

CURIOS



THE SCIENCE OF
DECODING DREAMS

WHY DO ANIMALS HAVE
DIFFERENT PUPIL SHAPES?

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NEWS BITES




A Chance For Climate Change

The United Nations Conference of the Parties, better known as **COP28**, takes place from November 30 to December 12 – and after last year's wash-out, real change must be agreed upon this year. The most well-known global climate conference, it hasn't made a meaningful impact since 2015's COP21, when the historic Paris Agreement was signed by most of the world's countries to limit the global temperature increase this century to 2°C (3.6°F), while really aiming for 1.5°C (2.7°F). Since then, not only are we globally failing to curb that limit, but governments are universally failing to put in place regulations and practices that will reduce emissions, prevent loss of biodiversity and habitat in the natural world, or meaningfully tackle climate change. After a year where **temperature records** have been smashed and climate-related natural disasters – fires, earthquakes, floods, heatwaves – have dominated the headlines, perhaps this November, the world's decision-makers will get serious.



Wildlife Photographer Of The Year

The winners of the Wildlife Photographer Of The Year competition have been announced and, as ever, they are jaw-dropping to look at. This year's competition saw over 38,000 entries from over 90 countries, and though there are multiple prizes across a range of categories, there can only be one winner. This year's top prize was scooped by Laurent Ballesta for their amazing shot capturing a golden horseshoe crab off Pangatalan Island in the Philippines. This year's winning images will be on display at the Natural History Museum, London from now until Sunday June 30, 2024, so if you find yourself in the city, the exhibition is always a treat. Otherwise, you can check out the winners online [here](#).



Planet Earth III

The third outing for this outstanding wildlife series documenting life on our planet hits screens this autumn. This series is set to not only celebrate the **wild and wonderful creatures** that call this planet home, but – as it and its presenter David Attenborough have been increasingly wont to do – highlight the challenges and crises they face. From skydiving frogs in the Costa Rican jungle to rhinos wandering the busy streets of a Nepalese town, the eight hour-long episodes, with soaring scores by Hans Zimmer, offer a glimpse into the lives of the extraordinary animals we share Earth with and remind us not to take them for granted.

Nessie At 90

Believe it or not, November 12 marks 90 years since the first-ever supposed photograph of Scotland's (and possibly the world's) most famous cryptid, Nessie, sparking a monster craze that endures to this day. On Nov 12, 1933, Hugh Gray took what he believed to be the first footage of the mysterious creature said to live in Loch Ness and sent it to his local paper, fueling a frenzy of interest around the world. This year, on the 90th anniversary, the largest Nessie hunt in over half a decade set out to conduct a surface watch of the loch over two days. **"Noises" were recorded**, but alas, no sightings or new footage came to light. Unlike Nessie, waiting underneath the loch for all the gathered amateur sleuths to leave, we wouldn't hold our breath.



Godzilla Is Back

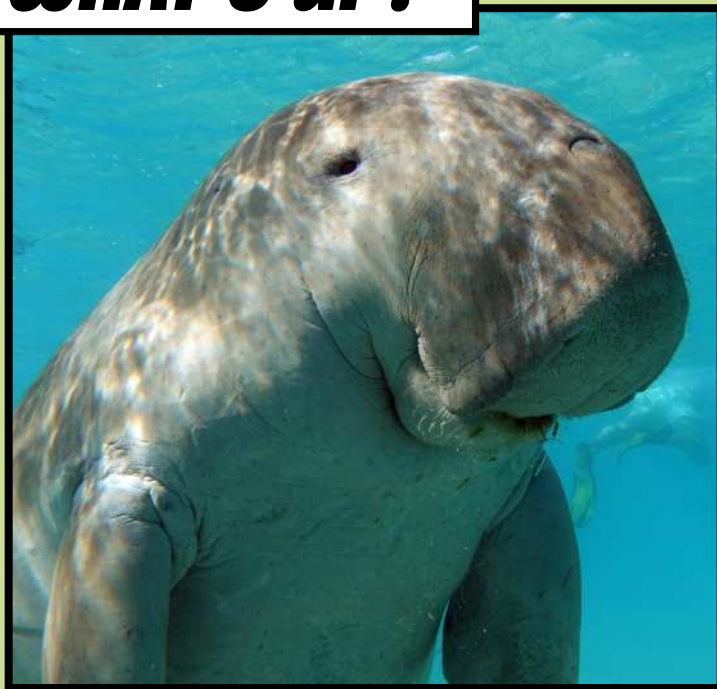
It's unclear if Godzilla is friend or foe, and yet the radioactive monster is always endearing. This month he will be stomping across our screens in two new formats. First, in Apple TV+'s big budget TV show *Monarch: Legacy of Monsters* starring Kurt Russell and hopefully a whole bunch of kaiju. The story follows two timelines in the 1950s and present day as two siblings try to uncover their father's connection to secret organization Monarch and fall down the proverbial monster rabbit hole. Second is Japanese monster movie epic, *Godzilla Minus One*. Set in post-war Japan, Godzilla is once more imagined as a manifestation of the nuclear terror that shook Japan at the end of WWII, making it closer to the original 1954 film than any other version yet.



OSIRIS-REx Forever

To commemorate the historic **first-ever US asteroid sample return mission**, the US Postal Service has issued new forever stamps featuring the parachute and capsule from NASA's OSIRIS-REx mission. On September 24, OSIRIS-REx dropped off its precious cargo of pieces of asteroid Bennu in the Utah desert after a seven-year mission to scoop up rocks and dust from its surface and take them to Earth. Studying Bennu could offer a window into the early Solar System and could help us understand how our planet came to be.

WHAT'S UP?



Manatee Awareness Month

Bring out the best in hu-manatee

Name: Manatee Awareness Month

Appearance: Like a walrus, but with no tusks, a rounder tail, and chiller vibes

Location: Florida, USA and beyond

What exactly is it?

