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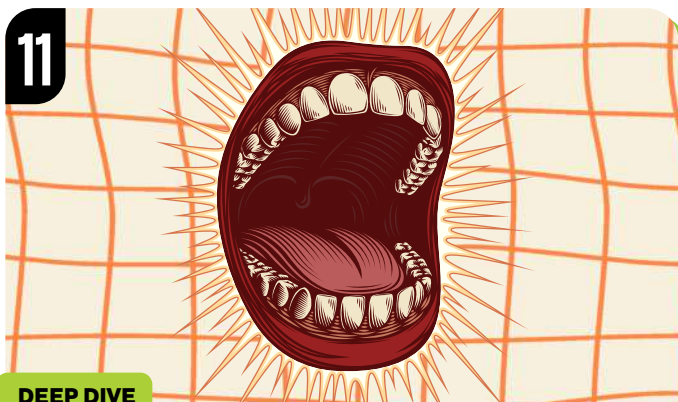


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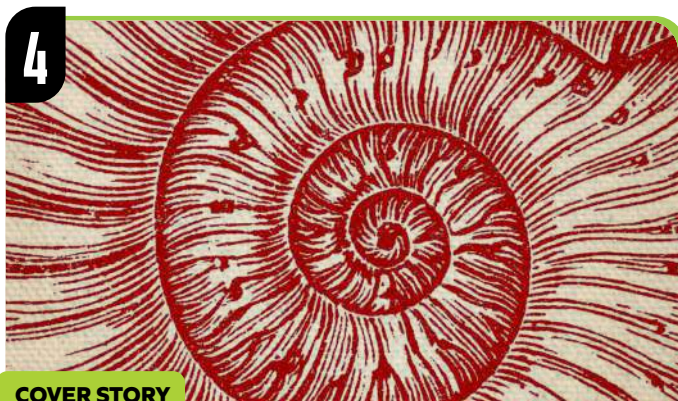


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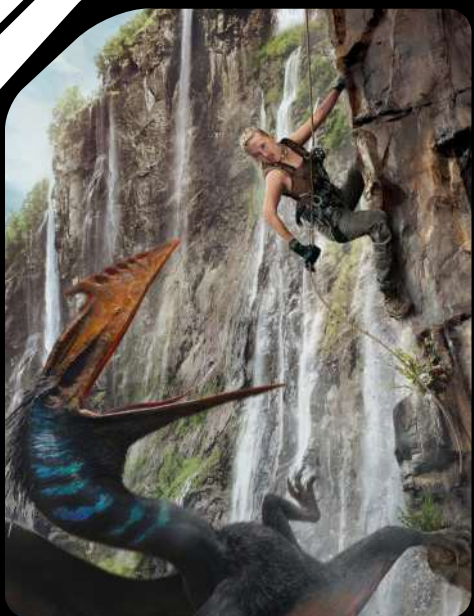
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Summer Sci-Fi

We are so back this summer with the latest in the increasingly unhinged (and increasingly bombastically titled) Jurassic offering, *Jurassic World: Rebirth*. Do scientists need to visit yet another island InGen had stashed away, this time somewhere in the Atlantic, to take a risky sample that will somehow save humanity? Yes. Do we care? No! It has swimming *Spinosaurus*es teaming up with a mosasaur and something called a Distortus rex, which looks like a xenomorph and a *T. rex* had a baby. Look, it's no *Walking with Dinosaurs* for accuracy, but on July 2, visit the largest cinema screen in London and you'll find most of IFLScience in the front row. Oh, and if superhero movies are more your thing, the 5 billionth *Superman* is out on July 11 and Marvel is still trying to make *Fantastic Four* happen with the latest iteration, *The Fantastic Four: First Steps*, out on July 25.

Earth's Aphelion

On July 3, Earth will be at its farthest point from the Sun – its aphelion – at a distance of around 1.0167 astronomical units, or AU. AU is the average distance between Earth and the Sun, about 152 million kilometers (94 million miles). This distance differs by about 3 percent during Earth's orbit because it is slightly elliptical rather than perfectly circular. Technically, this marks the moment that the Sun is the smallest in the sky – but at a 3 percent difference, it's barely noticeable, it's just fun to know it!

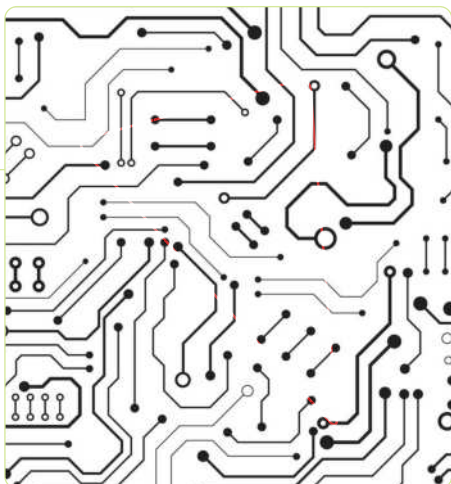
Zero Shadow Day

Twice a year, in just a few locations around the world at the right tropical latitude, a "zero shadow day" takes place where, at midday (12 pm) local time, the Sun will be directly overhead at 90°, meaning objects standing vertically will cast no shadow. During zero shadow days, when the Sun is at its peak in the sky, you will be standing on the closest place on Earth to the Sun, known as the subsolar point. In Hawai'i, the only US state in the tropics, so the only one to experience it, this is called "lāhainā noon" – roughly translated as "cruel Sun" – and it falls on July 15.



Most Prolific Sw*@rers

The first **large-scale analysis** of its kind to determine how offensive language was used in English-speaking countries has revealed which is the most prolific for profanities. Linguists created a database of 597 "offensive" words across 20 English-speaking countries ostensibly to explore cultural differences in the use of bad language – for example, in the US if you are "pissed" you are angry, while in the UK, you are drunk – and to highlight how navigating a new language means understanding and adjusting to the social and cultural nuances. However, the Australian researchers were disappointed to learn they only came third in the rankings, with the US taking top spot and the UK second. But don't worry, Australia, you still have the world's only **swearing duck**.



Mood Ring... For Your Face

Just in case you wanted to monitor *exactly* how much your job is stressing you out, scientists have **invented** a temporary face tattoo that tracks when your brain is working too hard. In what sounds very much like a facial mood ring, the scientists say the e-tattoo detects when your brain is overloaded by using a series of electrodes and a machine learning algorithm. Why would anyone want this, you ask? The teams suggest it could be a way of monitoring people with high-stress jobs, such as pilots, truck drivers, and frontline healthcare workers, where mistakes due to overwork can have serious consequences.

US's First Climate Museum Puts Down Roots

After a decade of operating as a roaming institution, the first museum dedicated to climate change and climate solutions in the US has found a permanent home in New York. Since being founded in 2015, the museum has sought to educate and inspire action – and combat climate despair – through free art and history exhibitions, workshops, performances, and events. Although the new permanent museum isn't slated to open until 2029, it will continue its roaming program of events, which you can find more on [here](#). "Our exhibitions have already inspired waves of civic action. This permanent, year-round space will make our signature, interactive arts and cultural programming more accessible to more people. Ultimately, this means more climate dialogue and action – moving us closer to a safe and just future," Founder and Director, Miranda Massie, **said**.

WHAT'S UP?



