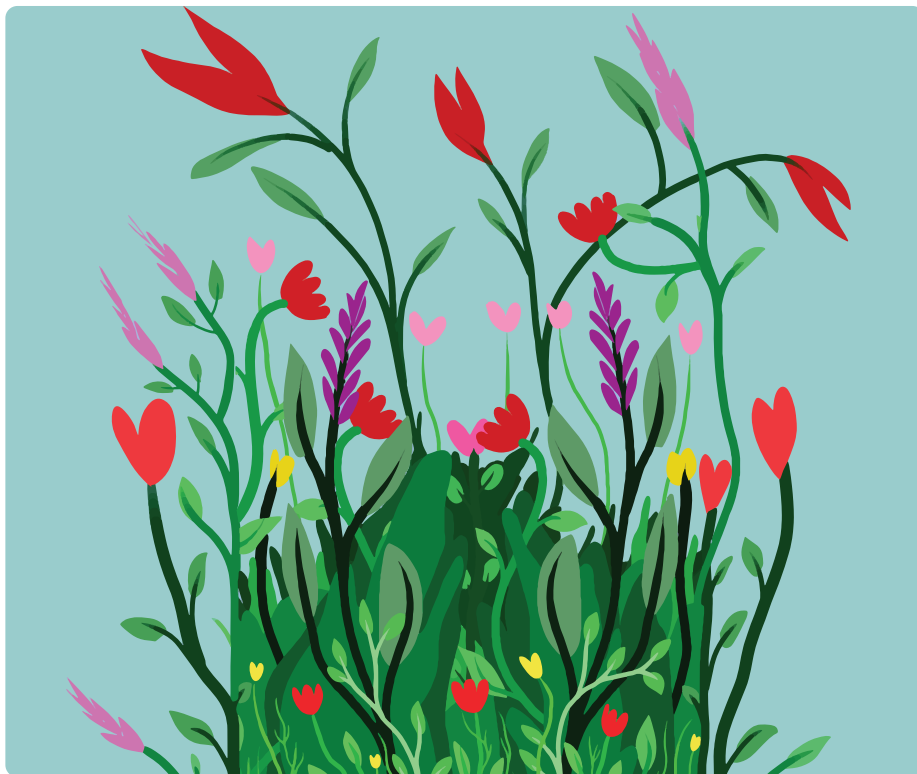




SCIENCE FACT OR FICTION:

DO PLANTS HAVE CONSCIOUSNESS?

The idea is taking root in some circles – but does it have merit? Maddy Chapman investigates.



Consciousness might not be unique to our species. Burgeoning evidence suggests that it may be **far more widespread** in the animal kingdom than anybody thought – some have even argued that the **Sun could be conscious** (but that’s a deep dive for another day). So what about plants? Do they have consciousness too?

It sounds like a wild idea, but as we keep discovering, plants are full of surprises – so maybe don’t write them off just yet.

What is consciousness?

Consciousness, at its simplest, refers to an individual’s awareness of itself or its surroundings. Knowing that you’re you; that the sky is blue; that it’s a little cold out; or that chocolate cake tastes great – these are all things that we, as conscious beings, might experience, although not necessarily.

“In its basic form, consciousness is the capacity to have experiences (feelings), a first-person point of view,” **Jon Mallatt**, an Associate Professor at the University of Idaho whose research focuses on animal evolution and the neurobiology of consciousness, told IFLScience. “Basic consciousness

involves experiencing mental images of what one senses *and* experiencing emotions, both of which help to guide one’s actions and behaviors.”

“Proponents of plant consciousness agree that this definition would hold for plants, animals, and any other conscious entity,” Mallatt said, before quickly adding that “the dominant view among scientists is that biological consciousness needs a nervous system, with neurons (nerve cells) and an elaborate brain” – something that plants famously lack.

But, as is often the case with science, things are rarely black and white, which means pinning down a singular definition of consciousness is easier said than done. Some **argue** it involves the capacity to have a subjective point of view; for others, it’s tied up in the ability to recognize and comprehend your own mental state; and then there are those who say that understanding that the world may look one way to you and another to somebody else is fundamental to the concept.