A mixture of celebration and seriousness – a month-long opportunity to share fun facts about manatees aka “sea cows”, but also raise awareness about their conservation.

Why do they need a whole month?

Their wholesomely chunky appearance and docile nature should be convincing enough on their own, but it's also useful to know that things aren't looking so great for manatees at the moment. Listed as an endangered species on the IUCN Red List, poor water quality and massive loss of seagrass (their main food source) along the

coast of Florida have led to a drastic increase in Florida manatee deaths in the last few years.

Humans can be problematic too – boat collisions, plastic pollution, and fertilizer-triggered algal blooms all pose a threat to these marine mammals. This month aims to bring these issues to people's attention and hopefully, give rise to change for all species of manatee.

How can I participate?

According to **Save The Manatee** – founded by former Florida Governor Bob Graham and musician Jimmy Buffett – there are lots of things you can do. They recommend spreading awareness by contacting local representatives and posting on social media. People can also take part in conservation fundraising events and, if you live close enough, help out with habitat restoration projects.



DOES IQ MATTER?

The importance of IQ, and what it's even measuring, is often widely misunderstood. Is it time to hang up the test or is there still validity in its results? Tom Hale investigates.

In the public imagination, IQ is often considered the gold standard for measuring intelligence – a cast-iron, bullet-proof measure of a person's brain power. However, not everyone is wholly convinced of the promise it offers. Some argue it runs the risk of being reductive and is incapable of accounting for the rich diversity of human minds. Conversations around IQ can also be prone to emit the stench of **pseudoscientific** BS. At its very worst, IQ scores can be – and have been – weaponized by racist ideologies to spread hate and discrimination. So, do IQ scores have any merit at all?

What even is an IQ score?

IQ tests changed the world, but they have humble beginnings. Their origins can be loosely tied back to 1905 when psychologists Alfred Binet and Théodore Simon designed a test to see which school kids in France needed extra assistance in their studies.

Children were assessed on their performance of three key skills – verbal reasoning, working memory, and visual-spatial skills – in comparison to others of their age, upon which their abilities were boiled down to a number.

This became the basis of modern intelligence tests, although it wasn't until 1912 that the term IQ – which stands for intelligence quotient – was coined by William Stern, a German psychologist and philosopher.

Modern IQ tests still work on a similar principle to the exams given to French children almost 120 years ago. People are assessed on a certain set of cognitive skills – verbal reasoning, working memory, and visual-spatial skills – and their performance is compared to a representative sample of the population.

The average IQ score is set at 100, meaning about half of people tested score above 100, while half score below 100. There is also a standard deviation of 15 points,

making around two-thirds of all test-takers obtain scores from 85 to 115. Classifications vary, but anything above 120 is generally considered “very high” or “superior”, while under 80 is called “very low” or “borderline impaired”.

What can we actually learn from IQ scores?

Countless studies have attempted to link IQ scores to all manner of things. One relationship that's commonly found is that people with higher IQ scores tend to have more success in the professional realm. **Some studies** have suggested that people with higher IQs tend to perform better academically, have more successful careers, and are more likely to enjoy economic comfort.

However, this link has failed to be unearthed in other research. **Another study** found that, regardless of differences in apparent intelligence, people who had better rational-thinking skills tended to experience significantly fewer negative life events, like suffering from serious credit card debt, having an unplanned pregnancy, or being suspended from school.

Likewise, many manifestations of raw brain power might not be accounted for in standardized intelligence tests, such as creativity, emotional intelligence, or hands-on technical skills.

Just a couple of years ago, scientists at University College London **identified** a general decision-making ability in young people that was particularly strong for those with sturdy social relationships among their peers. Interestingly, however, there was no relationship between the participants' IQ and this apparent display of social intelligence.

This raises the question: can a person's intelligence ever be reduced to a single number?

It's a pleasingly simple idea, but one that can lend itself to unscientific claims. On its most superficial level, the enticing promise of a tell-all intelligence score can attract pseudoscience like wasps to a picnic.

CERTAIN FORMER PRESIDENTS OF THE US HAVE REPEATEDLY DOWNPLAYED THEIR RIVALS' IQ WHILE BOASTING THEIR OWN WITHOUT PROVIDING ANY EVIDENTIAL SUBSTANCE FOR THEIR CLAIMS.

For instance, Leonardo da Vinci is credited with having a remarkable IQ score somewhere between 180 to 220. Although there's little doubt this archetypal “Renaissance Man” possessed a truly incredible mind, it's unclear how anyone would reach a solid conclusion about his IQ without making him sit down and take a test.

IQ scores have also been used as a weapon in empty rhetoric. Certain former Presidents of the US have repeatedly downplayed their rivals' IQ while boasting their own without providing any evidential substance for their claims.

The murky backstory of IQ

One of the first instances in which IQ-like tests were widely employed was during the US military selection of World War I. To dictate which recruits were to be assigned to which tasks, they were given an intelligence test devised by Robert Yerkes, a psychologist who later became a major figure in the eugenics movement.

Some 1.7 million men were tested, providing researchers with a vast bank of data detailing intelligence and demographics. To some scholars who pored over the results, it seemed to prove several truths: intelligence is genetic, innate, and can be accurately reduced to a single number.

Owing to the rampant bigotry (the US was still 50 years away from eradicating Jim Crow laws) and nationalism of the time, the findings quickly became tangled in many ugly debates about race. The results were hijacked by eugenicists to make misleading claims that certain racial groups, namely Black people, were fundamentally less intelligent. They failed to take into account the wealth of environmental factors

that might explain any differences within a population, let alone the fact that many of the tested recruits were first-generation immigrants who didn't speak English as a first language.

Race and IQ became falsely linked, used to fuel eugenics policy that sought to improve the genetic stock of the US. Yerkes himself, the inventor of the so-called Army Alpha Test, once stated: "No one of us as a citizen can afford to ignore the menace of race deterioration."

