

# CURIOS?



IS THERE A LIMIT  
TO HUMAN LIFE?

WHITE HOLES:  
BLACK HOLES' DESTINY?

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# NEWS BITES



## Precious GEM

Are you fascinated by pyramids and pharaohs? Know your mummies from your Miu? If you've ever wanted to visit Egypt, this is the year to do it, with the opening of the Grand Egyptian Museum (GEM) set for mid-2024. Located just 2 kilometers (1.2 miles) from the last remaining wonder of the ancient world, the Pyramids of Giza, it is the largest archaeology museum in the world dedicated to one civilization. The museum will house Egypt's greatest historical and cultural treasures, and its centerpiece is the Tutankhamun Gallery: For the first time ever, the entire collection of fabulous treasures found in the Boy King's tomb will be displayed together. Thought to contain around 5,400 items, the collection includes looted items previously on display in museums around the world, now returned to their permanent home in the GEM. Whether the treasure will be reunited with Tut's sarcophagus and mummy, which has been on display in the original tomb in Luxor for years, is yet to be confirmed.



## Leap Year

2024 is a leap year, which means instead of the usual 365 days, this year will see February get an extra day. February 29 comes around roughly every four years, though that's not guaranteed. The reason for leap years is that it takes Earth 365.24 days to orbit the Sun. If we didn't slip in an extra day every few years, those extra hours would add up and our calendars would not synchronize with the astronomical or seasonal year. Fun fact: To be a leap year, the year number must be divisible by four, except for end-of-century years, which must be divisible by 400. This means we'll see a leap year every four years until 2096, but then there won't be another one until 2104.



## What To Watch In 2024

The actors' and writers' guilds strikes of 2023 pushed a glut of sci-fi movies and TV shows to 2024, which means it is rich pickings for big and small screen spectacles this year. Many major franchises return to the big screen, including *Alien*, *Planet of the Apes*, *Godzilla*, *Ghostbusters*, *Transformers*, and *Mad Max*. We'll see the in-demand *Rebel Moon: Part 2* from Zack Snyder and Disney Pixar's latest animation, *Elio*, about a young boy who accidentally becomes an ambassador for planet Earth after being beamed into space by aliens. Most awaited is probably *Dune: Part 2*, while *Parasite* director Bong Joon-ho returns with an original sci-fi, *Mickey 17*, about a recyclable human sent to colonize an ice world.

## Fantasy: Realms Of The Imagination

If you find yourself in the UK between now and February, get yourself to London's British Library for its epic fantasy exhibition. Fantasy: Realms of the Imagination is a celebration of the genre that takes in novels, movies, board games, card games, video games, TV and radio shows, role-playing games, and even live-action roleplay. From early Terry Pratchett manuscripts to props from *The Lord of the Rings* movies, if you've ever read and loved Ursula K. Le Guin or Neil Gaiman, wanted to be *Xena: Warrior Princess*, or to experience the strange world of *Twin Peaks*, don't miss it. Exhibition ends February 25.



## 2024 In Space

It's an exciting year in space exploration as some long-planned missions finally get off the ground, moons become the hottest places to visit in the Solar System, and we should see the maiden flights of some epic rockets. The most exciting event is hands down Artemis II, set to return humans to the Moon's orbit for the first time in 50 years. Currently scheduled for November, the astronauts will launch on NASA's massive SLS rocket aboard an Orion spacecraft and see them fly 8,890 kilometers (5,524 miles) beyond the Moon before completing a flyby and returning to Earth.

This year will also see many moon visits, with Japan launching its Martian Moons Exploration spacecraft to collect and return a sample from Mars' moon, Phobos; China's Chang'e 6 in May is set to conduct the first lunar sample return from the far side of the Moon; and NASA's Europa Clipper will finally launch to Jupiter's moon Europa in October.

2024 will also see the test launches of some vital rockets: Blue Origin's New Glenn; the European Space Agency's heavy-lift Ariane 6; and the first flight to the ISS of NASA's Dream Chaser spaceplane.

Finally, Polaris Dawn – a private space mission that will be attempting, among other things, the first-ever commercial spacewalk and the highest Earth orbit – is expected to occur in early 2024 after being scrubbed last year.

# WHAT'S UP?



## Mercury-Mars Conjunction

### Get Outer My Space

**Name:** Mercury-Mars conjunction

**Appearance:** Two bright dots in the sky that appear very close to each other

**Location:** Just above the horizon

#### What's a planetary conjunction?

Just as the Earth orbits the Sun, so do the other planets in our Solar System. From our perspective, this means that it can seem as though the planets are wandering about the sky, and occasionally appear incredibly close to one another – this is known as a planetary conjunction. The planets actually remain millions of miles away from each other, it's simply our line of sight skewing reality.

**What does this mean for my stars?** Nothing, because astrology isn't real.

**When is the conjunction?** On January 27, Mercury and Mars will appear just 0°12' from each other in the sky – that's very close. In fact,

this will be the closest planetary conjunction of the whole year – at least out of those visible to the naked eye – and is almost as close as Jupiter and Saturn appeared to be during **2020's Great Conjunction**.

**How can I see it?** Both planets will be visible to the naked eye just before sunrise, as pinpricks of light that could easily be mistaken for stars. If you need a bit of assistance in finding them, there's a whole host of apps that can help by using your phone's location. If you know your star stuff (or simply fancy going old school), then from the Northern Hemisphere, the two planets can be found just above the southeastern horizon in the constellation Sagittarius, and from the Southern Hemisphere, just slightly higher.