Things are complicated further by the fact that the nature of consciousness likely looks

different for different people (and potentially species) – after all, your experience of the world is probably quite different from someone who lives on the other side of it, let alone your pet chinchilla’s, or that succulent on your windowsill. Then, even if we finally managed to settle on any one definition, how on Earth would we go about testing for it?

In short: understanding consciousness in humans is enough of a conundrum, and things get a whole lot more complicated when you throw animals – or plants – into the mix.

“The question of consciousness is very tricky,” **Vicente Raja**, a Research Fellow at the Universidad de Murcia, Spain, who specializes in the intersection of philosophy, cognitive science, and neuroscience, told IFLScience.

“The very idea of conscious experience is difficult to grasp even in clear cases like human beings. We still struggle to study consciousness as it occurs for us, so studying it in living organisms as behaviorally different from us as plants is a great challenge.”

Plant consciousness?

When poking around into plant consciousness, researchers tend to focus on what’s known as phenomenal or primary consciousness – the most basic type.

“Primary consciousness means having *any* type of experiences or feelings, no matter how faint or fleeting,” reads a **2020 review** authored by Mallatt debunking the “myth” of plant consciousness. “It means having a subjective or first-person point of view, and what is sometimes called sentence [...]. This primary form of consciousness does *not* involve the ability to reflect on the experiences, the self-awareness that one is conscious, self-recognition in a mirror, episodic memory [...], **dreaming**, or higher cognitive thought, all of which are higher types of consciousness.”

Given this, proponents of plant consciousness, propose a series of arguments in favor of the concept, including that plants sense environmental changes and respond adaptively – as if making decisions; that, like animals with neurons, plants use

electrical signals to integrate information; that they communicate in a purposeful way; and that they demonstrate classical associative learning.

The controversial field of “plant neurobiology” – which looks to understand how plants process and react to information from their surroundings – was established in 2006 with the publication of a **paper** exploring plant signaling. Those who back the concept draw parallels between the pathways of electrical signaling in plants and the nervous systems of animals, arguing that this constitutes some sort of consciousness.

The idea is far older than that though: “It is rooted in the animistic ideas of the first humans from prehistoric times,” explained Mallatt, adding that it appeals to our “tendency to anthropomorphize other living, and even nonliving, entities”.

It really took root – pun intended – in the

19th century, aided by the Romanticism movement, which “emphasized the unity of humans and nature”, Mallatt added. The concept was then explored by eminent biologists of the 19th and 20th centuries: “father of evolution” Charles Darwin proposed that the tips of plant roots may act like a brain, for example, and plant electrophysiologist Jagadish Chandra Bose concluded that plants have a nervous system, a form of intelligence, and are capable of remembering and learning – though his ideas were not well received in their time.

Today, our understanding of plants has bloomed. And while it’s certainly true that they are much more complex than we give them credit for, whether or not this can be considered consciousness is fiercely debated.

Plant power

The world of plants may seem relatively sedate – but in reality, it’s anything but. From towering trees to **fun-size ferns**, the leaf-

laden organisms can **remember stress**; they **sleep**; move around obstacles; **communicate** with other plants; make “**airborne sounds**” when stressed; and **recognize relatives**. We’ve been underestimating them for decades.

“Because plants are far less mobile than most animals, they were previously seen as passive, hardwired automatons,” Mallatt told IFLScience. “Now, however, plants are known to be highly sensitive and reactive to their environments. More and more of their remarkable abilities are being discovered and their behaviors are recognized as goal-directed. They communicate and compete with one another much more than was formerly realized.”

“Plants [also] have vessels, mainly in their phloem, that carry electrical signals including action potentials, as do the neurons of animals,” Mallatt added, explaining that this is why some claim they may have a nervous system – something he refutes.



THE FUTURE OF **IFL**SCIENCE

Plus, they're sensitive to anesthesia – a **2017 study** revealed that *Mimosa* leaves, pea tendrils, Venus flytraps, and sundew traps all lost autonomous and touch-induced movements after exposure to several different anesthetics.