This idea proved hard to kill. It bubbled under the surface of American society throughout the 20th century, erupting amidst a widespread scandal in 1994 with the publication of the book *The Bell Curve: Intelligence and Class Structure in American Life* by psychologist Richard J. Herrnstein and political scientist Charles Murray.

AS PER THEIR HYPOTHESIS, YOUR FINANCIAL INCOME, JOB PERFORMANCE, AND CHANCES OF CRIMINALITY COULD ALL BE PREDICTED BY YOUR IQ.

The basic premise of the book was that IQ had a massive influence on the personal outcomes of people's lives, even more so than their socioeconomic status. As per their hypothesis, your financial income, job performance, and chances of criminality could all be predicted by your IQ.

Academics and journalists alike viciously tore into the book's findings, claiming its arguments were poorly reasoned, riddled with mistakes, and reeked of social Darwinism.

Nature versus nurture

Many have since pushed back against the dangerous suggestion that genetics and race

can be used as reliable predictors of intellectual ability, pointing out that many analyses fail to account for environmental factors.

Instead of race alone – which itself is a vague, socially constructed concept – it's far more accurate to understand it through the lens of social deprivation and poverty. Racial minorities often belong to marginalized communities that have poorer access to healthcare and education, plus a high risk of discrimination and violence. When these environmental factors are properly accounted for or removed, significant differences in IQ drift away.

It's not hard to find real-world evidence to back up this argument. In 1984, researcher James Flynn made a groundbreaking observation: IQ scores rapidly rose between the 1930s and the tail end of the 20th century. Each decade saw IQ point differences ranging from three to five, equating to a mean increase of 13.8 IQ points over just 46 years.

This leap is far too rapid to be explained in terms of evolution, but it does align with wider social and environmental trends like improved nutrition, declines in infectious disease, better education, and improved living standards.

You can also see this pattern in developing countries today where researchers **have found** that IQ points rapidly increase as nations become richer and provide more welfare for people.

As history shows, IQ scores and generalized intelligence tests can end up in the wrong hands and be used to reinforce prejudice – something that is in danger of coming back around in our increasingly polarized world. Dig a little deeper though and you see these ideas hold a much more promising, less fatalistic lesson for the world. Quite simply, better lives create better brains. If we spend our energies on enriching the lives of the many, rather than sowing division, the collective intelligence of humanity has the potential to bloom and benefit us all. •





Image Credit: © Renee Capozzola

PAPER NAUTILUS RIDING A JELLYFISH

A female paper nautilus hitchhikes a ride on a jellyfish late one night in Anilao, Philippines. The hitchhiker is carrying precious cargo, an egg case that can house up to 170,000 eggs, which she'll tote around until they hatch. The egg sac itself can act as a flotation device, but a jellyfish is the perfect ride because its stinging cells protect the nautilus and her many offspring from predation. This photo was taken by Renee Capozzola, who scooped the Ocean Portfolio Award in Oceanographic magazine's Ocean Photographer Of The Year, 2023.



Image Credit: Chad Wright Photography / Shutterstock.com

WHY DO ANIMALS HAVE DIFFERENT PUPIL SHAPES?

AND WHAT MAKES THE MONGOOSE'S SO BIZARRE?

By Rachael Funnell

Were you to stare into the eyes of a tiger, you might clock that it has round pupils – just like ours – moments before it severed your carotid. It could be assumed it's a predatory adaptation, then, but look into the peepers of domestic cats and you'll see they have vertical slits. What's up with that?

We interviewed principal investigator Marty Banks of the **Banks Lab**, UC Berkeley's visual space perception laboratory, to find out more about how and why pupil shape varies among terrestrial animals. It turns out there are some general rules, but the mongoose has no time for them.

How do pupils vary among animals?

MB: We looked at **terrestrial animals**, and there are three prominent shapes. One is circular, another is a vertically elongated slit, and finally, the horizontally elongated pupil.

Are they associated with certain lifestyles?

MB: Absolutely. The horizontal pupil – with only one exception we could find – is associated with prey animals. It was very clear that these animals tend to almost always have eyes on the side of their head instead of frontal eyes like we do.

How does that influence how they see the world?

MB: The fact that their eyes are on the side of their head allows them to see almost 360 degrees around them. Something we can't do, obviously. The elongated pupil benefits that panoramic vision by letting in more light, so the left eye can see behind the animal on the left, and the longer pupil allows more light to get into that direction so they can see better.

TALLER ANIMALS IN THE PREDATOR FAMILY TEND TO HAVE CIRCULAR PUPILS. AND SHORTER ANIMALS TEND TO HAVE VERTICALLY SLIT PUPILS.

Interestingly, the fact that the pupil is narrow vertically, has the effect of sharpening horizontal contours the animal might see. And they might well need that for placing their feet on the ground as they try to run away from a predator.

What about the vertical slit?

MB: Many of those animals have frontal eyes, not eyes on the side of the head, and they are very likely to be predators – quite likely ambush predators. These are predators that don't run down their prey but rather wait and hide and then pounce when the prey comes close to them. The domestic cat is an example of that.

We also found a correlation between the animal's height and whether they had a vertical slit pupil or not. Taller animals in the predator family tend to have

circular pupils, like the lion and the tiger. And shorter animals like the domestic cat tend to have vertically slit pupils. We did a complicated analysis to show that actually makes sense.

We think these animals use blur as a cue to distance, helping them to judge the distance of the prey that they're going to pounce on. That cue is more useful if the eye is close to the ground, and less useful if the eyes are above the ground and the animal is larger.

How does that work?

MB: Any photographer knows this, if they want to take a picture with a sharp image at one distance and a blurry background, or a blurred foreground, they open the aperture of their camera. That provides a very useful cue that the blurry things are farther away than the sharp things in the foreground.

Photographers do that with a circular aperture, these animals appear to do it through a vertical swing aperture. So, their vertically extended pupil is large, which creates a nice blur signal. The horizontal extend to the pupil is small, and our argument is that that's useful for another depth cue called stereo offsets.