PLASTIC FREE JULY

Single-use plastic? We don't know her

Name: Plastic Free July

Appearance: Reusable containers galore (time to actually use all those Stanley cups you bought last year)

Location: Global

be able to avoid certain single-use plastic items. This year's campaign isn't about drastic action, but instead making a big impact through lots of people making small, everyday changes.

Plastic free? Does this mean I'm going to have to throw away my plastic kettle?

Don't worry, no one's going to force you to make your cup of tea with water boiled on the stove. Plastic Free July is all about minimizing plastic waste, particularly when it comes to single-use plastic – your kettle is safe.

Why go plastic free?

Plastic waste is a serious problem. We've all seen images of turtles caught up in carrier bags and six-pack rings, but plastic waste affects the planet in more than just one way. It piles up in landfill sites, contaminates soil, waterways, and oceans, and can even end up in our own bodies in the form of microplastics – the potential **health effects** of which we're still a long way from fully understanding.

You've convinced me – but what if I can't entirely avoid single-use plastic?

That's okay – there are all sorts of reasons why people might not

So how do I get involved?

The people behind Plastic Free July recommend choosing one single-use plastic to avoid for the entire month – and hopefully, beyond. This might include one of the three most common single-use plastic items used each day: cups, drink bottles, and food wrap. All can be switched out for reusable alternatives, like sturdy stainless steel tumblers and bottles, glass food containers, and wax food wraps. If you're feeling ambitious, maybe you could try ditching all three.

Do small changes really make an impact?

You bet they do. The Plastic Free July team estimates that over the last six years of campaigns, participants have collectively avoided 1.7 million tonnes of plastic waste. If we were to represent that as the average empty plastic water bottle, which weighs about 17 grams (0.6 ounces), that equates to about 100 billion plastic water bottles-worth of waste avoided.



OUR COVER STORY

HOW TO FAKE A FOSSIL

How to separate prehistoric fact from carefully crafted fiction.

By Katy Evans

Fossils are valuable; that's something most people can agree on. Whether it's their contribution to scientific knowledge, vital in helping us understand the history of life on Earth and our place in it, or you want to blow **\$44.6 million on a complete *Stegosaurus***, because you can. But where there is value, there is usually someone looking to make a quick buck. So, how can you tell the genuine article from a fake? Here, we dig into the telltale signs of a forged fossil, the techniques forgers use, and get some expert top tips on how to spot a fraud so you don't become a victim of a specimen just a little too good to be true.

Are all fakes forgeries?

I'm standing in the dinosaur archives of the Natural History Museum, London, huge bones on shelves all around me, and palaeontologist **Professor Paul Barrett** is showing me what turns out to be the lower jaw of the first known *T. rex* specimen. Its dark, shiny teeth remind me of another large set of teeth I had seen recently; these belonged to a **massive pliosaur** discovered on England's Jurassic coast. You may have seen it in the news: a huge skull removed from a precarious cliff face 12 meters (40 feet) up. It's the teeth that really grab you, poking outside the jaws like its mouth just can't contain them, and I was surprised to learn from Christopher Moore, one of its discoverers, that the teeth weren't found attached – they were mostly found nearby and they had reattached them in the preparation process. Basically, they glued them back in.

I know this is a legitimate palaeontological process, but I can see how purists might question the intervention. At what point does helping a fossil along in its presentation cross the line into augmentation – or even forgery, intentional or not? After all, I still remember the look of confusion on a friend's face when I explained the museum's famous Dippy the *Diplodocus* was a cast of about six different

dinosaurs. "So, it's fake?" they'd asked. "No...?" I replied. I then had to explain the unlikelihood of finding the complete remains of a 26-meter (85-foot) animal, all 292 bones intact, 145 million years after it died. By making casts of different individuals, you can eventually, hopefully, make up a full dinosaur, and often, that's what you're **seeing in museums**.

Anyway, all this flashed through my mind before I, perhaps unwisely, asked Barrett if the museum had any fake fossils that he knew about. He tried not to look affronted, pointing out that the museum did not take in fakes and had thorough techniques and processes in place to ensure that didn't happen. Although, he conceded, there have been times when researchers have been looking at specimens collected and realized some parts definitely didn't belong together. "That's not so much to do with people faking it dishonestly. That's more to do with just people forgetting when they put that skeleton there 50 years ago," he said.

ON CLOSER INSPECTION, THE DARK AREAS WERE DISCOVERED TO BE BLACK PAINT AND THE SHAPE OF THE ANIMAL HAD BEEN CARVED FOR A MORE DEFINED LOOK.

Behind the scenes of any museum are hundreds of thousands of decades- or even centuries-old specimens waiting to be catalogued, described, and studied with modern techniques. This has warranted a few surprise reveals that a prize collection may not actually be what we thought. This happened recently when post-doctoral researcher **Dr Valentina Rossi**, whose work specializes in the preservation of pigments and soft tissues in fossil vertebrates, got her hands on what was thought to be a

rare example of the fossilized skin of a 280-million-year-old reptile, only to find the "soft tissue" was in fact black paint.

The fossil ended up not having the value they had thought, but Rossi decided it did still have value in their reporting of it to have conversations, like the one we end up having, highlighting and discussing the issue of fossil forgeries.

THE REAL MONEY-MAKER IN FOSSIL FORGERIES THESE DAYS IS NOT TO FOOL SCIENTISTS, BUT THE PUBLIC.

Are fake fossils a problem now?

Many palaeontological forgery discoveries these days are historical specimens tucked away in dusty collections suddenly dragged, squinting, into the bright light of the 21st century. The specimen Rossi and her team were studying was a small lizard-like reptile from the Protorosauria group discovered in the Italian Alps in 1931 and housed in the Museo della Natura e dell'Uomo, Padua, Italy. Rossi sampled the skin and, while analyzing it with a scanning electron microscope, realized the soft tissue was too granular and there was no order to what she was seeing; it couldn't be soft tissue. On closer inspection, the dark areas were **discovered to be black paint** and the shape of the animal had been carved for a more defined look.

Though shocked to discover the forgery, Rossi was quick not to assign blame to anyone for the fact that this was only discovered now. Access to specimens has many limitations, she points out. If a specimen is unique, you don't want to destroy it, you might not want to sample it, transportation to another facility for study may be difficult. If the original collection notes are sparse, it is also impossible to tell if there was malicious intent to deceive or if

collectors just did things differently – and slightly less rigorously – 100 years ago.

"THERE ARE TWO STRATEGIES. YOU EITHER FAKE SOMETHING THAT'S REALLY RARE, REALLY WELL, SO THAT YOU GET A LOT OF MONEY FOR IT, OR YOU FAKE SOMETHING THAT'S REALLY COMMON THAT PEOPLE AREN'T GOING TO LOOK AT TOO CLOSELY BEFORE THEY BUY."

"I discovered, for example, that it was really normal, more than a century ago, to paint over rocks, to paint over historical objects, to make it either more pleasing to the eye or just [show] I can solve this better, or people are going to recognize me in society as an expert," Rossi told IFLScience.

"IF IT LOOKS TOO GOOD TO BE TRUE – TOO CHEAP TO BE TRUE – THEN IT PROBABLY IS."

"We don't want to do a witch hunt on who did this and why? Unfortunately, the act was done. We can hopefully think that this was not malicious, you know, it was just a way to maybe make whatever fossil was found [more pronounced]," Rossi said.