"If plants are affected by anesthesia, they might be losing something like consciousness when they are under its effects and they might be coming back [to] some conscious state when the effects of anesthesia are over," Raja told IFLScience, explaining how it could be argued this finding links to plant consciousness.

Raja's own work has added more fuel to the plant consciousness fire. In 2020, **research** from him and co-authors demonstrated that common beans grow along more predictable paths in the presence of poles, as if they can sense them in their surroundings and adapt accordingly.

This "may constitute evidence enough as to, at least, not [discard] the idea of plant consciousness right away," Raja said.

However, work such as this is currently in its infancy – it's still theoretical and, according to Raja, "should [not] be taken as direct evidence for plant consciousness. There is still a long way to be able to test conscious phenomena in plants (in case they exist)."

Are plants conscious?

It's undeniable that plants are incredibly impressive – but are they *conscious*? Do they choose to act in a certain way, or are they simply responding to stimuli?

For all its proponents, plant neurobiology has plenty of critics – and the idea of plant consciousness remains a contentious one.

In **2019**, an opinion piece titled "Plants Neither Possess nor Require Consciousness" concluded that it's "extremely unlikely that plants, lacking any anatomical structures remotely comparable to the complexity of the threshold brain, possess consciousness."

Coming to a similar conclusion, the 2020 review co-written by Mallatt found the idea of plant consciousness "highly speculative and

lack[ing] sound scientific support".

"Merely sensing stimuli and performing goal-directed actions are not enough to indicate consciousness," Mallatt told us. "Instead, consciousness requires a felt perception of the sensed stimuli and voluntary control of the directed actions."

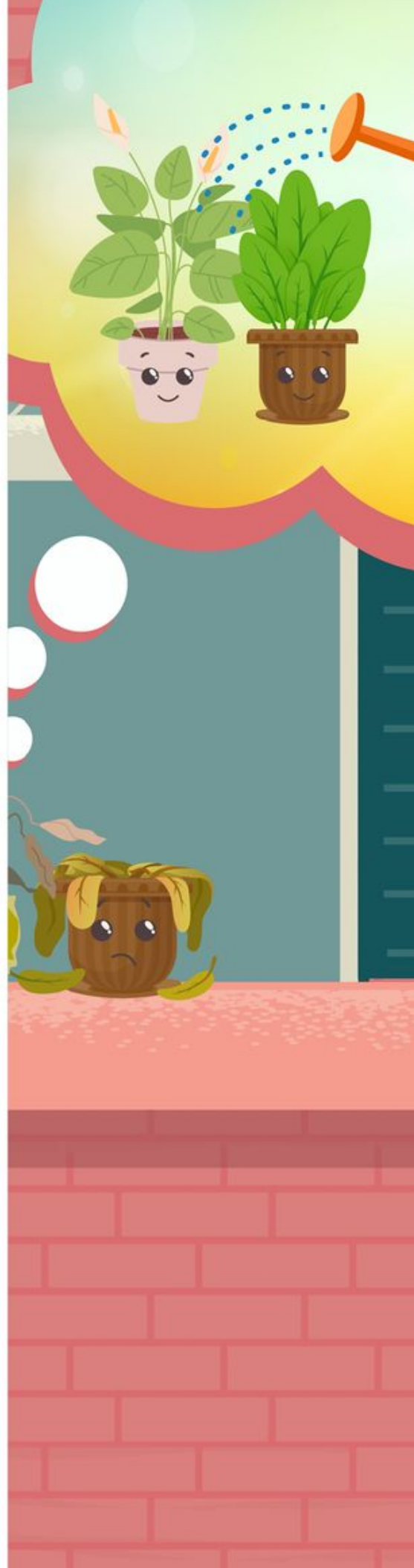
Plants receive sensory stimuli and respond via ordinary physiological processes, Mallatt explained – "rapid and unfettered progress is being made in understanding these aspects of plant science without any need to invoke conscious sentience or volition."