THERE'S ONE VERY CLEAR EXCEPTION FOR WHICH WE HAVE NO EXPLANATION: THE MONGOOSE.

Are there animals that don't fit the mold?

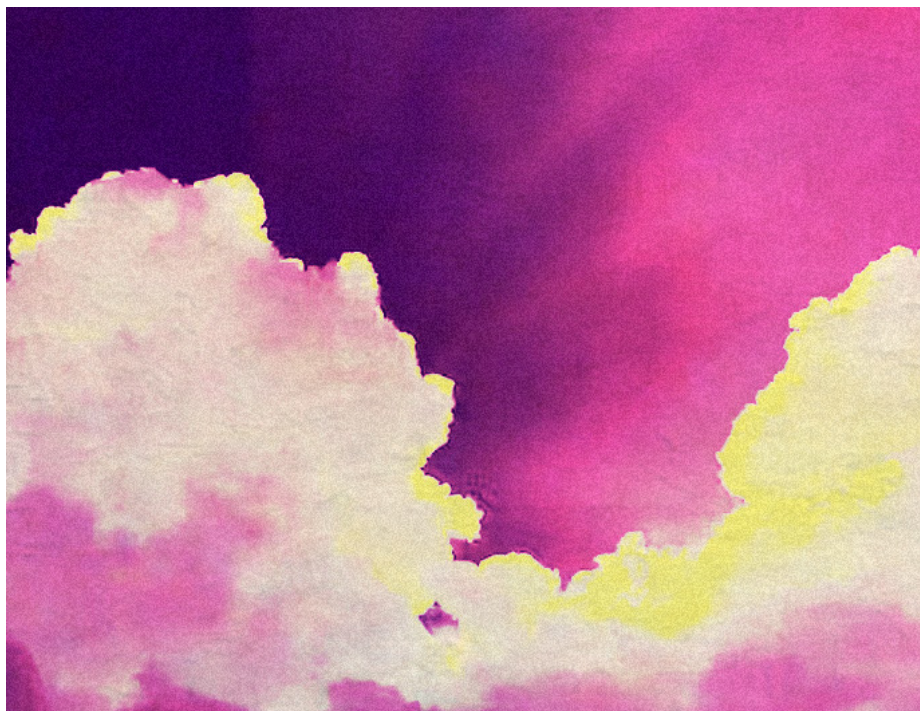
MB: There's one very clear exception for which we have no explanation: the mongoose. It's a small carnivorous mammal that has eyes on the front of its head. So, you'd expect them to have either a vertical slit pupil or a round pupil, but they have horizontal pupils. That animal does not fit our account at all. ●



SCIENCE FACT OR FICTION:

THE SCIENCE OF DECODING DREAMS

Do our dreams really mean anything?
And if so, what can they teach us?
Maddy Chapman investigates.



Dreaming is an almost ubiquitous human experience. When we drift off each night, imagery fills our sleeping minds – sometimes it's vivid and realistic, other times nonsensical or nightmarish. Some dreams are consigned to memory, to be shared, laughed at, or perhaps even Googled, while others are quickly forgotten. Despite their universality, there are still many unanswered questions surrounding dreams. Maybe the most pressing of these, for anyone who's had a particularly intriguing one, is: "What does it mean?"

These days, we know a fair bit about what is happening in our brains as we sleep – we even have some insight into what dreaming might look like in **other species** – but as for why we dream and what those dreams could mean, there remains a lot of mystery.

In light of this, we decided to dive into the science of decoding dreams and ask: Is there really any merit in it?

If you've ever dreamt about snakes or your teeth falling out (as, **apparently**, lots of you have) and wondered what, if anything, it might be able to tell you about the inner workings of your brain, this one's for you.

What are dreams?

"Dreams are sensory experiences we have while asleep," **David Billington**, a psychotherapist and Director of the Dream Research Institute, told IFLScience. "They can range from feeling impressions or subtle colours to complex narratives to the consciously-willed lucid dream experiences, in which you are aware that you are dreaming even though you are physiologically asleep."

Anything is possible in dreams, **Joseph De Koninck**, Emeritus Professor of Psychology at the University of Ottawa, who has been studying dreams for 50 years, added, which has led him to deem them "open season for the mind".

We're still learning what happens in our brains while we dream, but we do have some idea, Billington explained.

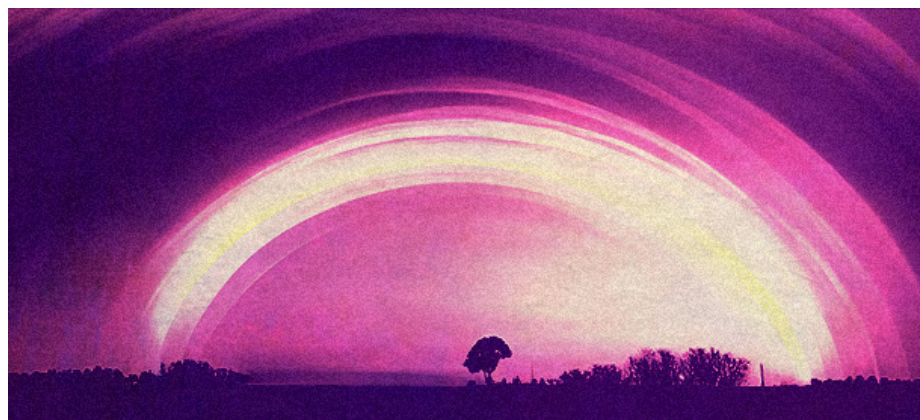
"We can see that there is almost as much activity in the brain during dreaming as during wakefulness, though of somewhat different types. The visual, memory, and motor areas of the brain are active (though sleep hormones block most people from acting out their dreams), but the logic areas of the cortex are less active, which might be one reason for the bizarreness of many dreams."

Dreaming can happen at any time while we're snoozing, but our most vivid dreams happen in a stage of sleep known as rapid eye movement (REM), during which – surprise surprise – our eyes move about rapidly.

