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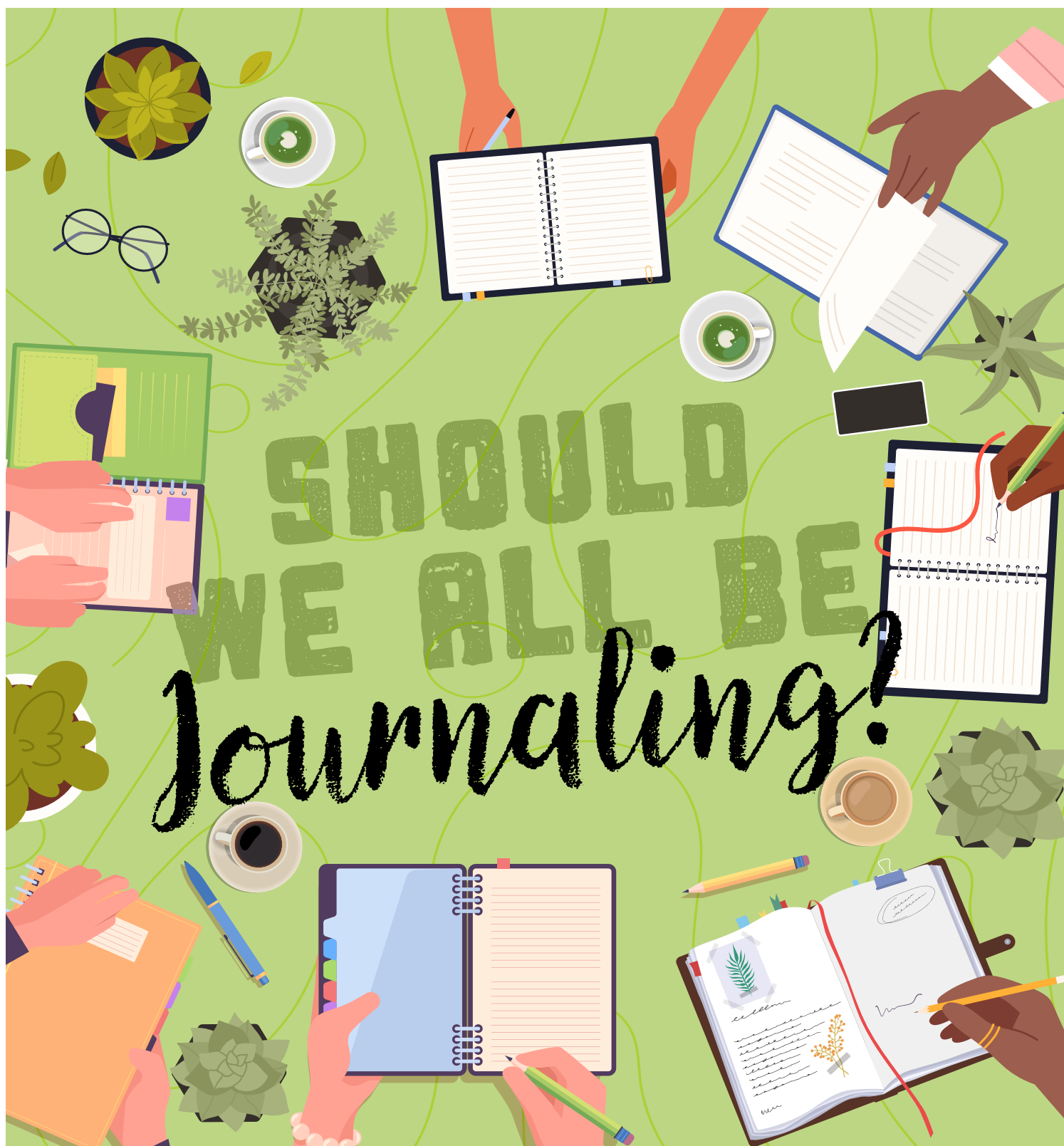


WHAT WAS THE EARLIEST
HUMAN USE OF COLOR?

HOW DO YOU REDISCOVER A
"LOST" SPECIES?

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IFLSCIENCE

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NEWS BITES



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See A Nova Explode

Any day now, we should be in for a once-in-a-lifetime treat of viewing a new star in the sky as T Coronae Borealis (TCrB), aka the "Blaze Star", is due to explode – and you should be able to see it with the naked eye. TCrB comprises two stars in the constellation Corona Borealis 3,000 light-years away. Every 80 years, the recurring nova explodes. It won't set the sky ablaze, but it's fun to see a star where there normally isn't one.

The explosion occurs when the white dwarf's intense gravity pulls material from its red giant companion; if it gets close enough, it will heat to the point where fusion ignites, leading to a surge in brightness. TCrB is visible (with a telescope) for most of the year from Europe and North America, and from May to September in the Southern Hemisphere. Don't worry, you are unlikely to miss the news when it happens.



This Barbie Is An Astronaut

This Barbie is a former commander of the International Space Station (ISS), don't you know? 2024 is the 65th anniversary of Barbie, and London's Design Museum is hosting a major exhibition (until February 2025) exploring the design evolution of the world's most famous dolls. The one that caught our eye and had us hot-footing down there though was the Original Barbie® Samantha Cristoforetti doll – who doesn't want to meet their heroes? In 2022, European Space Agency astronaut Cristoforetti became Europe's first female commander of the ISS and is a huge advocate for women in STEM and space. This Barbie walks the walk too: she went into space with the real Cristoforetti for her history-making mission and this is the first time she's gone on display on Earth.

Walking With Dinosaurs, Again

Twenty-five years ago, the BBC's iconic and ground-breaking *Walking with Dinosaurs* stomped across our TV screens. If you're too young to remember, then trust us, *Walking with Dinosaurs* walked so that *Prehistoric Planet* could run. Now, the BBC has teamed up with PBS to reveal the show will be back next year and bigger than ever. We're living in a golden age of palaeontology with around 50 new dinosaurs discovered each year. What we know about what they looked like and how they behaved is unprecedented, meaning we'll get dino-drama with state-of-the-art visual effects. 2025 can't come fast enough.



New Glenn Launch

Blue Origin's first orbital rocket, the heavy-lift New Glenn – named after John Glenn, the first American astronaut to orbit Earth – is set to launch for the first time from Cape Canaveral, Florida. At 98 meters (320 feet) tall, it is dwarfed by NASA's SLS and SpaceX's Starship but has big plans for reusability. The first stage is designed to be reusable for a minimum of 25 flights and engineers are working on making a reusable second stage. The rocket is designed to launch heavy cargo and satellites into orbit but won't be launching humans just yet. The inaugural launch is currently scheduled for no earlier than September 29.