Meanwhile, electrical signaling is very different in plants and animals – it is slower and less frequent in plants, Mallatt added. Consciousness is thought to involve the integration of information, with frequent back-and-forth communication between signaling cells – "yet in plants the signaling is in only one direction, with none of the required feedback ever demonstrated. This implies plants do not integrate enough information for consciousness to exist."

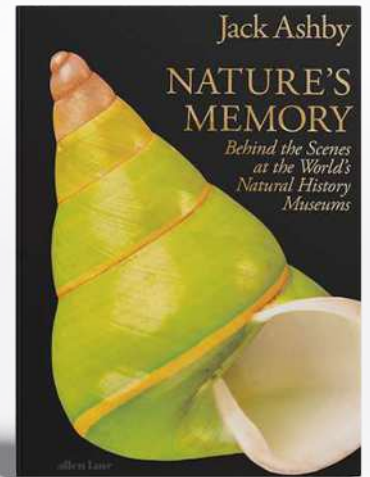
"The proponents of plant consciousness have built an elaborate conjecture that appeals to the public's interest, but lacks supporting evidence," Mallatt added. "It was constructed by a chain of reasoning that built speculation upon speculation without obtaining experimental data along the way." As such, it doesn't adhere to the **scientific method**.

Still, the criticism hasn't deterred supporters of plant consciousness. "I think skepticism is legit," Raja conceded. "Such skepticism is of course a reflection of our cultural inheritance – not so long ago, only some human beings were thought to be conscious – but this does not mean it is totally unjustified. Any science is healthier with a healthy amount of skepticism."

Conscious or not, plants are pretty cool. Research into their "neurobiology" doesn't appear to be going anywhere – but those in favor of it have a lot to prove. "The burden of proof is on them," Mallatt told us. "As the famous scientist Carl Sagan said, extraordinary claims must be backed up by extraordinary evidence." 🌱



IS IT REAL?



What are we really seeing when we visit a natural history museum? Is it nature, raw and unfiltered? Or do curatorial decisions and human bias shape what we see of the natural world? From the way that more specimens tend to be male than female, to even the choices made when deciding how to preserve a carcass, our influence sneaks in. So, Jack Ashby wrote a book on where to look for it. It's called *Nature's Memory*, and here's a snippet.

When a dead animal or other organism enters a museum, its afterlife will include performing a multitude of difficult tasks. First, it is there to represent itself: the unique individual it once was, the sum of its life-experiences, with the lumps, bumps, scars, and chemical signatures that can tell us about the way it individually lived

its life. Second, it is there to represent its sex, age group, time of year, population and region: when viewed alongside other individuals, it could tell us about how the species varies over space and time, and why. Third, it stands as an example to represent its entire species. We could keep going – often individual specimens are used as ambassadors to represent an entire group of animals, or a part of the world. For instance, a red kangaroo could be placed in different museum exhibits to represent all red kangaroos, all kangaroos, all marsupials, all mammals, all of Australia's fauna, plus any other category we might choose to put them in – hopping animals, red animals, herbivores, animals on national crests. It's a big ask.

To prepare an animal for these tasks, a lot of work needs to be done. The museum director Samuel Alberti put it well when he wrote, "The biological death of the living beast is the birth of the specimen". Natural history museums represent nature by battling against it. Death is natural. Dead specimens are not. Museum preparators have found myriad ways – many of which are decidedly dangerous – of arresting decomposition to allow their specimens to remain preserved indefinitely. We don't actually know how long these techniques will last, but we've been doing quite well so far – to date, specimens have survived in museums for hundreds of years, and with ever-improving techniques they look set to stay that way for a very long time.

How do animals go from decomposing carcass to pristine specimen, and how do plants get from the forest to herbarium cupboards? Choices have to be made. For instance, in the museum where I work we have a room of huge freezers containing hundreds of animal carcasses, from tiny hummingbirds to a seven-metre-long python. Some have been frozen for decades, partly because the decision for what to do with them can only be made once. It's a profound choice, altering the animal's future forever. If a dead beaver turns up, for example, should we turn it into taxidermy or a flat skin? A mounted skeleton or a box of bones? Can it be preserved whole – including its insides? Freeze-dried or pickled? Can we save its DNA? Its gut-contents? Its parasites?