It's thought we spend around **two hours** dreaming each night, although quite why we do is debated.

"There is so far no scientific demonstration that [dreams] serve a biological function," De Koninck told IFLScience.

It has been suggested that dreaming may help us to process emotions and memories, and aid us in solving problems in our waking lives. Other theories, posit that dreams may benefit our **perception of reality**, or, à la psychologist Sigmund Freud, that they serve to **protect sleep** from disruption or represent the fulfillment of unrealized wishes. Francis Crick, who dabbled in dream theory after his work identifying the structure of DNA, came up with an **explanation** deemed "reverse learning"



in which “we dream in order to forget.”

Even with these numerous theories, some of which hold more water than others, the question of why we dream still doesn't have a definite answer.

Do they really have meaning?

If you thought the question of why we dream was convoluted, the question of what they may mean is even more so, complicated further by the fact that it largely depends on who you ask.

OUR OLD FRIEND FREUD WOULD SAY – PERHAPS UNSURPRISINGLY GIVEN THAT THIS IS FREUD – THAT THEY REPRESENT REPRESSED, OFTEN SEXUAL, DESIRES.

If you happened to have the ability to **time travel** and asked the ancient Greeks

or Romans, they'd probably tell you that yes, dreams have meaning, and that they acted as **omens** or predictions of future events.

Our old friend Freud, as we touched on above, would say – perhaps unsurprisingly given that this is Freud – that they represent repressed, often sexual, desires.

Carl Jung, who founded the field of analytical psychology, meanwhile, might **remark** that “dreams are messages sent up from the unconscious” and as such can help us understand our inner psyche.

But what do modern psychologists and psychotherapists have to say on the subject? Do dreams really have meaning?

“Meaning” is a slippery term in the context of medicine,” Billington told us. There is no scientific consensus on what specific dreams mean, but that doesn't mean they're not useful.

“One can also say in a very broad sense that dreaming of specific things means that those things are related to your waking preoccupations – be that consciously, semi-consciously, or unconsciously,” Billington added.

“But what a specific dream experience or image means to a specific person is highly subjective, just as what we make of waking experiences is highly subjective: a moment of conflict with a stranger might be highly disruptive for a librarian, but is just part of every day for a nightclub doorman.”

De Koninck agrees: “Dreaming of a train will not always mean death but will have different meaning depending [on] if you travel often by train, or if you are a train driver, or if you are afraid of taking trains, or if you have never been on one.”

“In other words, the meaning depends on the waking experience of the dreamer [and] what the dream content resonates with you.”



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Dreams can be a very useful source of self-knowledge, De Koninck believes, and can be used in various ways in psychotherapy.

"They have meaning in the sense that [...] it's your brain, with your memory bank, and your emotions that are expressed, it's just that they're expressed in a different way."

What can we learn from our dreams?

We might not be able to glean that dreaming about spiders universally means a fear of the unknown, as a quick Google might have you believe, but there's still a lot that we, and particularly professional psychotherapists, could learn from them.

"Our dreams are part of our overall consciousness, but they happen in the absence of external stimulation, so they are in some ways a clearer picture of our 'inner' psychological selves," Billington said.

As mentioned, dreams often reflect our waking lives, though they are not a replication of waking, just contiguous with it. They could therefore reveal things our minds have been ruminating on, with or without our knowledge.

"[Dreams tend] to reflect your current concerns and amplify them. And that's where, in psychotherapy, it's interesting," De Koninck said.

This is in keeping with the Continuity Theory of Dreaming, Billington explained. "Related theories are the Threat Simulation Theory and the Social Threat Simulation theory, which posit an evolutionary use for dreams: that they let us rehearse responses to threatening situations (be they physical or social) without actually putting ourselves at risk."

In this sense, they could help us to adapt. "There could be a survival advantage to being able to 'try out' responses to situations before they happen," Billington continued.

Dreams, or more specifically **nightmares**, can also be linked to trauma faced in our waking lives and "may be symptoms of broader disorders," said Billington.

"Repeated dream recollections of frightening, damaging, or harmful memories, leading to disrupted sleep and physiological symptoms of stress (elevated heart rate, elevated levels of cortisol) are a sign of unresolved trauma." Occasional or idiopathic nightmares can be normal, Billington added, but when "frequent and disruptive might be signs of other non-trauma psychological disruption, including Nightmare Disorder."

Persistent nightmares could be indicative of other conditions, such as PTSD or schizophrenia, according to De Koninck. They could also be a risk factor for suicide. "When someone has a lot of nightmares it has some meaning for us. Meaning towards saying: 'Oh, you got to pay attention, there's something wrong there.'"

It's also possible that suppressed thoughts and feelings, which we may not be aware of, could come back to us in our dreams. "It can therefore be useful to spend a little time reflecting on what comes up in our dreams," Billington recommended, be that individually, with someone close to you, or, ideally, with a therapist.

"Is that dream of a colleague turning into a werewolf perhaps a dramatization of a side of them we are only peripherally aware of? Their volatile, changeable, aggressive side, perhaps? Or was it just that you watched *An American Werewolf in London* last weekend?"

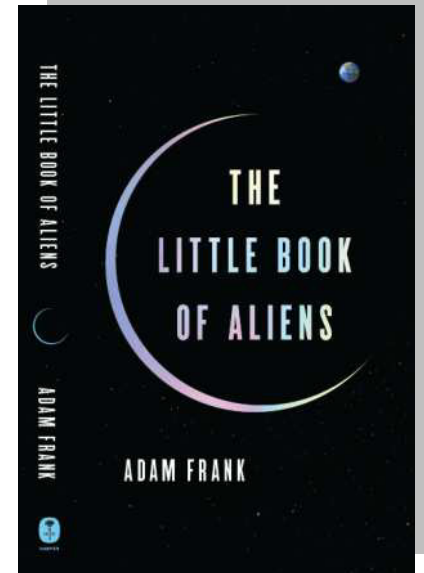
It's not just us who can learn from our dreams. When we share them with others we tell them things about ourselves that even we aren't aware of, "because our vulnerability is shared via metaphor and symbol rather than directly," Billington explained. "In this way, dreams are perhaps allegorical tales or myths about ourselves."