"Because that's the other issue. Unfortunately, we don't have a record, either a visual or a sketch, or a clear description of what was found almost a century ago. So, it puts us in a situation where we can't really make hypotheses."

Reading up on the history of how the profession has changed, not just the way modern scientists meticulously – and, importantly, these days, *ethically* – collect specimens and document discoveries, but how museums are making efforts to place their collections in historical context, including how they were acquired, even if the circumstances are unsavory, was a positive experience for Rossi.

"I think that's a nice twist that, you know, sometimes these things don't get into the publication. We talk about science, but I think this is an important aspect, that museums are working really hard with scientists to understand their collections, their history, placing them in context."

So, the who and the why of fossil forgeries may be less interesting to palaeontologists than the how you identify them – and then rule them out so you can concentrate on studying real glimpses into our past. Rossi noted that in the world of art forgeries, the remarkable skill of forgers has to be matched by the ingenuity of the sophisticated technologies experts use to uncover them. The technology palaeontologists have access to now – chemical analysis, X-rays, CT scanners, infrared spectrometers, microscopic analysis, to name a few – is light-years from just 30 years ago when *Jurassic Park* first hit the screens, let alone a century ago. And 21st-century forgers know that.

The real money-maker in fossil forgeries these days is not to fool scientists, but the public.

Strategies for faking fossils

I asked Barrett how he would fake a fossil. Again, he looked at me strangely, and I hurried to reassure him I was not putting together an IFLScience side-hustle on how to fake a fossil. I was curious, though, as an expert, what he thought would be the easiest to do.

"There are two strategies. You either fake something that's really rare, really well, so that you get a lot of money for it, or you fake something that's really common that people aren't going to look at too

closely before they buy," Barrett said. "I'd fake something that was simple and easy, because I lack the artistic skills to do anything really good," he added, laughing.

The most common trick that "more dubious fossil dealers" do is to augment an existing but not particularly valuable fossil, like an ammonite or trilobite, which can be found all over the world. "You just need a bit of a real fossil and then kind of carve a shape around it to make it look more complete than it actually is. That's probably the lowest impact way of doing it."

"It's partly playing on people's biases, as well as just making it look like a thing. Because it's not always what it looks like. It's what people think it *should* look like," he added. Thanks to this expectation, forged fossils are big business on eBay or even at fossil fairs, where people are expecting to find, well, fossils that look like (their idea of) fossils.

"HE BASICALLY ROCKED UP INTO A SHOP, THEY WERE SELLING A LOT OF THOSE TRILOBITES AND AMBER. HE HAD A LIGHTER AND A NEEDLE, AND WAS LIKE, 'DO YOU MIND IF I TEST THIS?'"

Another bias forgers use is perceived provenance. Two of the big markets for selling fake fossils are China and Morocco, both of which are known for their rich treasure troves of real fossils. If you know, for example, that many *Spinosaurus* fossils have been found in Morocco, then you may be less likely to question the surprisingly well-preserved *Spinosaurus* teeth that eBay seller realfossils4u insists were found in the Kem Kem river system of Morocco – despite the fact the export of fossils in both Morocco and China is illegal.

Rossi notes that forged amber is also on the rise. Amber is fossilized tree resin and while yes, it can be found with the odd 100-million-year-old creature trapped inside in certain regions of the world, it is just as easy to melt down modern tree resin called copal, and when it's soft and sticky, stick a bug in there.

So, anyone hoping to top their own cane with a perfect piece of amber containing a preserved creature à la John Hammond, beware of where you buy it: "Sometimes you get these things at fossil fairs or in shops, where they give you a piece of amber from India and there is a little ant stuck in it. Yeah, that's modern resin with a modern ant in there."

How to spot one in the wild

Both Barrett and Rossi agree fossil fairs are a wild west for those looking for authenticity. "If it looks too good to be true – too cheap to be true – then it probably is," Rossi shrugged.

So, can you arm yourself with some top tips to combat being hoodwinked by a dubious dealer? Thankfully, the answer is yes, there are ways to help you identify a forgery from a real fossil.

Sight

Does it look like a real fossil or is it too crude? Is the shape, texture, or color wrong? Conversely, is it too pristine or too complete, does it have all its bones or features like crests included when that wouldn't have survived the fossilization process? Use a hand lens to look closely at the surface of the fossil; the surface texture of bone is quite distinctive to the surface texture of a piece of plaster or wood.

Touch

Is it cold or warm to the touch? Fossil bone is stone and should be cold, whereas plaster and other materials are warmer. On the

other hand, real amber should be warm to the touch. Can you give it a little scratch with a nail? If it peels, then it's likely been painted to augment it. Is it heavy? Fossils may feel heavier than you expect for their size – they are essentially rock where the original organic material has been replaced by minerals. If it's suspiciously light, put it back.

Sound

Give it a little tap. Again, fossils are made of stone, so they are solid, and the sound waves will disappear almost immediately. If there is more of a ringing noise where the sound reverberates, or a clunky hollow noise, it's likely not solid.

Taste

One way to tell fossil bone from other materials is to **lick it**. Yes, that's a real thing. Touch it to your tongue and a real fossil should stick to it with a little bit of moisture, while rocks, wood, etc will not.

Provenance

Can a seller tell you where it came from, when it was found, and by whom, putting it into context? If not, why not?

There are other ways, but they are perhaps best left to the experts.

"I had a professor at University College Cork who used to give a seminar for undergrad students about history and palaeontology, and, like, the history of forgery," Rossi told IFLScience.