Sci-Fi September

After a summer of bombastic blockbusters, this September sci-fi gets weird. Kicking off with a Tim Burton sequel, *Beetlejuice Beetlejuice* sees a third generation of the Deetz family discover a portal to the Afterlife, accidentally unleashing everyone's favorite stripe-suited "bio-exorcist". It's taken Francis Ford Coppola 40 years to get *Megalopolis* off the ground, and it's still not clear what the movie is about – architects vs politicians creating self-sustaining cities of the future in an alt-verse, we think – but it's sure to be a talking point this fall. If there's been a Studio Ghibli-shaped hole in your life recently then *The Wild Robot* may fix that – based on Peter Brown's bestseller, it follows a robot shipwrecked on an uninhabited island that must learn to adapt to its wild surroundings, including its animal residents.

WHAT'S UP?



Partial Lunar Eclipse

It's just as cool as the other eclipses, we swear

Name: Partial lunar eclipse

Appearance: Part of the Moon goes dark – sometimes a bit red, if it's feeling fancy. The other bit is a party pooper and stays the usual color

Location: Europe, Africa, the Americas, some parts of Asia, Antarctica, the Arctic, and the Pacific, Atlantic, and Indian Oceans

Why's everyone talking about eclipses again?

Because we're about to see another one – a partial lunar eclipse on September 17-18, to be exact.

How's this one different from the eclipse earlier this year?

This one's a *lunar* eclipse. That thing everyone got excited about back in April was a total solar eclipse, where the Moon passes between the Earth and the Sun, casting a shadow on the planet. This time, we're the ones getting in the way; the Earth is between the Sun and the Moon, with the latter ending up in the planet's shadow.

So why is it only partial?

Unlike a total lunar eclipse, the Sun, Earth, and Moon aren't going to be exactly lined up, meaning only part of the Moon – 3.5 percent of it, at the eclipse's maximum – will be in the Earth's shadow.

Why can it turn a bit red?

It's because longer wavelengths of light coming from the Sun, such as those that appear red, are refracted by Earth's atmosphere into its shadow. They then hit the surface of the Moon, giving it a slightly red tint.

How can I see the eclipse? Do I need any special equipment?

Once it's nighttime, head to a place where there's minimal light, tall buildings, and trees that might block your view (although there's not much you can do if clouds decide to get in the way). Don't worry, you also won't need your eclipse glasses for this one – lunar eclipses are perfectly safe to view with the naked eye, but a telescope or a decent zoom on your phone might help you see things a little more closely.

OUR COVER STORY

SHOULD WE ALL BE JOURNALING?

An excuse to buy cute new stationery? We're sold.

By Laura Simmons

Image Credit: James Rodrigues/FL Science

While cleaning out a drawer during a recent house move, I found the diary I kept in high school. Obviously, I couldn't resist the temptation of reading the things 14-year-old me had seen fit to document – friendship dramas and getting braces featured heavily – and while a lot of it made me cringe, it also made me wonder why I've never kept a diary since then. In stressful times – career crossroads or COVID lockdowns – adult me has turned to pen and paper to vent my feelings, but it's not a regular part of my routine.

Maybe it should be. If writing can make me feel better when times are tough, might it not also work to help prevent stress and anxiety? Should we all be journaling?

What actually is journaling?

"Journaling" is a fancy word for a very simple concept – it just means documenting your thoughts, feelings, and experiences. People have been doing this for **centuries** – from famous diarists like Samuel Pepys and **Anne Frank**, to that LiveJournal page you hope never resurfaces from the internet doldrums.

There's no wrong way to keep a journal. You might prefer recording your life through Instagram stories, voice notes, songs, or drawings. But many of the most popular journaling practices involve writing, so that's what we're going to focus on.

One example is gratitude journaling, documenting things that you are thankful for. You could incorporate this into your daily diary if you keep one, or if you're really unsure where to begin you can buy ready-made gratitude journals with prompts.

Bullet journaling is another popular option. Pinterest abounds with beautifully curated bullet journal layouts – users commonly favor dotted paper and customize their journals with decorative flourishes. The beauty of this is that your journal can be adapted to become anything you want it to be.

You might keep a travel journal, or nature journal if you're not venturing too far afield. If you're on a fitness journey, or undergoing lengthy medical treatment, you might keep a written log of your progress, even if you don't think of this as a "journal".

Some people also keep a dream journal, habitually recording their minds' nighttime wanderings each morning. As well as helping you to remember elusive details of your dreams, **proponents claim** the practice can help spark creative ideas and even be a useful tool if you're trying to learn how to **lucid dream**.

All of these have slightly different purposes, but to stress again, there's no wrong way. And when it comes to using journaling as a **wellbeing** tool, sometimes the most effective approach is the simplest.

"Just write"

In 1992, teacher and author Julia Cameron released **The Artist's Way**, a book that aimed to provide "a spiritual path to higher creativity." You might assume such a text would be mostly used by creative professionals, but the **New York Times** recently included it on a list of six books that therapists read themselves.

I spoke to chartered clinical psychologist and Associate Fellow of the British Psychological Society **Linda Blair**, who told me about one aspect of Cameron's framework that she returns to time and again in her work.

"YOU SIT UP IN BED, AND BEFORE YOU DO ANOTHER THING, YOU WRITE THREE PAGES OF ANYTHING, WHATEVER'S ON YOUR MIND, YOUR DREAM. WHY AM I WRITING? THIS DOESN'T MATTER. JUST WRITE."

"[Cameron] gets [her students] to do something called **morning pages**," Blair told

IFLScience. "You sit up in bed, and before you do another thing, you write three pages of anything, whatever's on your mind, your dream. Why am I writing? This doesn't matter. Just write."

"THAT DISCIPLINE OF TAKING THE CHAOS THAT IS OUR STREAM OF CONSCIOUSNESS AND GIVING IT A FORM AND A SHAPE AND A DIRECTION IS JUST SO VALUABLE."

Blair explained to me that this practice of writing freely, before you're even fully awake, can be the time when issues you might need to work through will reveal themselves.

"It makes sense. It's not floating around your unconscious, just making you sort of agitated [...] You have to put a sentence down when you write, so it has to be logical and you begin to get a form to your problems, which is the first step in solving them."

She likened it to having a therapy session with "someone you really trust that knows you well" – yourself.

"I couldn't say stronger how important it is"

When I asked Blair if she recommends journaling to her therapy clients, she was unequivocal: "I couldn't say stronger how important it is and how possibly money-saving and timesaving it is as well."

Even for a patient experiencing psychosis, documenting their reality – however different from our own – can help them. "That discipline of taking the chaos that is our stream of consciousness and giving it a form and a shape and a direction is just so valuable," she added.

Blair is not alone in her praise. Gratitude journaling is one method that's increased in popularity in recent years, partly down to the work of influential American psychologist

Dr Martin Seligman. Seligman developed a technique called “Three Good Things”. It’s pretty simple: at the end of each day, you write down **three positive things** that happened to you, and reflect on why they made you feel good.

“IF THE LAST THING AT NIGHT YOU THINK ABOUT BEFORE YOU GO TO [SLEEP] IS POSITIVE, YOU’RE MORE LIKELY TO WAKE UP IN A BETTER MOOD, RIGHT?”