When thinking about how each of these processes works, and why different ones are used depending on what the museum wants to do with these specimens, the students in my class are surprised to consider the idea that although the specimens are made of real animal, they are nonetheless *made* – by people. Most of the above techniques require a huge amount of work: specimens that are made are therefore also artefacts. So how "real" is the specimen that is produced through each method? Human action involves human judgment, and so is there more to a specimen than meets the eye? *



Q&A WITH

JACK
ASHBY

AUTHOR OF:
NATURE'S MEMORY

We caught up with Jack Ashby, Assistant Director of the University Museum of Zoology, Cambridge, and author of *Nature's Memory*, to find out why it's worth digging a little deeper into what we're really seeing when we visit natural history museums, and how the decisions made by the people who put them together can change how we see the world and, indeed, even inspire lifelong careers.

Why did you want to write this book?

I think natural history museums are genuinely incredible places. I don't think there's anywhere even close to being like them, and just the scale of what they hold is astonishing. Together over a billion specimens, well over a billion specimens.

I've worked in museums for 20 years, and as well as all the amazing things, I've noticed that the window that they provide on the natural world isn't a very clear one. So, it's really interesting to think about how they reflect nature and what particular version of nature they provide.

Why have those specimens been picked while others have been left out? Who made the decisions? What are the stories behind the collections? We're very good at writing natural history stories, but there are also human history stories, both about how they were collected and what's happened since they arrived in the museum. All the science that's done on them, the decisions about making displays, about what to display, what not to display. I wanted to share all those stories, to explore how museums can tell us about the world we live in, both the societies we live in, but also how we can help save the world.

You outline examples where collectors have been left off the record. Was this information hard to track down?

Short answer is yes. It's really hard to track down. It's not so much that people were trying to hide that they were relying on the knowledge, skills, and expertise of local and Indigenous collectors. It's more that they just didn't think it was important.

I say in the book that museums are places of storytelling, and although they are some of the most trusted institutions in the world, whenever you've got a storyteller you've got to think about who is the audience, and who is the storyteller. Museums have been telling a particular kind of story to a particular kind of audience for a very long time. The evidence is often hard to come by, so you have to kind of look between the lines of what was going on, the published evidence,

and published accounts of expeditions.

Any advice for visitors?

Keep an open mind and look out for the gaps in what you're seeing. Natural history museums are wonderful places and what we're talking about here is adding relevance. It's an additive process, not a destructive one. We're not seeking to diminish people's enjoyment of natural history museums, but it's about making the stories richer and more complete and include a greater cast of characters.

For example, if you see a label that says this person collected 129,000 specimens, just think, is that actually possible? Can someone collect 129,000 specimens on their own? The answer is almost certainly no. So, who else was involved? And I guess you can challenge floppy language. I've seen museum labels that say, "when James Cook discovered Australia in 1770". I'm like, well, people had been living there 50,000 years?

Museums want to get it right, and they've got a lot going on. We're not always the quickest to be able to correct things, but we want to get things right. So, I'd say, let the people in the museum know, and they'll take note, because it's about wanting to tell the stories the best way we can.

Any favorite specimens?

There is this pair of Colobus monkeys in the University Museum of Zoology in Cambridge, where I now work, that as a student over 20 years ago, I was sat in the classroom of the museum in the evening on my own, and these two Colobus monkeys – they've got their claws out, teeth out, tongues out, lips bared. I just remember thinking at – whatever, 20 years old – "why on Earth has someone chosen to display them like that?"

That was a real kind of eureka moment for me, where I thought, this is an interesting place to work. That is when I first started thinking about how nature is shown in museums. 🌟

Nature's Memory is published by Allen Lane and is out now.