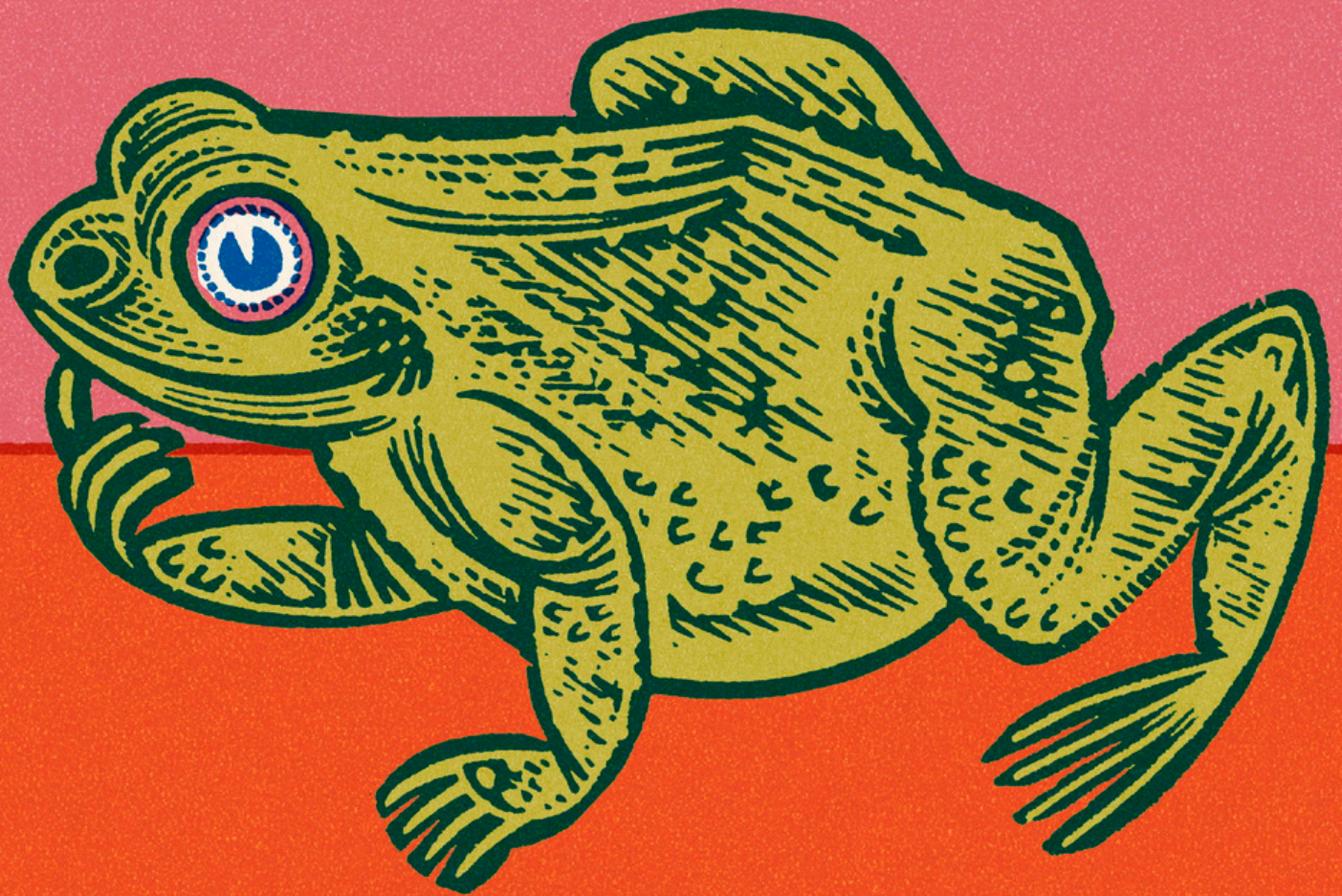
"He once told me that he basically rocked up into a shop, they were selling a lot of those trilobites and amber. He had a lighter and a needle, and was like, 'Do you mind if I test this?' And this guy was like, no, no, no, no, no, no, you can't! So that was kind of a flag, you know. All you need is a lighter, just show the lighter... and depending on the reaction you get, you know, brilliant." 🌟



CANNIBALISTIC POTATO BUGS

Say hello to the **potato bug**, also known as the Jerusalem cricket, which is interesting because it's neither a potato, bug, nor cricket. As a nymph, it's known to violently cannibalize other potato bugs, and the bug-eat-bug action doesn't end there. A **2008 study** learned the hard way that Jerusalem crickets aren't opposed to eating each other when one of their biggest subjects ate one of the smaller ones. Females also occasionally eat males shortly after copulation. Now that's romance.





FROG PREGNANCY TESTS

People were finding out they were pregnant via frogs until the 1960s.

By Rachael Funnell

We all know that many of the tools in human life have been inspired by nature's creations, but how often do you stop and really think about where these products come from? A new gallery at the Natural History Museum (NHM) in London is encouraging visitors to think more about their impact on the planet, as well as showcasing the inspiring work that demonstrates that however doom and gloom the news might be, **hope is not lost**.

Among its many intriguing displays, we stumbled upon something curious: a frog pregnancy test. We had questions and needed to know more about this item, and we were surprised to find these frogs had a lot to say about women's access to healthcare in the not-so-distant past. Here's what we learned from **Dr Isabel Davis**, Research Leader in Collections and Culture at the NHM.

Where did you find these tests?

ID: I was working on a history of human conception and really thinking about pregnancy diagnosis as part of that. When I heard about the fact that in the middle of the 20th century, frogs were the main pregnancy test, I just thought,



"What was that like?" And I was trying to picture it.

I decided to find out more about it. So, I went to the Family Planning Association archive, which is held in the Wellcome Collection in London, and I found these files, which were all about the logistics of moving [African clawed frogs (*Xenopus laevis*)] from South Africa to the UK.

The Family Planning Association had one of the labs that ran in the UK. They opened their lab in 1948, but there were NHS labs just before that, other labs in the UK that were doing this testing. So, from the 1930s to the 1960s, it was the main way that pregnancy tests were done. People would send their urine samples by post through their doctors or pharmacy, and they'd be injected into these frogs, and if you're pregnant, the frog would lay eggs.

Were any other animals used this way?

ID: Before the frogs, there was another animal test, which used mammals, and particularly mice. But of course, you've got to dissect the mouse to get the result. So, frogs were an improvement in the sense that you can reuse them. You don't need a vivisection license, because they lay eggs externally. The principle was discovered through hormone testing and research on human hormones and mammalian hormones.

The frog test was really developed in Cape Town, South Africa, and they were the local frog. They were also good for studying embryology and reproduction because they have very large eggs, and they have very large embryos.

They did have a chemical pregnancy test earlier, but the problem with the chemical test is that it was very difficult to read, so you had to have very specialist readers. The results were a little bit ambiguous, and so it took time to get those tests to the same accuracy level as the animal tests.

Was it any good?

ID: It was really good. They say it was about as accurate as modern tests are, but the problem with them was it took more time.

Now, you can even take a test before your period is due, but then it was really only during the two weeks after your period was due. You had to do things by post as well.

You would send your sample in, then it's tested,

and then you have to go and get that result from the doctor. Back then, it wasn't thought that it would be right for women to get their own results. People feared that there would be an abortion epidemic. So, you had to go to your doctor to get your results.

Is it just the one frog?

ID: They do use other frogs. Sometimes there were shortages, if there was a drought or some other reason that meant they couldn't collect enough of them. They're quite difficult to breed in captivity, so they were collecting them from the wild.

Certainly, the Family Planning Association tried to use local British frogs, and they actually tried using male frogs as well. Female frogs will lay eggs, but if you have male frogs, they will produce sperm. So, they did sometimes use the male frogs as well, but the results just weren't as good, or not as clear.

How does this all tie in with the NHM's new gallery?

ID: There's a story here about how human health has impacted on wildlife. These frogs have been moved, and that's created vectors of disease. There was a concern in the 1930s and '40s from South African conservationists that they were being irresponsibly over collected. In the end, these frogs have done quite well.

One of the things about the gallery is it's trying to get us to be mindful about how the things that we do for ourselves have an impact. Of course, we're always going to want to use natural resources in different ways, but we also ought to do it knowingly. 🌱



DEEP DIVE



SCIENCE FACT OR FICTION:

WHY CAN'T EVERYBODY SING WELL?

Do you light up a room, or break glass? As Rachael Funnell finds out, there is hope for (most) of us lousy singers.



I have this daydream I like to revisit when I'm somewhere boring, like sitting on a train. I'm at a pub or a family gathering, and reluctantly, I'm encouraged onto a stage. It's karaoke, they say. Be fun, I think. Then, to the surprise of me and everyone else in the room, I smash out a perfect rendition of Cher's *Believe*.

As luck would have it, I was able to take this particular daydream for a spin last year when a friend's hen-do led me to a dodgy karaoke joint in London. The microphone was forced into my inebriated hand, and I was off. The sobering reality was that even though I know that song like the back of my hand, some of the sounds I intended to make did not match what was coming out of my mouth. Devastated to learn that I can, in fact, not reach the dizzying heights of Cher's vocal talents, it got me wondering: why?