“Gratitude provides many advantages throughout development,” begins a **2018 review** entitled *How Gratitude Connects Humans to the Best in Themselves and in Others*. From their research, the authors concluded that engaging in practices that “elicit positive appraisals of one’s daily life” – like gratitude journaling – could help promote wellbeing and more positive interactions with others.

Blair explained how this practice can be particularly helpful for people experiencing depression: “If the last thing at night you think about before you go to [sleep] is positive, you’re more likely to wake up in a better mood, right?”

A **recent study** even found that feelings of gratitude were associated with a longer lifespan in a group of older adults. While the authors cautioned that their results could not be interpreted as a definitive causal link, it’s food for thought at least.

But if all this sounds too prescriptive or unachievable for you, don’t worry. You don’t have to follow a set method to reap the benefits of journaling.

“Getting your thoughts down is the key, however it works for you,” Blair said. “It’s like exercise – if you do it again and again, then do it that way.”

As well as promoting mental wellbeing, the very act of writing every day can be good for you. Some research suggests that **hand writing** helps **learning**, information processing, and memory. One **recent study** concluded that hand writing from a young age is essential to “provide the brain with optimal conditions for learning.”

In our increasingly tech-reliant world, taking a few minutes each day with just a pen and blank piece of paper might provide some welcome respite. “We’re not so good at communicating nowadays,” laments Blair, who also holds qualifications in creative writing. With electronic communication, “we don’t need the discipline of writing it down in an order and in a way that is communicable to others.”

“IT’S NOT DIFFICULT, IT’S NOT MAGICAL, YOU DON’T HAVE TO PAY FOR A THERAPIST TO LEARN IT – THAT’S ALL YOU DO.”

The case for journaling looks pretty strong from where I’m standing. Fourteen-year-old me was clearly onto something – perhaps I should take my cue from her.

As our conversation draws to a close, Blair is also fulsome in her recommendation: “It’s not difficult, it’s not magical, you don’t have to pay for a therapist to learn it – that’s all you do.”

Hold that thought – I’m off to buy a notebook. ●



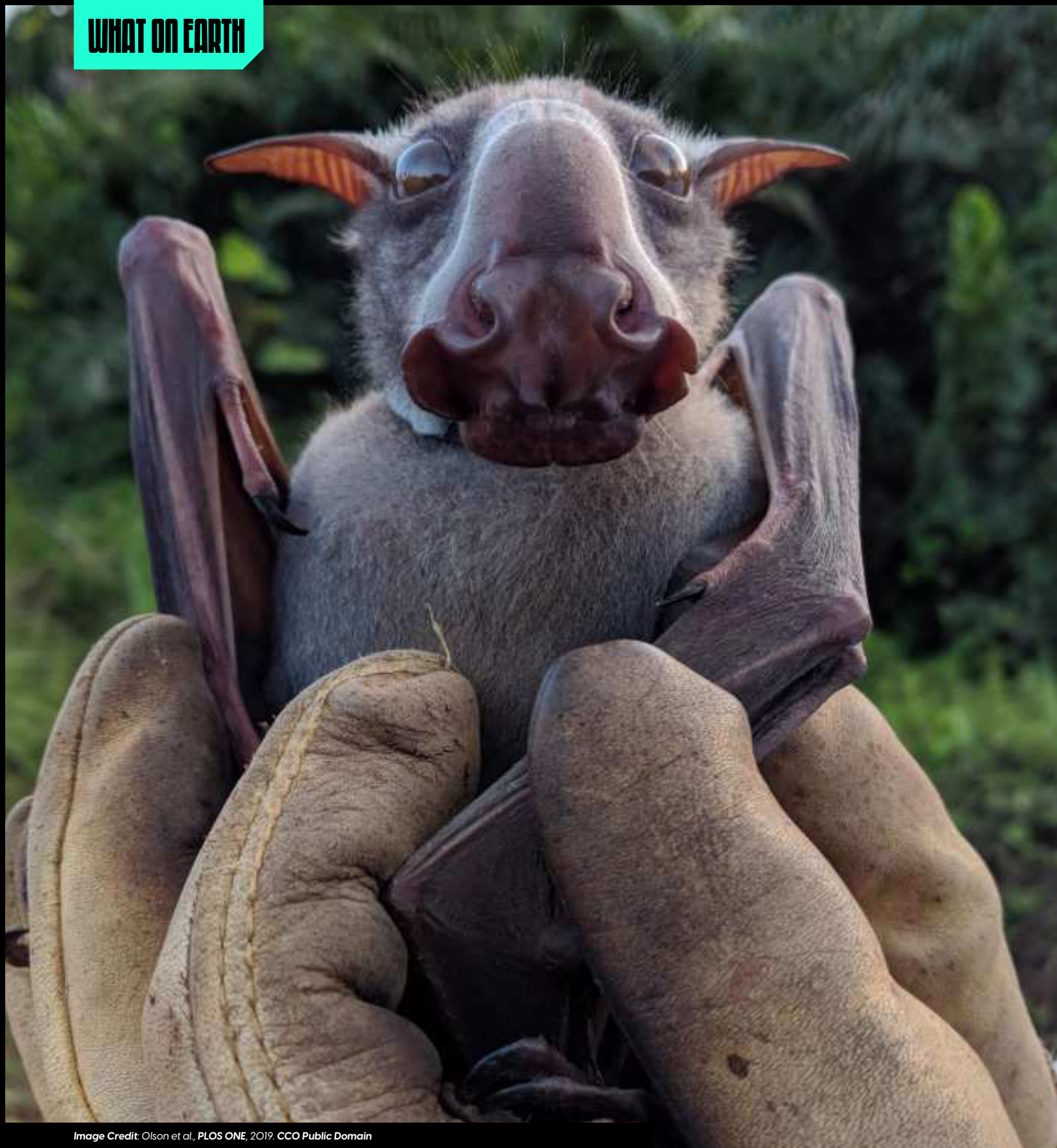


Image Credit: Olson et al., PLOS ONE, 2019. CCO Public Domain

THE HAMMERHEAD BAT

Get a load of the snoot on this guy! This is the **hammerhead bat** (*Hypsignathus monstrosus*) and it's a male. How do we know that? Because only the males have such impressive, enlarged noses that aid them in making loud honking noises to impress the ladies. Hammerheads are the largest bat species on the African continent with a wingspan of up to 97 centimeters (38 inches), but if you're afraid of bats, fear not – hammerheads are out for fruit, not blood.



Image credit: Sérgio Henriques

HOW DO YOU REDISCOVER A “LOST” SPECIES?

WHEN A 10-YEAR SEARCH COMES DOWN
TO A SINGLE ROCK.

By Rachael Funnell

DNA analysis confirmed in 2023 that a trapdoor spider lost to science had been rediscovered in the Portuguese village it was named after following a 92-year disappearance. **Fagilde’s trapdoor spider** (*Nemesia berlandi*) was first described in 1931 before apparently dropping out of existence – but all that changed when an expedition team happened to look under just the right rock.