WHERE ON EARTH

An aerial photograph of Hormuz Island, Iran, showcasing its unique geological features. The landscape is dominated by vibrant red and orange hues, which are the result of iron-rich soil and rock formations. A small, simple building with a flat roof is situated on a rocky outcrop in the center of the island. The island is surrounded by the Persian Gulf, with waves breaking against the shore. The overall scene is a striking example of natural beauty and geological diversity.

In Iran, you can visit an island where the local geology turns rainwater into dramatic streams that run blood-red. Hormuz Island is an active salt dome that generates its own ocher-stained soils that have been used in everything from cooking to cosmetics. Who doesn't love some fresh bread with a side of geology?

THE RAINBOW ISLAND



Iran's Hormuz Island is a curious place indeed, famous for its salt rock and striking red ochre soils. Locally, the red stuff is known as Gelak, made up of a mixture of hematite and iron hydroxides. Not only does it give the island a dramatic shade of blood red (just wait until you see what happens when it rains), but it's been mined as an ingredient in paints and cosmetics.

The island, located in the Persian Gulf off the southern coast of Iran, is an active salt dome that from satellite imagery looks like a teardrop with raised layers. A salt dome is a kind of geological formation where underground salt deposits continuously move upward.

This movement occurs because salt is less dense than surrounding rock layers, allowing it to push through overlying sediments. The process of salt rising and deforming the Earth's surface is known as diapirism, and active salt domes often end up with a rough surface as a result, covered in hills, ridges, and even small mountains.

According to **NASA Earth Observatory**, Hormuz Island's features are mostly made of gypsum, anhydrite, and halite – a kind of rock salt. What gives it that otherworldly red hue is a mixture of hematite and iron hydroxides, but that redness doesn't really shine until it gets wet.

The ancient deposits that make up the island have risen to the surface over thousands of years, and because there's not much in the way of groundwater and rainfall to dissolve its salty constituents, it's been able to maintain its distinctive shape. That's not to say it never rains, however, and a recent **video** shows quite how dramatic the transformation can be when a downpour comes to Hormuz Island.

As the water hits the ground, it picks up the red iron oxide, turning the downpour blood-red. The unique structure of the island means the water flows off the salt dome towards the sea, creating impressive red streams worthy of a horror flick, but fear not. It's just a quirk of this salty "rainbow island".

Hormuz is not solely composed of salt, however. It also contains layers of clay, carbonates, shale, and iron-rich volcanic rocks. Despite being such a dry and salty place, several species of lizards, insects, and birds have set up camp here. Off island, visitors can spot dolphins, sea turtles, and snorkel among colorful coral reefs.

In local cuisine, you'll find Gelak used as an ingredient in sauces and a kind of bread called "tomshi," and it's been used like this for centuries. However, a **2023 study** raised concerns about the soil's heavy metal content, warning that exposure through consumption could carry some health risks.

There have also been concerns raised about the sustainability of current mining practices, which, combined with the impacts of tourism, are placing a strain on the island environment. In response, conservation initiatives have set out to protect Hormuz Island's natural beauty so that it can be enjoyed by future generations. 🌟

DISCOVER

WHAT HAPPENS TO EYES DURING THE MUMMIFICATION PROCESS?

Podcast from IFLScience

Mummification is arguably the world's most famous funerary practice, but for all we learnt back in school, do you remember what they said happened to the eyes? In this episode of *We Have Questions*, writer Rachael Funnell spoke to Egyptologist Dr Campbell Price to find out.

– Available Now.

PLAY

ASTROBOTANICA

Game from Space Goblin Studio

Discover Earth 300,000 years ago as an alien biologist, using your botanical expertise to grow plants, harvest crops, and brew tonics as you explore the planet. You may even meet a human, but not as you know them.

– Available Spring 2025.

WATCH

BLACK MIRROR

Series from Netflix

Charlie Brooker's dark, dystopian, and satirical sci-fi anthology series returns with six brand new episodes, including a sequel to season 4's *Star Trek*-like space adventure USS Callister.

– Available now.