Yes, I know she's the Goddess of Pop, but we're both human and we have around about the same vocal setup (genetic differences

aside). Had I made different (read: better) choices in life, were I to have paid more attention during music at school, could I, convincingly, believe in life after love? I wanted to find out.

Talking in tune

If we ignore all the beauty and wonder that song has brought our existence, the physical act of singing, much like talking, essentially boils down to breath. When our diaphragm contracts, it makes space so that our lungs can fill with air. As the diaphragm boings back again, it pushes that air out. This can either be a quiet breath, or we can utilize our vocal cords to make sound.

Vocal cords, found in the larynx, also known as the voice box, are two folds of smooth muscle that vibrate as air moves past them. This vibration is what we hear as sound, and we can adjust pitch thanks to muscle groups that alter vocal cord length and stiffness. We get a further bit of control over the way we sound

thanks to everything from the strength of our breath to our tongue, lips, and teeth. Why not give it a try? I just took my upper body for a spin and made all kinds of weird noises.

The science of song

If we can get our diaphragm to do its thing, make sounds, and form words, then singing should be a breeze, right? Not quite. Singing employs many techniques to create different qualities and resonances of sound compared to everyday speech. You also need more air to get the job done. It can be a lot to think about all at once, but it really boils down to one key thing.

"Singing requires a lot of fine motor control,"

Dr Sean Hutchins, Director of Research for The Royal Conservatory of Music in Toronto, told IFLScience. "It's an act of movement, right? One analogy I like to use is bowling. You can take a whole bunch of people out to a bowling alley, and almost everybody will know exactly where they want to aim the ball, but not everybody has the motor coordination in order to get it there reliably."

"Singing has a similar issue with it, where most people know what they want their muscles to do and know the right pitch to aim for, but in terms of being able to do it reliably, so that you can sing every note when you want to sing it, that's a bit more difficult."

"THERE ARE OTHER FACTORS THAT GO INTO WHAT WE THINK OF AS HIGH-LEVEL SINGING, THINGS LIKE TIMBRE, INFLECTION, AND MOTION, BUT ALL OF THOSE COME AFTER BEING ABLE TO HIT THE RIGHT NOTES."

Singing as exercise?

As someone who does most of her singing lazily in the shower, singing as a form of

exercise is a strange concept, but it's true. Like any other activity that involves some kind of muscular control, it burns calories. It improves with training, and for those who do it properly, it certainly feels like a workout.

"It's not exactly the same feeling as going for a run or bike ride or something like that, but I often joke that the audience members at our choir concerts probably don't understand that for us, singing is a full-body process – it's a bit like running a marathon," IFLScience's resident choral singer, **Laura Simmons**, told me. "To sing properly with good technique, you have to engage your core muscles, and your leg muscles are engaged if you're standing as well, as it's important to maintain good posture. If you're holding music, then that's tiring on your arms too – a choral score for a big piece like Mendelssohn's *Elijah* can be pretty weighty, I can tell you!"

The good, the bad, and the wobbly
I asked the IFLScience crew "can you sing?"

last week, and – in true IFLScience fashion – the first five messages I got back were along the lines of "everyone *can* sing," and "I feel that the implication here is can you *well*" (scientists and their caveats, give me strength). It slowed down my polling process, in which 10 said they couldn't sing while three said that they could, but it raised an interesting point: what constitutes good singing?

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"THERE IS A SMALL PERCENTAGE OF THE POPULATION WHO ARE KNOWN AS CONGENITAL AMUSICS. IT'S ESTIMATED 1-4 PERCENT OF THE POPULATION HAS THIS SELECTIVE PITCH PERCEPTION DEFICIT."
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"One of the main ways that we look at defining singing performance is the ability to hit pitches correctly," said Hutchins. "To be able to sing the actual notes that you're intending to sing. That's probably the foundation of good singing ability."

"If you're not hitting the correct note, or somewhere reasonably close to it, nothing you sing is going to sound good. There are other factors that go into what we think of as high-level singing, things like timbre, inflection, and motion, but all of those come after being able to hit the right notes."

The happy news, as I would come to discover, is that this puts me in one of two camps that typically lead to poor singing performance, and it's one that is reversible. There is, however, another contributor that's much harder to overcome.

Pitch imperfect

For some people, the problem with singing



THE FUTURE OF
IFLSCIENCE

begins before they've even thought about taking a breath. It's connected to a rare condition that's written in their genes, and it means that whereas another person can differentiate subtle changes in pitch with ease, they might never hear it at all. The result is a kind of mistranslation of how the song should sound, so that person singing isn't even aiming for the right notes to begin with.

"There is a small percentage of the population who are known as congenital amusics," said Hutchins. "It's estimated somewhere between 1 and 4 percent of the population has this selective pitch perception deficit. They are unable to, for example, hear the difference between up to about a semitone. That obviously leads to a lot of singing deficits."

For these people, it's unlikely that training will improve their singing performance because it impacts their ability to perceive music. As Hutchins mentions, however, that's rarely the case. For me and my fellow dodgy karaoke singers, the problem far more often boils down to something else.

Standing in the way of control

"Around 35 to 65 percent of the population have that problem of getting their voice to do exactly what they want it to do," said Hutchins. "Most of the time, when you hear somebody who's not singing well, it's not a problem with their ears. It's a problem with how they're coordinating the muscles that control their voice."

"In most circumstances, any kind of singing practice or training will help, and that can be self-directed practice, like singing along with something in the car, in the shower. Or it can be singing with a professional vocal teacher. Any kind of practice is going to be good."

As with any skill in life, there are always going to be people who are naturally more gifted than others, and the specific tastes of the time will decide if people are more appreciative of Andrea Bocelli or Dave Grohl. Upbringing can also play a pivotal role, as singing ability can improve rapidly when we're attending music classes as kids only to drop off when we stop training as young adults. So, as for the big question...

How can I learn to sing?

At the end of the day, the entire discussion boils down to one important point: if you want to sing, just do it. Studies have shown that the arts can have **beneficial effects** on our wellbeing, even if we're rubbish, and oftentimes it's the very act of being made to feel not good enough that means people didn't develop the motor control needed to sing well in the first place.

"What happens to a number of people early on in their musical journey is that they will sometimes get feedback that they're not particularly good singers, which can happen to anybody who's just starting out in something, but many people will take that as a cue not to sing," said Hutchins. "It actually used to be a lot more common among music teachers 50 years ago or so. I hear from people who are a little bit older than I am that they were told not to sing during music classes and performances."

"As it turns out, that's the one way that you can make sure somebody doesn't become a good singer. For the vast majority of people, they're not going to have any issue in getting better, and sometimes that growth can be quite rapid if they really stick to it and enjoy it. If it's something that you like, and you want to be better at, just go ahead and do it."

And as for whether all those vocal workouts are worth it? Perhaps Simmons can sell you on that one.

"Singing, in my view, is one of the purest forms of self-expression we can access as humans," she said. "The feeling of creating music with your whole body is hard to describe, and for me it also reaches another level when I can perform in front of other people and you feel the reaction in the room and see the emotions you're evoking in the audience – it's unmatched!"

"There's literally no feeling like creating music with other people, in my opinion. It's a great social activity, and you build this real camaraderie with the other choir members, especially when you're performing live. It's great for mental wellbeing in my experience – it's definitely not something I'd want to live without."