It marked the 12th “most wanted” lost species to be rediscovered since Re:wild’s **Search for Lost Species** launched in 2017, which got us wondering: how on Earth does such an epic mission unfold? Fagilde’s trapdoor spider was rediscovered by an expedition team led by the Global Center for Species Survival at the Indianapolis Zoo, where **Sérgio Henriques** is the resident Invertebrate Conservation Coordinator. We caught up with Henriques to find out just how much work goes into tracking down a missing spider.

How did you start?

SH: We spoke to the local community to get permission to go into their land, and then we picked which parts we wanted to visit based

on satellite imagery. We had some idea from other closely related spiders about which habitats they might prefer, usually natural habitats – it's more likely to find a rare spider in a natural habitat than in the middle of a city.

What did you have to work from?

SH: We knew nothing. We knew where it was [originally] seen, and how it looks, but that was literally it. What we do know, from other trapdoor spiders in the country, and in the world, is that trapdoor spiders live very long lives.

Fagilde's trapdoor spiders can live very long lives as well. We don't know how long, but what that tells me is once they build a trapdoor, they have their burrow, put a little trapdoor on it, they're not going to move. They're going to stay there until they're disturbed or killed.

So, if you see in a landscape an area that is very disturbed, the spider is not going to be there. That's a very unlikely place because it doesn't have the stability, the safety, doesn't provide that long-term housing.

It's more of an exclusion process than anything else. But in effect, [it involves] being on our hands and knees, looking at the ground. We put ourselves in a position where it's likely, or it's possible, that the spider is there, and then we just look really. It's just a matter of patience, perseverance, and just looking at clues in the environment over and over again. Over a course of hours, days, weeks. We just keep at it until we are lucky.

And you tried some trickery?

SH: Spiders will stay in their burrows except when males need to find a partner. So, what we tried was providing them with artificial shelters out in nature.

Did it work?

SH: No, that failed miserably.

What did work?

SH: We turned to natural shelters. We looked in the soil and we did find some tantalizing evidence: a small trapdoor,

some juveniles, but they were abandoned meaning there was no spider with them, so we couldn't confirm. But we knew some trapdoors were there, which gave us some momentum. Then, under a natural rock, my colleague turned it and beneath was a damaged burrow.

At the bottom of that burrow was an adult female spider caring for her young. Between five and 10. We couldn't see the burrow [from the outside] because she had locked herself inside with silk, and she had covered her own trap door from the inside so that nothing could come in, nothing could come out. There was nothing, no clue of its existence on the outside world. If we hadn't turned that rock, and if that rock hadn't touched that wall slightly, we'd have never seen it.

How did it feel?

SH: So, in my mind, my job at the time was "I need to see what animal made this burrow without hurting it." That was my priority. That was my only focus. So, I took a long time to dig that burrow, and I did. I succeeded. I didn't kill, didn't hurt, however many of the juveniles or the female.

Then there was a moment where I had to hold that spider. And for many people, that would be a scary proposition. I understand that people are afraid of a myriad of things, but that spider, in my hand – at that time – was probably the only animal of that species ever to be seen in 100 years. So, the sheer amount of responsibility, of duty, of diligence one has to put into that moment, is very hard to explain.

How long did the rediscovery take?

SH: It took us a decade to find it. ●



Want to hear more about the teams' adventures in search of the Fagilde's trapdoor spider? Check out the full interview on the We Have Questions podcast, episodes released monthly.

Image credit: Sérgio Henriques

SCIENCE FACT OR FICTION:

WHAT WAS THE EARLIEST HUMAN USE OF COLOR?

What was it used for and where did it come from? Tom Hale investigates.



For as long as humans have set eyes on Earth, we've been besotted with red – the color of blood, lust, luck, pain, and passion. It's the first primary color we're able to see as babies and the early introduction leaves a lasting impression on us. Forget soothing blues and luscious greens, it's red that captured the imagination of our distant ancestors, who wielded the color in great abundance to paint their bodies, decorate their ornaments, and fuel their rituals.

Seeing red

Harnessing its chromatic qualities wasn't always easy, but fortunately, the planet provided a path. Prehistoric humans widely used a material known as ochre, a natural earth pigment composed of clay, sand, and iron oxide, which gives it a characteristic rusty hue. Brown, earthy tones are the easiest to unearth, but evidence shows humans had a clear affiliation for the ochre that was most vibrant and rouge in color.

According to the archaeological record,

humans started using the material somewhere between 500,000 to 330,000 years ago, around the time *Homo sapiens* were evolving.

"Ochre use is so old, at least as old as our species itself," **Rimtautas Dapschauskas**, an expert on the evolutionary origin of rituals at the University of Tübingen and the University of Heidelberg, told IFLScience.

A **2022 study** by Dapschauskas and co-authors located evidence of humans using ochre pigments at several sites across southern and eastern Africa in an initial phase that spanned between 500,000 to 330,000 years ago. As the millennia passed, the pigment became a habitual cultural practice across southern, eastern, and northern Africa starting about 160,000 years ago.

It's possible that ochre wasn't the only pigment being exploited by color-hungry humans around this time. Ochre is essentially

an inorganic rock, meaning it tends to stick around for much longer than organic pigments made from berries, roots, or other plant material. Furthermore, these kinds of organic colorants are more likely to be found in tropical regions, like Central Africa, locations where the damp rainforest does not preserve materials well. Perhaps other pigments were around, but proof of their presence has since been wiped from the Earth.

While there are undoubtedly gaps in the archaeological record, it is evident that ochre use was very widespread in Africa during the Middle Paleolithic.

Red rituals

The "\$100,000 question", Dapschauskas says, is why the colorful material became so prolific across the continent around this time. Some archaeologists argue it was purely practical. Evidence does indicate that ochre may have been a crucial ingredient in various technological innovations in the Paleolithic era, such as sunscreen, insect repellent, the tanning of animal skins, and glue-like adhesives.

However, others believe something less tangible was afoot. There is a strong case to be made that ochre – particularly red ochre – was primarily used for ritualistic, symbolic, and esthetic means.

"WE SEE OVER MANY, MANY GENERATIONS OVER THOUSANDS OF YEARS THAT PEOPLE PREFERRED BLOOD RED HUES OVER BROWN, ORANGE, WHITE, OR BLACK MANGANESE, WHICH WOULD ALSO BE EASILY AVAILABLE IN THE LANDSCAPE. BUT NO: THEY USED RED, ESPECIALLY BLOOD RED AND BRIGHT RED."

Some of the clearest indications of this come in the form of seashells crafted into ornamental beads. Across Stone Age Africa, many shells have been found covered in

iron oxide, indicating they were in close contact with red ochre. It's possible the red coloring was directly applied to the beads or, alternatively, they picked it up after being worn by a human who had covered their skin in pigment.

Indeed, **many archaeologists** associate the use of red ochre with body paint. It's not hard to imagine an emotionally charged ritual involving rhythm and movement where people stained their skin with scarlet pigment, utilizing the color's properties to evoke an instinctive response. If that picture is accurate, it would indicate a very early example of symbolic, ritualistic behavior – a major milestone in the cultural development of humankind.