All things considered, maybe we could all do to pay a little more mind to our nighttime imaginings, but best not to get too bogged down in unpicking them, particularly if you can't remember them, De Koninck stressed.

"It can be important to pay attention to [dreams]. But if you don't, no big deal. Sleep well – just get a good night's sleep." ●



HUMANITY'S MOST IMPORTANT JOURNEY



Astrophysicist Adam Frank introduces the field of technosignatures and reveals how it could change the way we search for intelligent, civilization-building life in this excerpt from *The Little Book of Aliens*.

As you read these words, the human species is poised at the edge of its greatest and most important journey. Over the past three decades, the scientific search for life in the universe – a field called astrobiology – has exploded. We’ve discovered planets everywhere in the galaxy, and we’ve figured out how and where to look for signs of alien life in the atmospheres of these new worlds. We’ve also looked deep into Earth’s almost 4-billion-year history as an inhabited world.

From this view, we’ve gained new and powerful insights into how planets and life evolve together. Seeing the way life hijacked Earth’s evolution over the eons gives us clues about what to look for on distant planets (like oxygen, which

generally can exist in an atmosphere only if life puts it there). We’ve also sent robot emissaries to every planet in our Solar System. With their wheels or landing pads on the ground, we’ve begun searching these neighbor worlds for evidence of life existing now or perhaps deep in their past.

Most importantly, we have launched and are building insanely powerful, next-generation telescopes. With these tools, we’ll finally go beyond just yelling our opinions about life in the universe at each other. Instead, we will get what matters most – a true scientific view of if, where, and when extraterrestrial life exists.

All these new discoveries, from exoplanets to Earth’s deep history, are transforming what we think of as SETI [search for extraterrestrial intelligence]. A new research field is rising that scientists are calling technosignatures, which embraces the “classic” efforts of SETI while taking the search for intelligent life into new forms and directions. Knowing that the galaxy is awash in planets means we now know exactly where and how to look for alien civilizations. Rather than hoping for someone to set a beacon announcing their presence (one premise of the first generation of SETI), we can now look directly at the planets where those civilizations might be just going about their “civilizationing”.

By searching for signatures of an alien society’s day-to-day activities (a technosignature), we’re building entirely new toolkits to find intelligent, civilization-building life. These toolkits will also allow us to find the kind of life that doesn’t build civilizations. Using our telescopes to find a signature of a planet covered in alien microbes or alien forests (a biosignature) would also be a game changer in terms of how humanity sees its place in the cosmos.

So now, finally, we are on the road to finding those aliens I was so obsessed with as a kid. Or we’re on the road to finding out we really are alone in the cosmos. Either answer would be stunning. It’s a pretty damn exciting moment.

But it’s also a confusing moment. Just as the scientific search for alien life is gaining steam, there’s also been an explosion of interest in aliens that are supposedly visiting Earth right now. Over the last few years, a handful of videos taken by US fighter pilots have cropped up online showing fuzzy blobs appearing to fly in ways that would be impossible for normal aircraft. The videos have brought unidentified aerial phenomena (UAPs) into the spotlight, raising the stakes on the alien debate. But the UAP furore also confuses the issue about the giant leap science is taking as it begins looking for aliens in the most likely place (i.e., alien planets). ●

AUTHOR Q&A

WITH ADAM FRANK

AUTHOR OF *THE LITTLE BOOK OF ALIENS*



In *The Little Book of Aliens*, astrophysicist Adam Frank separates fact from fiction when it comes to what we know about the possibility of intelligent life on other planets.

Why did you want to write this book?

After 30 years as a professor of astrophysics studying everything from the formation of stars to the evolution of technological civilizations, I wanted to give people a fast, fun way to understand everything that's happening now in the search for alien life. While people are captivated by stories about UFOs and UAPs [Unidentified Aerial Phenomena], they may not know how close astronomers are to getting real, hard data about alien life in the most likely place it exists... alien planets.

The book is a comprehensive but concise tour of all the amazing progress in astrobiology going on now and what it means for answering that ancient question – “are we alone?”. I also dedicate time to UFOs and UAPs

because people want to know how serious we should be taking them. Do they have anything to do with alien life? I wanted people to see how science views that question and why. I'm pretty sceptical but in the book, I unpack what a true, transparent scientific investigation of UFOs and UAPs would have to look like.

What's something you learned that surprised you?

Oh man, where do I begin? Every day I get surprised and delighted. That's what I wanted to share with people by writing the book. I want them to have the same feeling. One thing that has amazed me is how Earth's history shows that life is NOT fragile on the scale of planets. Life literally hijacks the evolution of planets.

The Earth's atmosphere is 21 percent oxygen. All that oxygen comes from life. As photosynthetic organisms go about their energy-harvesting business, they fart out oxygen, filling the planet's atmosphere with the element. It's pretty amazing. We should expect this to happen on other planets where life has formed as well. That's actually how we're going to find alien life, by looking for the signatures of how it altered the planet it inhabits. The same goes for technological civilizations altering their planets.

What do you hope people will take away from it?

I want people to have the “Holy Crap!” moment that I have almost every other day. It's amazing to me that after 2,500 years of people yelling “like their opinions, man” about life in the universe, we finally have the capacity to go find it! We may be the first generation that knows the answer to the most important question humans have ever asked: is life common among the stars?

Why should humans care about aliens?

The last part of the book really unpacks this question. If we find even one example of life beyond Earth, then everything changes. It would be the most profound and important discovery in human history. That's because life is unlike any other physical system in the universe. Stars are amazing. Comets are amazing. Black holes are amazing. But only life invents. Only life creates. Only life goes beyond itself. Right now, it's entirely possible that life and Earth and humans are an accident, a one-off that's never occurred anywhere else in the universe. But if we knew of just one other example of life on another world then we can conclude there are even more out there. If that's true then who knows what life has created, how far it's gone, what it might have done.