If you'll excuse me, I'm off for a shower. ✨



WHAT IS EXTINCTION?

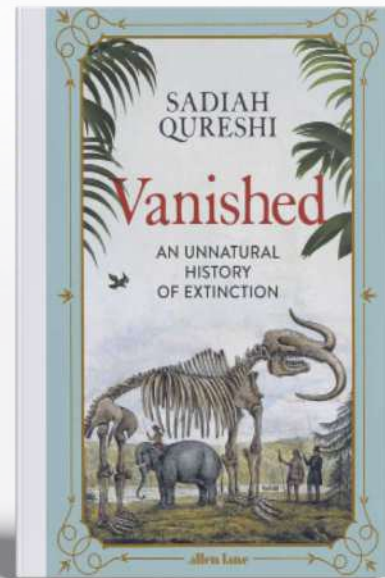
In this excerpt from *Vanished: An Unnatural History Of Extinction*, writer and historian Professor Sadiya Qureshi challenges dominant extinction narratives, bringing to the fore the histories, people, and politics that are often left out of the conversation.

We craft many narratives to make sense of, and wrest meaning from, extinction, yet far too many histories remain untold, forgotten, or erased. Epics in which heroic scientists discover lost species and formulate new theories about their extinction are the most obvious, and common, ways of tracing scientific debates about extinction. In these tales, heroes rooted in entrenched privilege, whether in terms of class, wealth, gender, or race, prevail against the odds to introduce new ideas and change how we view the world. Unfortunately, sweeping accounts of ideas about extinction often fail to recognize women and colonized peoples as producers of meaningful knowledge about the world. In these surveys, marginalized peoples are merely onlookers as history unfolds around them, even as it envelops and destroys

their world. This suggests a rather narrow understanding of extinction as a biological process discovered almost exclusively by male scientists, and the nature of history as tales of individualized heroic discovery. Alternatively, we might encounter tragedies in which we lose Edenic bliss and bounty through the sin of earthly over-exploitation that is not slowing even in the gaping maw of an apocalyptic future. Rarity and pre-emptive mourning can also prompt quixotic pilgrimages by intrepid explorers seeking to see the last of their kind. Some extinctions are rendered into exquisite miniatures of endings, or the last living member of their species, creating a canonical roll-call including Martha the Passenger Pigeon (1914) and Benjamin the Thylacine (1936). While captivating, this can lead to histories of climate change, conservation movements, and species loss privileging iconic animals or spectacular wildernesses. However, we need much richer accounts of how ideas of extinction developed, and not just as stories about species and sites we find enchanting, from pandas to national parks.

Vanished traces how naturalists reimagined extinction from acts of wanton human destruction into a scientific idea born of revolution, and the chilling choices facing us today. By exploring concepts of human and ecological loss together, the book provides a broad exploration of how we understand, and make meaning from, extinction. Instead of a sweeping epic, the book offers kaleidoscopic glimpses of how extinction has been imagined through examples of animals, peoples, and

plants over the past three centuries. Part One addresses the challenge of “Peopling Extinction”. We begin by tracing how 18th-century naturalists changed their minds about the nature of extinction. Once regarded as a theologically suspect idea, modern naturalists established the notion of extinction as a providential natural law that governed all life. We continue by exploring how ideas about animal extinction were extended to colonized peoples – from North America to Australia and ancient humans – during the 19th and early 20th centuries. Only by peopling histories of extinction can we fully appreciate how the political processes of colonization, conquest, and extermination were routinely conflated, and recast, as the natural extinction of “doomed races”. As such, there are deep-rooted associations between extinction, empire, genocide, dispossession, and conservation strategies such as the establishment of natural parks, or present-day campaigns for Indigenous land rights. Part Two explores the making of “Empire’s Endlings”. Between the later 19th century and mid-20th century, concerns about “dying races” were joined, and ultimately eclipsed, by concerns about vanishing species. When extinction was first accepted as a pervasive feature of life on Earth in the 19th century, naturalists tended to think about species loss as historical. When species were eradicated in the modern world, from Steller’s sea cow to the great auk, naturalists reimagined extinction as a process creating, and threatening, vanishing species. As such, *Vanished* argues that extinction isn’t just a natural process, but also a political choice. ✨





Q&A WITH SADIAH QURESHI

AUTHOR OF:
*VANISHED: AN
UNNATURAL HISTORY
OF EXTINCTION*

How can a better understanding of extinction inform better conservation practices?

I think national parks are one of the best examples of how histories of extinction can help us understand some of the troubling roots of modern conservation. National parks were founded in North America on the lands of Native people who were removed coercively. The national parks movement created a vision of unpeopled wilderness that was exported worldwide, and which gave rise to the assumption that protected areas were best protected as fortresses. Understanding how and why these policies are rooted in dispossession can help us make sure we don't further perpetuate such injustice.

Over 90 percent of species that ever existed are now extinct – but extinction is a surprisingly modern concept and it's not as natural as we might think. In her new book *Vanished*, writer and historian of science, race, and empire, Professor Sadiah Qureshi, reveals extinction as both a scientific and political phenomenon, shaped by evolution but also by empire and ideology.

Why did you want to write this book?

I originally wanted to write about how and why colonised peoples in the 19th century were said to be on the verge of becoming extinct. As I explored these histories, I felt as if I was missing a huge part of the story by not discussing the history of extinction more broadly. Once I started to bring together stories of animals, humans, and plants, I felt I was able to provide a much more interesting and compelling account of how and why extinction shaped the modern world.

What do you hope readers will take away from it?

Hope that we can change the world for the better, while knowing how to avoid perpetuating historical injustices as they seek a more worthwhile world for life itself. For me, this would mean acknowledging extinction is a political choice, and shifting from adopting policies rooted in panic or historical erasure to policies and practices rooted in historical awareness as well as a profound commitment to the lives we share Earth with.

**"WHEN THEY DIE, WE
DON'T JUST LOSE GENETIC
INFORMATION, BUT WAYS
OF BEING ALIVE."**

What do you mean by "lifeways"?

Extinction is often discussed as the loss of species. While I understand why, I think it doesn't quite capture how species are incredibly diverse ways of being in the world. When they die, we don't just lose genetic information, but ways of being *alive*. For me, lifeways captures that sense of the sheer variety of life in a way that the technical term species does not.