People were especially enticed by the esthetic quality of the red material. Other pigments were around at the time, such as yellow ochre from weathered shales or black manganese, but there was clear favoritism for red ochre. It's apparent that

ancient people went to huge lengths to source and process the finest red ochre that was rich and bright in tone, despite it offering no immediate help for our survival.

"We see over many, many generations over thousands of years that people preferred blood red hues over brown, orange, white, or black manganese, which would also be easily available in the landscape. But no: they used red, especially blood red and bright red," notes Dapschaskas.

"Some of the behaviors in the archaeological record are really costly. Sometimes people walked more than 100 kilometers [62 miles] just to get high-quality material that they were not using for practical purposes – not for eating, not for hunting, not for shelter – but for non-utilitarian purposes, whatever they may be," he said.

One of the oddest and most spectacular uses of red ochre comes from a 49,000-year-old site in Sibudu, South Africa.

Here, archaeologists **have found evidence** of prehistoric people making a special liquid out of ochre and the milk of a bovid. This was long before the domestication of cattle, so they must have obtained the milk by hunting a lactating wild animal.

Strangest of all, why would they waste precious milk? The Paleolithic was not a plentiful time of surplus and it wouldn't be wise to squander calories – unless you had something very important in mind.

Red in art

Homo sapiens began migrating out of Africa approximately 60,000 to 70,000 years ago (this figure is likely to change, but that's what the current archaeological and genetic evidence suggests).

Upon leaving their homeland, the waves of humans brought their innate propensity towards colors and their knowledge of how to harness them. Ochre, once again, became prolifically used across Eurasia and

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Australasia where it is naturally deposited in cliffs, seashores, and caverns.

When we started marking cave paintings in the form of non-figurative art, red ochre was the medium of choice.

“I THINK THE INITIAL MOTIVATION TO USE BLOOD RED PIGMENT STEMMED FROM THIS VERY PRIMORDIAL AND ANCIENT PSYCHOLOGICAL EFFECT WHICH THE COLOR HAS ON OUR PERCEPTION.”

“Non-figurative art is typically marks left of the body, usually with red ochre, either covering a fingertip with a red ochre paint and pressing it to the wall, or more commonly putting your hand on the wall and spitting pigment at it to leave what we call ‘hand stencils’. And a few other things, like washes of red color on nice white stalagmites,” **Professor Paul Pettitt**, an archaeologist specializing in Paleolithic art at the University of Durham, told IFLScience.

Abstract paintings and simple stencils eventually **paved the way** for figurative cave art that depicted animals, humans, and other visions of reality. The artworks’ forms and meanings became increasingly complex, but the color palette rarely swayed from rusty brown, charcoal black, and claret red.

We see this tried-and-tested formula throughout the art of the Upper Paleolithic, most notably the **Lascaux Cave** of France – the Sistine Chapel of the Stone Age – which heavily relied on iron-rich ochre to illustrate its hordes of prehistoric beasts.

Red, red ochre goes to my head

It’s no surprise that red was the color of choice in the Paleolithic. Throughout our history, red has attracted humans, from the robes of Catholic cardinals and revolutionary flags to the vermilion Shinto shrines and medieval depictions of Christ’s blood.

Cross-cultural experiments have suggested the perception of red can vary slightly across different societies and historical epochs. In China, red is famously associated with good fortune and prosperity, while Westerners are more inclined to link it to passion and love.

That said, research has shown that red, regardless of where you were raised, evokes a potent reaction on a subconscious level. Red can **attract us to mates** and fuel our sexual desire. Simultaneously, it can subconsciously instruct us to avoid danger – like a flashing stop light or a scorching hot stovetop.

One way or another, red “highlight[s] the relevance of a goal-related stimulus and correspondingly intensifies the perceivers’ attentional reaction to it,” according to a **2014 study**.

Studies of monkeys **further suggest** that red stimuli can spark profound responses and speak to their strongest desires: food and sex. Red is used in the social signaling and mate selection of primates, most notably in the rosy backsides of baboons, but it also helps them spot ripe fruit among green foliage.

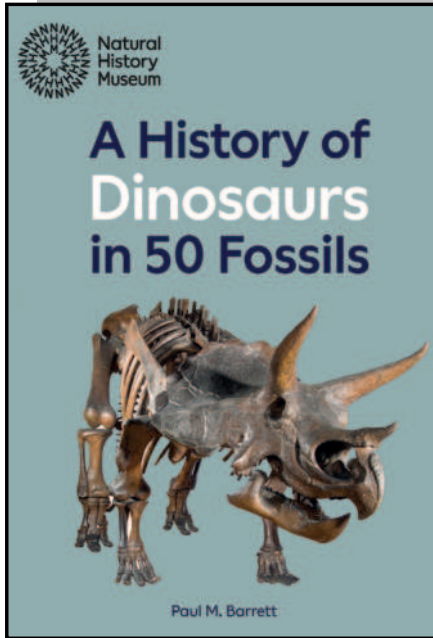
All of this could indicate there is a deep evolutionary basis for the color’s power over us. We see its use emerge and expand at the same time humans were forging complex social behavior, fueled by rituals and symbolism. Was the color red the catalyst behind it all?

“I think the initial motivation to use blood red pigment stemmed from this very primordial and ancient psychological effect which the color has on our perception. It’s something very, very ancient. And I think that early *Homo sapiens* or [their] predecessors were attracted to this material because of this ancient psychological reaction,” Dapschauskas said.

“Blood is red in most vertebrates. It has an inherent signaling property, even in other species,” he explained.

“There’s something really deep evolutionary going on.” ●





THE FIRST NAMED DINOSAUR

In this excerpt from *A History Of Dinosaurs In 50 Fossils*, author **Professor Paul Barrett** explains how the first-ever named dinosaur was retrieved from a picturesque corner of England **200 years ago** – even if they didn't know it at the time.

During the 18th and 19th centuries, another biologically derived rock – coal, the product of even more ancient swamp forests – fuelled the Industrial Revolution. This, in turn, led to further exploitation of the UK's natural resources, with economic growth stoking demand for goods, services, and infrastructure. Mining for building stone, fuel, and ore increased in scope and intensity. Although a farming area, the Cotswolds were also mined, with quarries opening to provide stone for the expansion of towns and cities, including the establishment of grand new colleges at the University of Oxford, the local seat of learning. Many of these building stones could be reached easily from the surface, but some – the layers providing the best roofing “slates” – were in seams

that were harder to reach. These required digging claustrophobically narrow tunnels deep underground, lit only by candlelight or oil lamp. This was dangerous work, as the tunnels often collapsed, but the miners excavated thousands of tonnes of slates, which still adorn the roofs of chapels and dining halls.

As the miners worked, they found strange objects similar to the bones of the horses, sheep, and cattle living in the farms above, but differing in shape, and often of prodigious size. Some of these bones were acquired by local pastors and aristocrats who used their financial resources and ample leisure time to study these objects, thereby contributing to the developing sciences of biology and geology. This was a revolutionary time, when the dogma of Christian scripture was being challenged by experiments in laboratories and observations in the field. These “petrifications”, the objects we now call fossils, were already known to be the remains of once living creatures, but they were often unlike anything alive today. These curiosities fuelled vicious controversies on the age of the Earth, the processes that created our landscapes, and on the life of the past.