HUNT

TREE HUNTING

Book by Paul Wood

Over five years, Wood traveled 48,280 kilometers (30,000 miles) across the UK and documented 1,000 of Britain's most remarkable trees, some as old as Stonehenge. See what he discovered and where in *Tree Hunting*. – Available May 29.

LISTEN

HOW DO YOU REDISCOVER LOST SPECIES?

Podcast from IFLScience

The *Fagilde's trapdoor spider* went missing for 92 years, but then, it was rediscovered. Join content creator Eleanor Higgs as she asks expedition leader Sérgio Henriques how that happened.

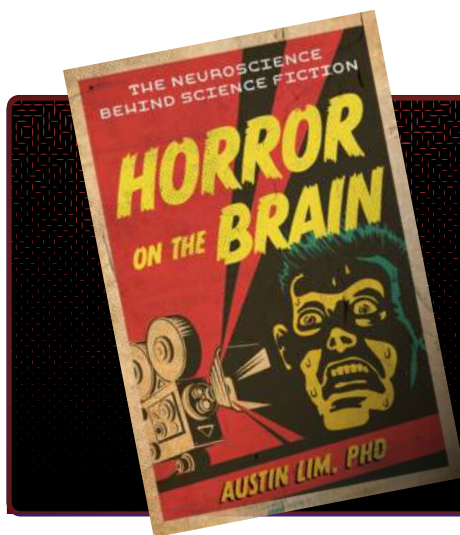
Come for the science, stay for the trapdoor spider cake. – Available now.

CURE

COMMON SIDE EFFECTS

Animated series from Adult Swim

This comedic thriller follows Marshall and Frances who reconnect after discovering the Blue Angel Mushroom, a magical cure-all that Big Pharma don't want getting out. – Out now.



is BACK!
May 24th

JOIN US

CURIOUS LIVE

Virtual event from IFLScience

IFLScience's festival of science is back this May with a spooky instalment as we explore horror and science fiction from a neuroscience perspective.

Join us as we take a deep dive into some of the most loved and haunting stories in the genre with Dr Austin Lim, neuroscientist and Associate Teaching Professor at DePaul University, who recently published *Horror On The Brain: The Neuroscience Behind Science Fiction*.

As an IFLScience subscriber, your ticket is already secured so keep an eye on your inbox for sign up details. Interested in writing sci-fi? Lim will be at the screening event to answer your burning questions, so don't miss it! – Join the Q&A screening on May 24, or view later on demand.



3

INTERNATIONAL ASTRONOMY DAY

Celebrate the wonders of the universe by checking out your local astronomy club, observatory, planetarium, or science center, many of which will be hosting special events and activities to mark the occasion.



25

NATURE PHOTOGRAPHER OF THE YEAR

The deadline for the Nature Photographer of the Year contest is fast approaching. Get your snaps in by May 25 to be in with a chance of winning up to €3,000.

19-21

PINT OF SCIENCE

An international festival that marries science and pints? We're sold. Find events near you [here](#).



5

ETA AQUARIDS PEAK

The Eta Aquarids meteor shower will be active until May 28, peaking between midnight and dawn on May 5. It will be best seen from the Southern Hemisphere, but will still appear low in the sky for those at northerly latitudes.

4

STAR WARS DAY

May the 4th be with you.

2025

MAY

This May, prepare to be stunned by a meteor shower, quench your thirst for knowledge (and beer) at Pint of Science, and celebrate everything from astronomy, *Star Wars*, and endangered species to bees.

11

WORLD MIGRATORY BIRD DAY



20

WORLD BEE DAY



12

FULL FLOWER MOON

On May 12, the whimsically named Full Flower Moon will rise, so-called because of the beautiful blooms that pop up as spring gets into full swing.

15

GLOBAL ACCESSIBILITY AWARENESS DAY

GAAD aims to "get everyone talking, thinking, and learning about digital access and inclusion", particularly for the over 1 billion people with disabilities and impairments.