**"I THINK IT IS IMPERATIVE
THAT WE STOP SEEING THE
RIGHTS OF INDIGENOUS
PEOPLES AND WILDLIFE
AS A ZERO-SUM GAME."**

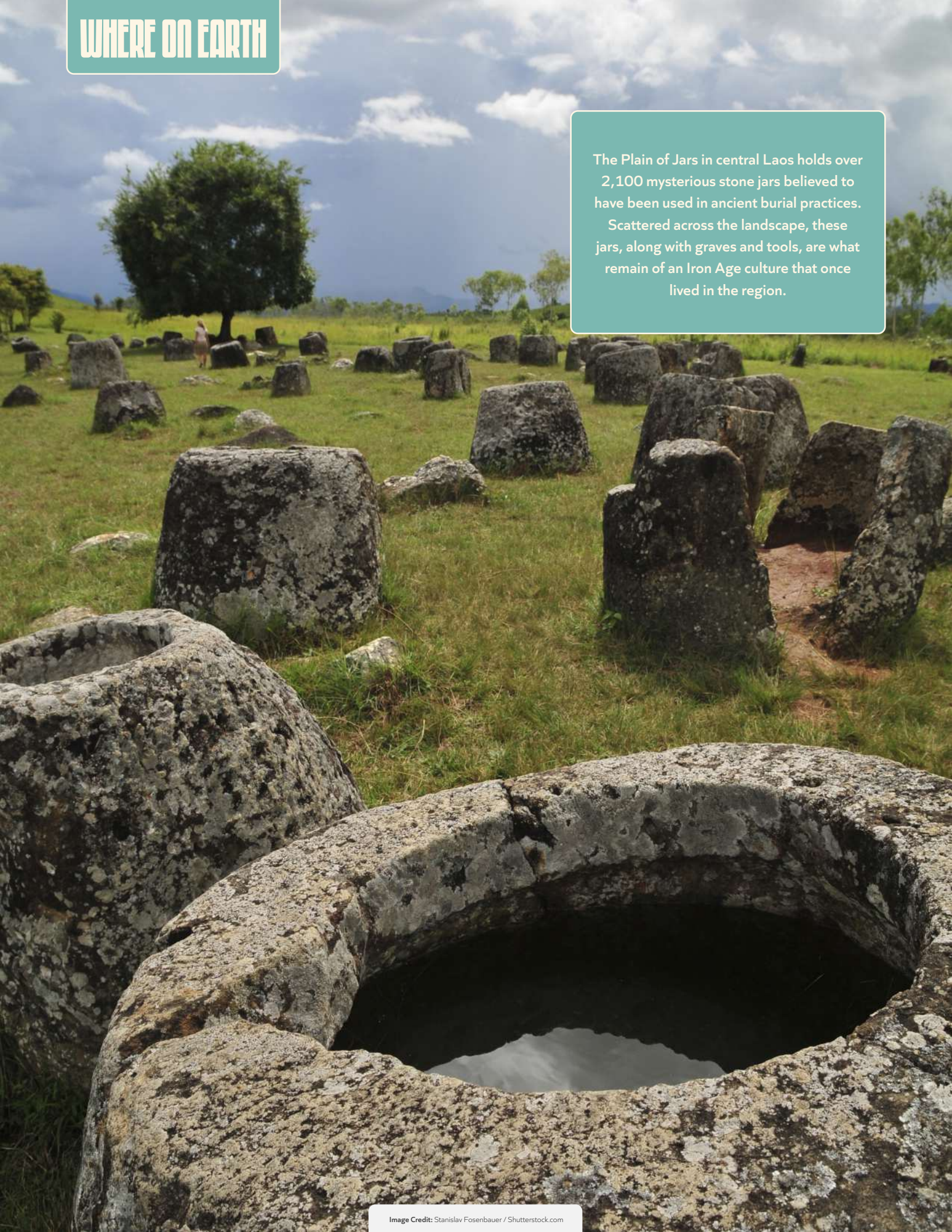
How do you hope conversations around extinction will change?

I think it is imperative that we stop seeing the rights of Indigenous peoples and wildlife as a zero-sum game and fortress-like unpeopled wilderness as the most desirable form of wildlife protection. These tendencies cause many issues by excluding Indigenous peoples from international conservation practices, when they are often the people who know the most about local biodiversity. I also think it is important that we don't reduce species to genetic information that can be stored and engineered to suit our purposes without paying attention to the lives of living animals, as with freezing genomes. 🌱

***Vanished: An Unnatural
History Of Extinction by
Sadiah Qureshi is published
by Allen Lane and out now.***

WHERE ON EARTH

The Plain of Jars in central Laos holds over 2,100 mysterious stone jars believed to have been used in ancient burial practices. Scattered across the landscape, these jars, along with graves and tools, are what remain of an Iron Age culture that once lived in the region.



PLAIN OF JARS



A megalithic wonder can be found in central Laos, where the Plain of Jars stretches out across thousands of square kilometers. "Jars" feels like an understatement when you hear how enormous these tubular-shaped stone structures are, sometimes as big as 3 meters (10 feet) tall and 1 meter (3 feet) across. That would, after all, be a frankly inappropriate volume of jam.

Over 2,100 jars have been found to date, dotted across the valleys and foothills of the Xiengkhouang Plateau (also known as Xiangkhoang). Divided into 129 confirmed sites, they cover an area of more than **10,000 square kilometers** (3,860 square miles). A site can hold anywhere from just one jar to over 400, so what were they for? And who made them?

Analysis of the jars has revealed that they're mostly made from sandstone, breccia, limestone, conglomerate, and granite. The raw material for the jars came from the local area and dates between 500 BCE to 500 CE. It's thought they were placed in Xiengkhouang province by an Iron Age civilization around 2,000 years ago, but there's still a lot we don't know about them.

The Plain of Jars Archaeological Research Project (PJARP) took up the reins in 2016 as the biggest archaeological investigation of the site since it was first surveyed and excavated in the 1930s. They released tens of papers on their findings across the project's five-year runtime, including the discovery of human remains and **evidence of ancient funerary practices**.

In 2016, it was announced that three different kinds of burials had been discovered across the Plain of Jars' sites. Teams surveying the area found evidence of bones placed in pits and a whole body in a grave, as well as human remains buried in ceramic vessels.

"From our excavations at Site 1, we have identified three types of mortuary ritual practice: secondary burial of human bone, secondary burial of human remains in buried ceramic jars and, for the first time, a primary burial of two individuals," Dr Louise Shewan told **IFLScience** in 2019.

One theory was that the jars were used as a kind of container to store corpses as they decomposed before they were later buried elsewhere – something that's known as secondary burial, but that will be hard to prove now that the jars have been exposed to the elements for millennia.

Want to learn more about the Plain of Jars? Well, you'll soon be able to get a good look at some of the PJARP team's most exciting findings in a local museum.

"All of the artefacts excavated by the PJARP team have been turned over to the Xiengkhouang Provincial Museum for safe-keeping," they say on their **website**. "Some of these are on display in the museum and more are expected to be added to display in 2025 as part of further Australian Research Council funding." 🌟

LISTEN

A YEAR OF TROPICAL BIRDSONG

Book by Dominic Couzens
and Madeleine Floyd

Did you know that being around birds is linked to lasting mental health benefits? Celebrate the benefits of birds with this deep dive into the most beautiful and complex calls out there. The book includes QR codes, so you can listen as you learn. – **Available now.**

READ

DESTROYER OF WORLDS

Book by Frank Close

How did we get from a smudge on a glass plate to the **H bomb**? Discover how the search for nuclear power was overwhelmed by politics in the 1930s, spawning the devastation of the atom bomb – and perhaps even worse yet to come. – **Available now.**

WATCH

JAWS @ 50

Documentary from National Geographic

Yes, **JAWS** is half a century old, and this documentary charts the extraordinary journey from Peter Benchley's bestselling novel to one of the most iconic films ever made. Expect rare archival footage and behind-the-scenes chaos, plus **interviews** with shark scientists and filmmakers as they explore the film's past and the future of shark conservation. – **Available July 10.**

EXPLORE

FUTURE OF FOOD

Exhibition from the Science Museum, London

This illuminating new free exhibition explores how science is creating more sustainable ways of producing food with over 100 objects, from Mendel's microscope to McNuggets, cricket burgers to cell-grown salmon, and 3,500-year-old bread to the first Quorn burger. – **Opens July 24.**