Dozens of large, fossilized bones emerged from the slate mines around the village of Stonesfield, Oxfordshire. Many of these were acquired by the Anatomy School, in

Christchurch College at the University of Oxford. Several scholars worked on this material but it was the brilliant and eccentric cleric, the Reverend William Buckland, who first brought them to public prominence. Buckland, Oxford's first academic geologist, was initially stumped by the jaw bone, vertebrae, and gigantic limb bones in these collections. However, the great French anatomist Georges Cuvier, who visited Buckland in 1818, applied his extensive knowledge of living animal anatomy to the problem, identifying the remains as those of a previously unknown gigantic reptile.

Cuvier's insights, and those of other colleagues, enabled Buckland's studies to progress and he presented the results of his work to a meeting of the Geological Society of London on 20 February 1824. During the proceedings, he described in detail the remains of this “...enormous fossil animal...”, which he identified as “...belonging to the order of Saurians or lizards”. Buckland painted an evocative picture envisioning this creature – dubbed *Megalosaurus*, the “great lizard” – describing it thus: “...the beast in question [would have] equalled in height our largest elephants, and in length fallen but little short of the largest whales”. What Buckland did not know was that he had just named the first example of what would become one of the most famous animal groups of all time: he had named a dinosaur. ●

AUTHOR
Q&A

PROF. PAUL BARRETT

AUTHOR OF *A HISTORY OF DINOSAURS IN 50 FOSSILS*

Since the first dinosaur was named 200 years ago, we've had quite the palaeontological party. Dinosaur expert Prof. Paul Barrett decided to give himself a challenge in telling their story in 50 fossils, and we wanted to find out just how hard that was.

Well, how hard was it?

It was pretty hard, as there are literally hundreds of species to choose from! However, what I really wanted to do was to pick a set of dinosaurs that told us something about the history of the subject, current ideas on dinosaur biology, and that gave an introduction to their huge variety of shapes, sizes, and behaviours. There's a slight bias towards dinosaurs in the [Natural History Museum, London's] own collections, as I see those most often, but I also wanted to represent dinosaurs from all over the world.

Any favorites?

A little dinosaur from southern Africa called *Heterodontosaurus*. It's close to my heart as

I work a lot on the evolution of plant-eating dinosaurs, and it has a whole set of features that made it a really impressive early herbivore. It's also just cute!

The ***Titanosaurus* egg** is another intriguing fossil and one I've only known about for a couple of years. This egg had been hiding in the museum's mineral collections for over a century, as it was thought to be a kind of quartz specimen, but it turned out it was actually a dinosaur egg, and one of the first (perhaps the first) to end up in any museum.

Do particular fossils become very important to palaeontologists?

They can become very personal. If you were the person to find it, you're likely the very first human to see that fossil, ever. Naming a fossil as a new species is always special and sometimes they have an aesthetic appeal in terms of shape, texture, or colour that strikes a chord. Some are also lucky enough to have fossil species named after us, which creates a direct lasting connection.

Delighted to see some coprolites in the mix. What are they good for?

Fossilized poop is really useful as it contains direct evidence of what a dinosaur ate. In the case of *Tyrannosaurus*, this includes broken bone fragments from other

dinosaurs. Sadly, we can't often match a coprolite to a species, as dinosaurs don't generally drop dead in the act of using the bathroom but left their poop lying around. However, given the age of the rocks and the place in which this coprolite was found, we can identify it as that of *Tyrannosaurus* as this was the only meat-eater large enough to have made it.

What's the key takeaway from the book?

That dinosaurs were not movie monsters but living, breathing, exciting animals, whose descendants – the birds – are still **with us today**. I'd also like it to change the perception of palaeontology, to show that it's not confined to dusty museums or remote excavations, but that we use lots of cutting-edge technology and comparisons with living animals to understand them (and we do dust the fossils!).

However, perhaps the best thing to take away is that dinosaurs were at the top of their game when they were wiped out by a meteor slamming into the Earth 66 million years ago. They show that no matter how successful you are, disaster might be around the corner. Given our current climate and biodiversity crises, which affect all life on Earth, we'd do well to try and avoid the same fate.

Dream fossil you'd like on the mantelpiece?

Hard choice, as there are lots of pretty dinosaur skeletons and skulls to choose from, although quite a few would simply be too big for my mantelpiece. I have to admit that I wouldn't mind seeing a *Triceratops* skull on the wall above the fireplace, though it's much better off in the museum. •

***A History Of Dinosaurs In 50 Fossils*, is published by the Natural History Museum, London, and is available September 19.**

One of the world's most dangerous volcanoes is also home to the world's largest lava lake. Mount Nyiragongo is one of eight active volcanoes in a chain that stretches across the Virunga Mountains and contains a vast pool of lava that's chemically predisposed to move unusually fast.



THE WORLD'S LARGEST LAVA LAKE

The world's largest lava lake lies in the Democratic Republic of the Congo (DRC), nestled within Mount Nyiragongo. Stretching about 250 meters (820 feet) across at a depth of 600 meters (1,970 feet), it's quite the hot tub of bubbling magma.

Part of the Virunga Mountains, it sits within the UNESCO World Heritage Site Virunga National Park, close to the city of Goma in eastern DRC. A chain of eight active volcanoes stretches across the landscape, experiencing eruptions at regular intervals every few years. Nyiragongo joins **Nyamuragira** in being the most active in Africa, the two being responsible for two-fifths of the historic eruptions on the continent, according to **UNESCO**.

The highly active pair are both notable for the extreme fluidity of their basaltic lava flows, meaning eruptions are particularly dangerous as the lava can move at speeds of 60 kilometers per hour (37 miles per hour). This was demonstrated in the deadly 2002 eruption, which resulted in dozens of fatalities and displaced almost 500,000 DRC citizens as fissures along its southern slope leaked lava into the environment.