Also, right now it looks like humanity has a very troubled future ahead. If we find another example of a civilization, especially one older, it will give us hope that “making it” to maturity is possible. If other civilizations have done it, we can too.

How can people search for reputable information?

At the end of the book, I give a list of other resources people can check out to find good information. There is so much exciting stuff happening right now but there is also so much misinformation, disinformation, and just plain crap. We need to stick to the science because we don't just want to believe, we want to know. That's what *The Little Book of Aliens* is all about. ●

The Little Book of Aliens by Adam Frank is published by Harper Collins and is available to buy now.

A photograph of a sea cave entrance on the Isle of Staffa, Scotland. The cave is formed by hexagonal basalt columns, which are dark grey and arranged in a regular, repeating pattern. The columns are stacked vertically, creating a series of rectangular openings. The cave is located on a rocky coastline, and the water is a deep blue-green color. The sky is not visible in the image.

A hexagonal marvel can be found tucked into the cliffs of the Isle of Staffa in Scotland. The natural sea cave is thought to have formed around 60 million years ago, at a time when intense volcanic activity was reshaping the landscape.

FINGAL'S CAVE: HEXAGONS, BUT MAKE IT GEOLOGY

A dramatic sight awaits anyone drifting near the shores of the Isle of Staffa, where a unique sea cave is carved into the rugged coastline. Known as **Fingal's Cave**, its name comes from an Irish myth in which Fionn MacCumhaill, nicknamed Fingal for "white stranger", migrated to Scotland from Ireland. Fingal was believed to be the creator of the **Giant's Causeway**, which boasts a similarly hexagonal esthetic.

The Isle of Staffa is small and uninhabited, but it attracts lots of tourists each year who are drawn to its peculiar, hexagonal-shaped basalt columns. Most of the columns are true hexagons with six sides, but five-sided and seven-sided columns can also be found, according to the **Scottish Geology Trust**.

Fingal's hexagons were stacking up around 60 million years ago at a time when the Atlantic Ocean was still taking shape. They're the result of what unfolds when molten lava cools and contracts, breaking apart in an orderly fashion – which is more than can be said for us under pressure.

"Imagine a huge flow of hot, liquid magma that is settling," posits **Arizona State University**. "The outer layer is starting to cool and darken in color from orange to black. As it cools, it needs to shrink a bit, as hot materials usually take up more space than cooler ones. Because of this shrinking, the surface of the lava starts to crack. But this cracking isn't always random. In this case, the lava starts to crack into regular shapes."

Hexagons are just one of the many **patterns that we see in nature**, and the uniform magic of Fingal's Cave is a reminder that you can't hide from math – not even in a **decaying shrub**.

Resembling a giant honeycomb, the gridded geometric pillars stretch to heights of 22 meters (72 feet). Some say it also resembles a cathedral, which leads us to another quirk of Fingal's Cave.

It has a funky sound as well as appearance thanks to its remarkable acoustic properties. The unique shape of its columns means sound reverberates unusually, creating an otherworldly auditory experience that's earned the cave the nickname "nature's cathedral". It's also known in Gaelic as "An Uamh Binn", meaning "the cave of music".

Fingal's Cave inspired "Hebrides Overture" by composer Felix Mendelssohn, who visited the cave in 1829. As it happens, there are a few natural caves that have proven to be a hit with musicians, just ask the glow worms in **New Zealand's Waitomo Cave**. •



How to get there

You can explore Fingal's Cave by boat from Oban, or as part of a swimming tour that'll take you into its mouth. If you're lucky, you might even spot a basking shark, but you should stay out of theirs.

EXPLORE



Spy In The Ocean, A Nature Miniseries

Documentary series on PBS

Animatronic robots armed with convincing get-ups and hidden cameras record never-before-seen behaviors from some of the oceans' most fascinating wildlife in *Spy In The Ocean*. From **hermit crabs stealing their shell camera homes** to a face-off between a spy creature and a sarcastic fringehead, and a puffer fish making art, it really has to be seen to be believed.

Available from **October 25** on PBS.

WATCH



Leo

Film from Netflix

Jaded 74-year-old lizard Leo – voiced by comedian Adam Sandler – has been stuck in the same Florida classroom for decades. Living alongside his terrarium-mate turtle (Bill Burr), he learns that he has just one year left to live, so hatches a plan to get out of the school – but leaving isn't so easy.

Available from **November 21**.

TEACH



The Plastic Changemakers

A global initiative from The Breteau Foundation

Educational resources created to inspire the conservation leaders of the future are now available to download for free as part of the Plastic Changemakers initiative, developed by educational non-profit organization The Breteau Foundation. It includes five modules, leaning on the popularity of the global hit TV show *Miraculous™: Tales of Ladybug and Cat Noir* to keep kids hooked as they learn about plastic pollution.

Available **now**.

READ



White Holes: Inside The Horizon

Book by Carlo Rovelli

What happens at the bottom of a black hole? Rovelli dives into this fascinating subject as he explores the

theory of white holes, a new speculative idea about the inverse of black holes. In it, he questions, "What would we see if we were to imagine filming the entire life of a black hole and then run the film backwards?"

Available **now**.

SCIENCE IN MEDIA



DISCOVER



The Six: The Untold Story of America's First Women Astronauts

Book by Loren Grush

Sally Ride, Judy Resnik, Anna Fisher, Kathy Sullivan, Shannon Lucid, and Rhea Seddon.

These exceptional women battled against misogyny and the societal norms of the era as they made their mark in the pursuit of space exploration. In this book, space reporter for Bloomberg Loren Grush weaves a captivating narrative that celebrates both their resilience and significant contributions to the space program.

Available **now**.