16

ENDANGERED SPECIES DAY



16

INTERNATIONAL DAY OF LIGHT

Celebrated on May 16, the International Day of Light highlights the role light plays in science, culture, art, education, sustainable development, and beyond.

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 the unfortunate reason why a normally wholesome Galápagos bird has been getting more aggressive. If you like your science lighter, discover just how busy the month of May is for the history of US space exploration.



EXPLORE YOUR SIDE ON FACEBOOK

ANGRY BIRDS

If you thought humans were the only ones to experience road rage, think again; a recent study has found that the sound of traffic can be pretty aggression-inducing for some birds too, and shows that human activity is capable of affecting even some of the most distant reaches of the planet.

“WE ALSO FOUND SOME EVIDENCE OF BIRDS TRYING TO COPE WITH NOISE BY ADJUSTING THEIR SONG.”

The angry birds in question are Galápagos yellow warblers (*Setophaga petechia aureola*), a small species of songbird that’s found throughout their namesake archipelago. That includes the most populous island of Santa Cruz, which has a relatively high level of traffic, and Floreana, where there’s only about 10 vehicles.

Researchers wanted to figure out if the noise from the traffic on these islands made any difference to the warblers’ songs, or levels of aggression. The theory behind this is that traffic noise could

make it harder for the birds to determine what the song of a potential rival might mean, and that increases the likelihood that they’ll resort to physical aggression.

And that appears to be the case – when the team played a combination of intruder-simulating birdsong and recorded traffic noise at 38 locations across the two islands, some closer to roads than others, they saw an uptick in physical aggression in warblers living in roadside areas. This effect was even seen on the low traffic island of Floreana.

As for how this behavior developed, study co-author Dr Caglar Akcay explained in a statement: “Birds occupying roadside territories on both islands, and therefore having regular experience of traffic noise, may have learned to increase physical aggression when the territorial intrusion was accompanied by traffic noise.”

“We also found some evidence of birds trying to cope with noise by adjusting their song, with yellow warblers in all habitats increasing the minimum frequency of their songs to help them be heard above the traffic noise.”

These findings, said Akcay, demonstrate “the significant impact of human activities on wildlife behaviour, even in relatively remote locations such as the Galápagos Islands.”

SPACE HISTORY

May happens to be quite the month when it comes to the US and its history of space exploration. At least, in non-fictional terms – the release of the first *Star Wars* movie in May 1977 doesn’t count, I’m afraid.

MAY 1961 WOULD ALSO BE THE MONTH THAT PRESIDENT JOHN F. KENNEDY MADE OFFICIAL HIS PLANS FOR A “GREAT NEW AMERICAN ENTERPRISE.”

Let’s begin in 1961. April was a slightly disappointing month for the US, as Soviet cosmonaut Yuri Gagarin beat out American astronaut Alan Shepard to become the first ever person in space – something that Shephard was reportedly (and unsurprisingly) not too happy about. Still, he wouldn’t have to wait much longer before joining this exclusive club – on May 5, Shepard became the first American, and second human being, to travel into space.

May 1961 would also be the month that President John F. Kennedy made official his plans for a “great new American enterprise”: putting a man on the Moon and bringing him back in one piece, all before the end of the decade.

That might have seemed like a pretty lofty – and expensive – endeavor, but eight years later, in May 1969, the US would take the last, crucial step in achieving its goal. On May 18, Apollo 10 blasted off from the Kennedy Space Center towards the Moon, where it would carry out a successful “dress rehearsal” for a crewed lunar landing – except for the actual landing part, that is. July would end up claiming that one (rude).

But May in US space history isn’t all about the Moon. Fast forward to May 14, 1973, and the US would launch its first-ever space station, Skylab. The station would only be occupied until the following February, but in that time, would allow for huge amounts of scientific data to be collected.

Most importantly though, Skylab also marked the first time that American astronauts were able to take a shower in space. The downside? Doing so often took over two hours.

What will the Mays of the not-so-distant future bring? The return of American boots to the lunar surface, perhaps? We’ll have to wait and see.



The Darker Side of Science



THE LIGHTER SIDE OF SCIENCE