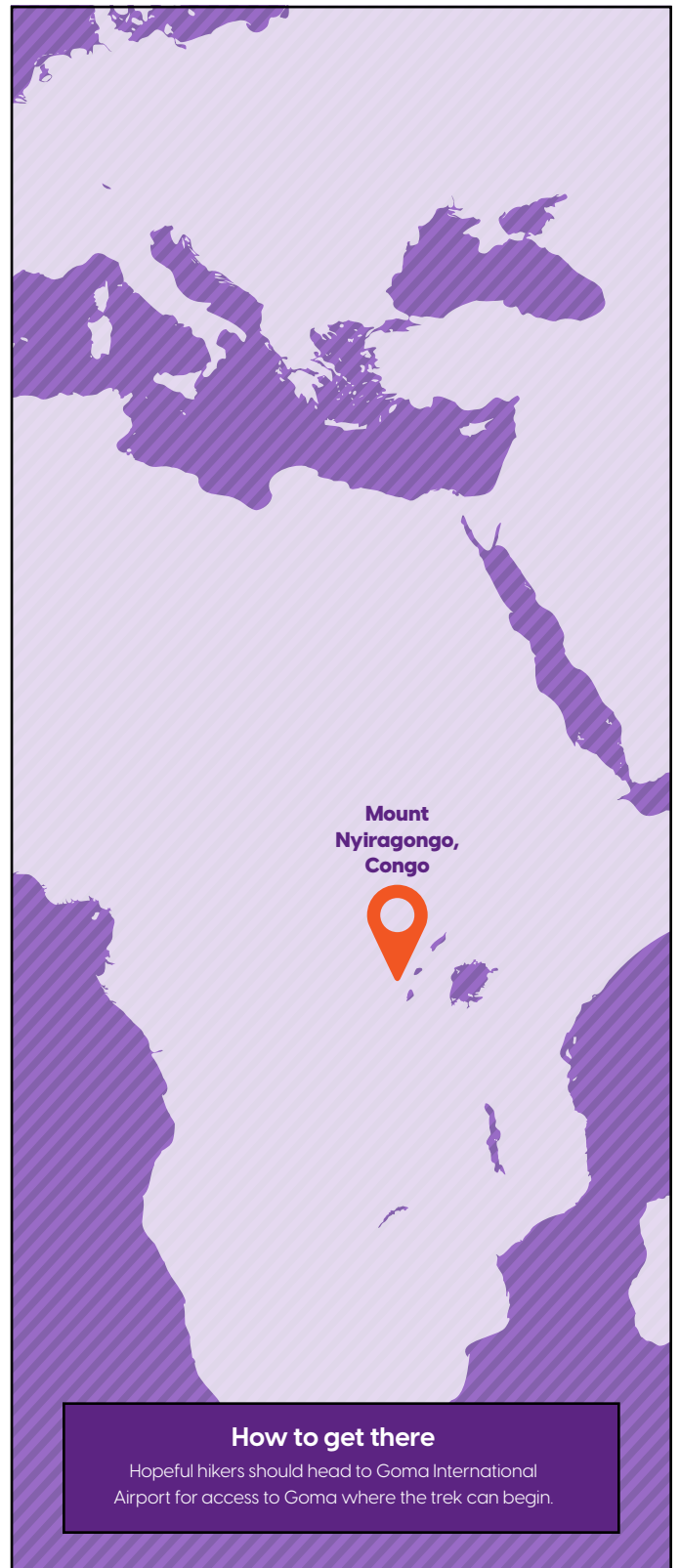
The reason why the lava is so dangerous is because it's low in silica, and it's the strong silicon-oxygen bonds that usually make lava thick and slow-moving. The difference is so significant that fast-flowing lavas were responsible for 90 percent of recorded lava-related deaths in the 20th century.

Deep inside Nyiragongo's crater sits the largest lava lake in the world, filled with semi-permanent lava that empties every now and then in the event of catastrophic eruptions. Lava lakes are characterized by large quantities of molten lava, meaning it's not solidified, and so puts on a smoky display in the day before lighting up at night with hues of orange you love to look at but don't want to touch.

(Side bar: If you've ever wondered what lava would taste like, good news! You're not alone. We put that exact question to the raised eyebrows of Scientist-in-Charge at the Yellowstone Volcano Observatory Michael Poland and University at Buffalo Associate Professor of Geology and expert on planetary volcanology Tracy Gregg in our first-ever issue of **CURIOUS**.)

Its high rate of activity, fast-moving lava, and proximity to humans make Nyiragongo one of the **most dangerous volcanoes in the world**. As such, scientists keep tabs on its movements for early warning signs of an eruption.

For all its ferocity, Mount Nyiragongo is also a breathtaking sight to behold, surrounded by lowland forests that are home to a variety of animals, including chimpanzees, monkeys, beautiful birds, and three-horned chameleons. If you're up for a bit of hiking, you can take it all in along the Nyiragongo Volcano Trek. ●



Mount
Nyiragongo,
Congo

How to get there

Hopeful hikers should head to Goma International Airport for access to Goma where the trek can begin.

LISTEN



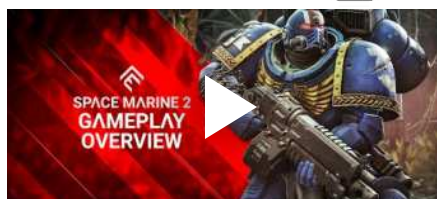
We Have Questions

New podcast from IFLScience

You've read We Have Questions in the magazine, now you can hear the full interviews as the CURIUS feature goes multimedia. Each episode puts some of the stranger queries to scientists in the know, exploring the questions nobody thought to ask but that everyone wants the answers to. New episodes come out monthly, but if you're hungry for more, you can always check out **The Big Questions** for meatier topics, or our weekly podcast, **Break It Down**, for the latest news.

Launching **Sept 2** on all good podcast platforms.

PLAY



Warhammer 40,000: Space Marine II

Game from Saber Interactive

You've painted the figurines, you devoured the last game over 12 years ago, and now the digital Warhammer 40,000 is back with Space Marine II. The third-person shooter hack-n-slash video game was developed by Saber Interactive and published by Focus Entertainment, and is scheduled for release on PlayStation 5, Windows, and Xbox Series X and Series S. You'll fight as part of the Indomitus Crusade reclaiming lost worlds in the face of an alien race known as the Tyranids that are about to declare war.

Available **September 9**.

WATCH



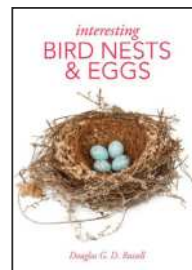
Apollo 13: Survival

Documentary on Netflix

The phrase "Houston, we've had a problem," was first made infamous during the Apollo 13 disaster in which an oxygen tank ruptured two days into the mission, forcing the crew to abort a Moon landing. Instead, the seventh crewed mission in the Apollo program looped around the Moon in a circumlunar trajectory that enabled them to return safely to Earth on April 17, 1970. Find out how the crew and teams on the ground fought to bring the astronauts home in this nail-biting cinematic retelling of one of NASA's greatest crises.

Available **September 5**.

READ



Interesting Bird Nests And Eggs

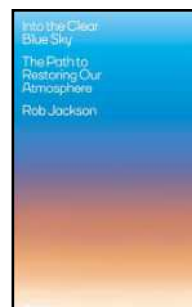
Book by Douglas Russell

Explore the beautiful and bizarre world of our planet's last surviving dinosaurs in this visually led

deep-dive into *Interesting Bird Nests And Eggs*. Douglas Russell is Senior Curator of birds at the Natural History Museum, London, looking after all the avian egg and nest collections. In this book, he presents over 100 examples from one of the largest and most historically important bird egg and nest collections in the world, including a hummingbird nest dating to 1768 and the first voyage of Captain James Cook on HMS Endeavour.

Available **now**.