DATES TO REMEMBER

The end of the year may be fast approaching, but there are still plenty of dates and events to look forward to. This November, we have International Day of LGBTQIA+ People in STEM, as well as days dedicated to peace and development in science and the Red Planet. There's also meteors to be marveled at, and polar bears to protect, you really don't want to miss out!

NOVEMBER

OCT 29-NOV 4

Polar Bear Week

The first week of November is Polar Bear

Week. Organized by Polar Bears International, the event coincides with the time when, every fall, polar bears gather on the shores of Hudson Bay in Canada to await the return of sea ice so they can hunt. However, the ice-free period is now several weeks longer than it was in the 1980s, testing the limits of the bears' fat reserves. Polar Bear Week aims to raise awareness about sea ice loss and the **impacts of the climate crisis on polar bears**. Find out how you can get involved [here](#).



10 World Science Day for Peace and Development

The United Nations' (UN) **World Science Day for Peace and Development** is celebrated every November 10. Now in its 21st year, it serves to highlight the importance of science in society and the need to engage more people in conversations on emerging scientific issues. From government officials and the media to students, the UN is encouraging people from all walks of life to get involved by organizing events or activities.



18

Leonids Peak

The Leonids meteor shower will be active for most of the month, from November 6 to 30, peaking in the early

hours of Nov 18. Under a dark sky with no Moon, you can expect to see between 10 and 15 meteors per hour, and no binoculars or telescope will be necessary, just cast your eyes up!

18

International Day of LGBTQIA+ People in STEM

The **International Day of LGBTQIA+ People in STEM** on November 18 recognizes the incredible contributions of LGBTQIA+ people in science, technology, engineering, and math, as well as the barriers they face. This year, the event will be marked with the Community & Careers Conference on November 17 at Cardiff University, Wales, presided over by IFLScience's own Dr Alfredo Carpineti, co-founder and chair of Pride in STEM. You can join online or in-person to enjoy an array of talks, workshops, and panels designed to provide practical advice for navigating the world of STEM as a queer person. Register for free [here](#).



28

Red Planet Day

November 28 marks 59 years since the launch of the Mariner 4 spacecraft, which performed the first successful flyby of Mars. It is also, not coincidentally, Red Planet Day, a day dedicated to celebrating and learning more about our crimson neighbor.



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 cannibalistic tendencies of Costa Rican pirate spiders. If you like your science lighter, find out how the humble cheese sandwich could actually be helping your brain.

SWASH- BUCKLING SPIDERS

A species of pirate spider found in Costa Rica has a unique hunting strategy: it tricks other spiders into "walking the plank", or in this case, a string of web.

**LIKE A BUCCANEER
SWINGING FROM A
SHIP, THE ORB WEAVER
LEAPS OFF THE STRAND,
FOLLOWED BY THE
PIRATE SPIDER.**

Much like pirate humans, pirate spiders are something of an arachnid bandit, using the resources of others for their own ends – and by that, we mean cannibalizing their own cousins. Not sure we'd like to attend that family dinner party.

Gelanoir squirres, a Costa Rican pirate spider, has a particularly distinctive way of securing its loot. **Researchers** have recently witnessed, for the first time, its method of capturing its orb weaver prey before the unfortunate victim even has the chance to build a full web.

To create the foundations of a web, orb weaver spiders drop "floating lines" of spider silk that blow around until they anchor to another surface. Scientists discovered that *G. squirres* sits atop a leaf and drops its own strands to create a "capture web"; the orb weavers' floating lines end up sticking to these strands.

Thinking it can start building, an orb weaver will start scurrying across the strand. The pirate spider, who was lying in wait on the leaf, sneaks down towards its prey and attacks – but the orb weaver doesn't go down without a fight.

Like a buccaneer swinging from a ship, the orb weaver leaps off the strand, followed by the pirate spider. "They're hanging there, fighting," said Segura-Hernández, one of the researchers, to **ScienceNews**.

Unfortunately for orb weavers, pirate spiders live up to their name and are pretty nifty fighters. They nearly instantly paralyze and kill their prey, returning to their leafy hideout to feast upon their plunder.

It turns out *G. squirres*' swashbuckling strategy is unique too. Gustavo Hormiga, who helped name the species, said, "I don't know of anything like that in any [other] spider group."

CHEESE THE DAY

Good news for cheese chompers – a love affair with the popular dairy product might actually be gouda for the brain.

**OUT OF THE 81 PERCENT
OF PARTICIPANTS WHO
ATE CHEESE, THOSE WHO
ATE IT REGULARLY WERE
LESS LIKELY TO HAVE POOR
COGNITIVE FUNCTION.**

According to a recent **study**, cheese intake could be associated with higher cognitive function. The research took place in Japan, with 1,503 participants aged over 65 years being surveyed on their cheese consumption habits and other factors such as general diet, blood pressure, exercise level, and fat and muscle mass.

They found that 81 percent of the participants ate cheese, with 27.6 percent doing so daily. As for the most important results, the most popular product by a long shot was processed cheese – like the orange kind you slap on top of a burger – which accounted for nearly 66 percent of the cheese eaten by participants.

To test cognitive function, participants completed a 30-question test of their memory, language, and attention skills, called the Mini-Mental State Examination (MMSE).

The researchers found that, out of the 81 percent of participants who ate cheese, those who ate it regularly were less likely to have poor cognitive function (a score of 23 or lower on the MMSE).

"The results suggest that cheese intake is inversely associated with lower cognitive function even after adjusting for multiple confounding factors," write the authors.

They indicate that cheese could therefore be an important part of a diet that reduces the risk of cognitive decline and dementia. However, they are also careful to mention that this doesn't mean that cheese intake directly reduces the risk of cognitive decline and that studies over longer periods will be required to determine this.

The results also show other impacts on health, both positive and negative. Cheese-eaters were found to have higher cholesterol levels, but they also had a more varied diet overall and slightly lower blood pressure – so maybe don't put down the cheddar just yet.



**The Darker Side
of Science**



**THE LIGHTER SIDE
OF SCIENCE**