CELEBRATE

UNDERDOGS

Series from National Geographic

Get ready for what might be the first-ever wildlife documentary to require an age rating because Ryan Reynolds is getting into nature. Yes, that **Ryan Reynolds** of Hollywood and *checks notes* Wrexham Football Club fame. See the biggest weirdos of the animal kingdom finally get the limelight as he dives into the freaky ways animals get things done. – **Available now.**



LISTEN

WE HAVE QUESTIONS

Podcast from IFLScience

Are yawns contagious? Why does snow sometimes look blue? And why don't animals have to brush their teeth? Join Rachael Funnell over on the *We Have Questions* podcast as she dives into these curious questions and many more, including some of life's least explored mysteries. Andrew Gallup, Teaching Professor of Behavioral Biology at Johns Hopkins, explains what we know about catching a yawn, and how to stop one in its tracks. Dr Andrew Schwartz at the UC Berkeley Central Sierra Snow Lab in California dives into cool snow facts, and dental surgeon Peter Kertesz reveals why working in animal mouths isn't always so easy. – **Yawning launches on July 21. Check out available episodes.**

WATCH

GENGHIS KHAN: THE SECRET HISTORY OF THE MONGOLS

Series from Disney+ and Hulu

A fearless warrior and ruthless conqueror, Genghis Khan's epic rise and the Mongolian Empire's incredible expansion are brought to life in this six-part series. Drawing on a new translation of *The Secret History of the Mongols*, the series reveals stunning insights into the life and many battles of the legendary ruler. – **Available on Disney+ and Hulu.**



10 FULL BUCK MOON

3, 17, AND 31 NEW *THE BIG QUESTIONS* PODCAST EPISODES!

You get three helpings of *TBQs* this month, and we're asking, are we living through a sixth mass extinction, how do black holes shape the universe, and what might English sound like in 100 years?



30 ALPHA CAPRICORNIDS AND DELTA AQUARIIDS PEAK

Not one but two mighty meteor showers will reach their peak on July 30. The Alpha Capricornids should put on a display of slow, yellow fireballs, while the Delta Aquariids are set to dazzle with a steady stream of space rocks. Get your binoculars at the ready.

30 INTERNATIONAL DAY OF FRIENDSHIP



27 CURIOUS ISSUE 37!

August's issue of your favorite e-magazine will be coming to an inbox near you on July 27!

14 SHARK AWARENESS DAY

Sharks get a bad rap, but they are key players in the marine ecosystem and are vitally important to ocean health. To combat the fear, stigma, and misinformation that mars them, Shark Awareness Day is marked on July 14.

20 SPACE EXPLORATION DAY

Celebrate the anniversary of the first successful Moon landing in 1969.



2025

JULY

Celebrate the joys of chess, space, and friendship, and enjoy a new episode of *We Have Questions* while watching some meteors streak across the sky – what more could you want from July?

22 WORLD BRAIN DAY

World Brain Day is a global campaign devoted to promoting better brain health for all. This year, the campaign will be dedicated to improving brain health and wellbeing at any age.



21-27 CORAL REEF AWARENESS WEEK



20 WORLD CHESS DAY

21 NEW *WE HAVE QUESTIONS* PODCAST EPISODE!

Why are yawns contagious? Find out the answer in the latest episode of *We Have Questions*, as host Rachael Funnell puts the question to Professor of Behavioral Biology Dr Andrew Gallup. It's not to be missed.

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 time when bread turned deadly. If you like your science lighter, discover how our feline friends might recognize us based on our smell.



EXPLORE YOUR SIDE ON FACEBOOK

DEADLY BREAD

Bread might be a staple of the French diet, but what happens when the humble loaf turns against you? Convulsions, hallucinations, and even death, as one town in southern France found out back in 1951.

Residents of Pont-Saint-Esprit first began to fall ill on August 16. At first, their symptoms were more generalized – they simply felt a bit low and under the weather. However, within hours, those affected began to experience widespread abdominal pain, accompanied by nausea and in some cases, vomiting and diarrhea. Many had bouts of intense sweating. If it ended there, most people would likely assume they'd caught a nasty stomach bug, or maybe had food poisoning.

But the symptoms didn't stop with digestive issues. After the initial signs of illness, people experienced several days of insomnia, alongside worsening abdominal pain and what was described as a burning sensation throughout the digestive tract.

That sounds gnarly enough not to want to experience it, but for the majority of patients, their illness

luckily didn't progress any further. For the minority, however, things would get a lot worse.

In the most severe cases seen, patients appeared to be recovering – but within 48 hours, were hit with problems ranging from severe fainting attacks through to tremors, delirium, and hallucinations. Some people had terrifying visions of animals, while others attempted to throw themselves into the river and out of windows. Four people died.

The cause? It's still debated, but many people both now and at the time believe the incident was the result of ingesting *Claviceps purpurea*. This is an ergot fungus that infects rye and other cereal plants and produces toxic substances, leading to a condition called ergotism when ingested in high enough doses. Infected grains had been harvested and milled, and the flour used to make what turned out to be deadly bread.

Some people believe something similar happened back in 1692 in Salem, with contaminated rye responsible for the spate of mass hallucinations and seizures that led to the now infamous **accusations of witchcraft**.

The good news? Ergotism is rare nowadays, thanks to improved screening of grains – so you can continue chomping on your nice, freshly-baked baguette worry-free.

SMELLY CAT

Cats can often be seen giving things a big ol' sniff, and there's a good reason why. Not only is their sense of smell super powerful – cats have a whopping 200 million scent receptors compared to humans' puny 5 million – but it's also key to how they identify one another.

What's long gone unanswered, though, is whether or not they can identify particular humans, such as their owners, based on smell alone. Now, we've finally taken a step towards an answer.

It comes courtesy of a **study** from researchers at the Tokyo University of Agriculture, who recruited 30 domesticated cats (through their owners – cats with access to email would have global consequences, I fear) and 25 humans, 17 of whom were owners of the cats involved and eight of whom had no prior contact with the test cats or their owners, or kept any animals themselves.

The role of the humans was to provide odor samples, with swabs taken from behind their ears, armpits, and in between their toes. Not just for the sake of whoever had to take the swabs, but to also minimize variation, the human participants were also asked to try and minimize the chance of particularly pungent smells on the day previous to and

day of collection – that meant taking it easy on the garlic, not working a sweat up at the gym, and avoiding perfumes.

Then, the cats were presented with three tubes at the same time: an odor sample from their owner, an odor sample from a stranger, and a blank control consisting of a clean cotton swab.

Having recorded the responses of the cats, the researchers found that they spent a “substantially longer time” sniffing the tubes containing the odor of a stranger compared to that of their owner or the control. This, the team concludes, indicates “the use of their sense of smell to distinguish between heterospecific (human) individuals.”

This doesn't necessarily mean, however, that cats can identify their owners solely by their stink. For one, the owners themselves presented the tubes to the cats – this visual stimulus could've helped too.

The authors also recorded “characteristic rubbing (marking) behavior occurring after sniffing”, which they suggest indicates “that sniffing may be an exploratory behavior preceding the rubbing of odor (marking) in cats.”

“This relationship warrants further investigation,” they conclude, “along with the theory of whether cats are able to recognize a specific person from olfactory cues.”



The Darker Side of Science



THE LIGHTER SIDE OF SCIENCE