DISCOVER



Into The Clear Blue Sky

Book by Rob Jackson

In *Into the Clear Blue Sky: The Path to Restoring Our Atmosphere*, author Rob Jackson reveals a fascinating look

into some of the cutting-edge climate solutions in the modern era's arsenal against a warming planet. Drawing on decades of research and a vast network of experts, the Chair of the Global Carbon Project introduces some of the brilliant innovators behind the boldest solutions to climate change in industry, business, and agriculture. With a hat tip to activists like Rev. Lennox Yearwood and Rose Abramoff, it's a reminder that change can't happen without human-led movements.

Available **now**.

SCIENCE IN MEDIA





DATES TO REMEMBER

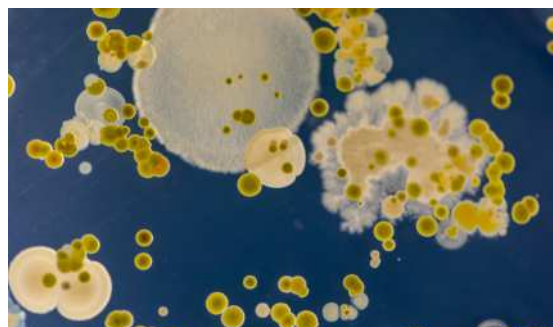
A new season looms, and there's lots to look forward to this September. See some spectacular space snaps as the Astronomy Photographer of the Year competition announces its winners, do your bit to create a waste-free planet, and marvel at a full Harvest Moon – and see in the Fall Equinox, which will herald the arrival of Autumn.

SEPTEMBER



13 Astronomy Photographer of the Year exhibition

From stunning skylscapes to awe-inspiring aurorae, the cosmos really is a thing of beauty. This September, thanks to the Astronomy Photographer of the Year exhibition, you can marvel at it in person as some truly outstanding space photography goes on display at London's National Maritime Museum. The competition – the largest astrophotography contest in the world – is now in its 16th year, and promises to be just as spectacular as ever. The winner will be announced on September 12, ahead of the exhibition opening the following day. For a sneak peek of what's on offer, you can check out the shortlisted images [here](#).



17 International Microorganism Day

September 17 is International Microorganism Day, dedicated to learning about and celebrating all things microbe. With a part to play in everything from our health to the food we eat, microorganisms are an essential part of everyday life, and yet we often don't appreciate them. International Microorganism Day strives to change that, providing a platform for microbe lovers around the world to share their passion and knowledge of the microscopic organisms all around us.



17/18 Full Harvest Moon/Supermoon

The second of four supermoons in 2024 is happening overnight on September 17-18 – the same date as a partial lunar eclipse. Known as the Harvest Moon, it is the full Moon that occurs closest to the Fall Equinox, and it is expected to rise at 2:34 am UTC. It is also a supermoon – a full Moon that nearly coincides with the point in the Moon's orbit that is closest to Earth – meaning it appears much larger and brighter than usual.



20 World Cleanup Day

We all want to live in a healthy, waste-free world, and World Cleanup Day is making strides to make that happen. The initiative aims to tackle the global waste crisis and so far has removed 543,704 tons of mismanaged waste and inspired 91 million participants. By joining them this year, you can help them achieve their goal of engaging 5 percent of the world's population.



22 Fall Equinox

For those in the Northern Hemisphere, the Fall Equinox is almost upon us and marks the end of summer and beginning of fall. On September 22, the Sun will be directly above the equator, illuminating both hemispheres equally and giving us a day and night of roughly equal length.



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

Choose how you end each issue. For those who prefer the darker side, Dr Jasmine Reggiani explores the time tulips went quite literally viral. If you like your science lighter, discover why birds look flashier in the tropics.

TULIPS GONE VIRAL

Centuries of careful selective breeding have given us over 3,000 tulip varieties – but in the past, our pursuit of the perfect tulip has led us to unwittingly make them sicker.

It's 1624 and, in his garden in the Netherlands, Adriaen Pauw has built an elaborate mirrored gazebo to reflect and multiply the beauty of the handful of tulips growing inside. At the time, he was the owner of almost all of the dozen or so *Semper Augustus* tulips in existence. He had no idea that he was glorifying the work of a virus.

Today, tulips are an industry worth billions of dollars, but our current obsession is nothing compared to the tulipomania that took over the Netherlands in the 17th century. Rather than a market based on the sale of billions of flowers, tulipomania was about selling rare bulbs for steep prices. The *Semper Augustus* came out on top.

This beautiful flower that broke the bank is today only accessible to us in the

paintings from that time – it's even illegal to grow it in the Netherlands nowadays without permission. What was so special about it?

Like most of the prized tulips of tulipomania, it is what is called a "broken" tulip. A descendant of red tulips, the first *Semper Augustus* blossomed in tantalizing flames and streaks of red and white, a bit like a head of radicchio. What broke the *Semper Augustus* is TBV – *tulip breaking virus*. A name that says it all.

The color of a tulip comes from a blend of two pigments. A white or yellow base pigment, and a class of pigments called anthocyanins which can be red, purple, blue, or black. TBV suppresses the production of anthocyanins, after the normal flower color has developed. The patterns it forms are therefore different on the two sides of each petal.

While the offspring of a broken tulip do keep the sought-after imperfections, the virus also causes tulips to produce fewer offspring and die out over a few generations. During tulipomania, this only helped drive the prices for these rarities even higher – although you can't say people didn't bring it on themselves.

RAINBOW DINOSAURS

In the male bird of paradise's elaborate courtship dance, the coup de grâce is the flash of his iridescent breast feathers. She can't resist it.

If you live in temperate regions of the world, you may not be as lucky as a female bird of paradise to encounter such a display in the wild. There, you are more likely to see birds with pigmented plumage – still plenty colorful, but lacking the brilliance of iridescence.

A **study** from an international team of researchers has found that the closer you are to the equator, the more likely you are to encounter an iridescent bird. One more reason to book that vacation, if you don't already live there.

Iridescence is the phenomenon of a surface changing color based on the point of view or illumination angle. The word comes from the name of the Greek goddess of the rainbow, Iris.

It's caused by melanosomes, tiny structures within our cells

that are filled with melanin (what gives your hair and skin its color too). They produce this effect in the feathers of birds through variation in their shape or arrangement. Layer some melanosomes with some keratin into a photonic crystal and your iridescence is sure to dazzle.

So how come birds with iridescent feathers are more common in the tropics?

The study looked at more than 9,000 species of bird from all over the world and found that the common ancestor of birds, the one that was **basically a dinosaur**, is likely to have had iridescent feathers.

After that, over the course of evolution, iridescence was lost many times, but also gained. Iridescence wasn't more likely to be gained in the tropics, but iridescent birds were more likely to "disperse and expand their range into the tropics".

Why might that be? In the tropics, higher UV light might favor iridescent birds. In the already colorful bouquet of the tropical forest, a little iridescence can increase novelty when trying to find a mate, but could also help background match for predator avoidance.



The **Darker** Side
of Science



THE **LIGHTER** SIDE
OF SCIENCE