**When is the next one?** You won't have to wait long. On February 22, Venus and Mars will appear less than 1 degree apart, and April gets a whopping four.



# WHAT DOES THE UNIVERSE SMELL LIKE?

From searing steak to raspberry via sickeningly sweet cyanide, space has a smell for everyone.

When it comes to astronomy, sight is the sense that we as a species mostly rely on. Contrary to popular belief there is **some sound in space** – the sonification of many cosmic events can deliver intriguing insights – and a lucky few can actually touch space material, but what about smell?

Can we smell space or do space objects have a smell? *Futurama* had a running gag with the Smell-O-Scope, a telescope that can smell through cosmic distance. We are not quite there yet, but between astronauts' experience and the chemical analysis of distant objects, we have identified many "smells" of places and objects in the cosmos.

## Outer space is like a seared steak?

Astronauts have reported that the International Space Station (ISS) doesn't smell too good. It is usually home to about seven astronauts (but it can get more crowded). European astronaut, former commander of the ISS, and **all-round legend** Samantha Cristoforetti described it as a persistent "peculiar odor" in the ISS that it takes a few days to get used to.

**THE SMELL OF GUNPOWDER, SPECIFICALLY ACRID GUNPOWDER, HAS ALSO BEEN REPORTED FROM THE SURFACE OF THE MOON.**

But that is still about the inside of a spacecraft, what about the outside? Upon returning from space walks or when the hatch is open, there is a strange smell in the air. Astronauts have described it in different ways: **metallic, like welding**

**fumes**, like gunpowder, and even like the smell of a seared steak. After all, the rays of the Sun are quite unforgiving when it comes to being in low-Earth orbit.

## Moon dust and Moon allergies

The smell of gunpowder, specifically acrid gunpowder, has also been reported from the surface of the Moon. The 12 men who walked on its surface brought dust back into the lunar module, which they could smell. That's what you get when your surface is bombarded by sunlight with no atmosphere to act as a filter for 14 days a month over 4.5 billion years.

"All I can say is that everyone's instant impression of the smell was that of spent gunpowder, not that it was 'metallic' or 'acrid'. Spent gunpowder smell probably was much more implanted in our memories than other comparable odors," Apollo 17's Harrison Schmitt, who Moon walked in December 1972, told **Space.com**.

Schmitt didn't just not enjoy the smell, he had an **allergic reaction** to the sharp, abrasive, and possibly toxic Moondust; his nose became swollen at first contact with the dust, and even when brought back to Earth, it continued to cause reactions. Schmitt recalled in 2019 that a flight surgeon had such a strong allergic reaction while taking suits out of the command module that they couldn't continue working on it.

So, the Moon's smell might not be exactly offensive, but you have a risk of being severely allergic to it. You have been warned.

## The stinking Solar System

But let's extend our reach a bit beyond our cozy corner of the universe. What kind of molecules are found elsewhere in the Solar System? Seven out of the eight planets have substantial enough atmospheres for us to smell something; only one won't kill you if you smell its air: Earth.

Many gases that are found in abundance in the atmospheres of planets are odorless, such as hydrogen, helium,

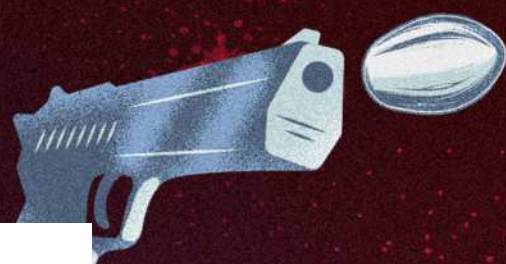
carbon dioxide, and methane. So what we are looking at are the minor components of these worlds – and none of them are a bouquet of roses. A chief molecule that is commonly found is ammonia; both Jupiter and Uranus have it in their atmospheres. Ammonia famously smells like urine or sweat, so not exactly a pleasant smell, but there's worse.

Venus, Mars, and Uranus have in common the presence of hydrogen sulfide, which is also known as sewer gas, stink damp, and manure gas. It's the smell of rotten eggs and farts, at least at low concentrations, so you need to be careful about not encountering pockets of it because it then gets sickeningly sweet. And then it kills you, like roughly everything else on those planets. Mars might have some sweet, chalky undertones, but if you like something more intriguing and dangerous, we can either go back to Jupiter or take on the comets.

**IT SEEMS THAT THE EARTH IS NOT JUST THE MOST HABITABLE PLANET IN THE SOLAR SYSTEM BY FAR, BUT IT IS ALSO THE ONE THAT SMELLS THE BEST.**

Similar molecules have been found in the icy travelers of the Solar System, with the addition of delicious (and highly poisonous) hydrogen cyanide. As popularized by Agatha Christie, cyanide has a bitter almond smell. It is found on comets and in the atmosphere of Jupiter.

It seems that the Earth is not just the most habitable planet in the Solar System by far, but it is also the one that smells the best – hey, maybe that's a solution to the **Fermi Paradox**, aliens have not contacted us because they think we stink.



## Cocktails at your local giant molecular cloud

When it comes to interstellar molecules that are fun to smell, there is no better than ethyl formate, which was discovered in molecular cloud Sagittarius B2. You might not be familiar with ethyl formate as a molecule, but we are pretty certain that you have experienced it: the substance is what we normally associate with the characteristic smell of rum. That is not all: it is partially responsible for the flavor of raspberries.

Now, a giant nebula that smells of rum and tastes of raspberries sounds delicious, and is definitely an improved sensory experience compared to the rather stinky Solar System. Unfortunately, molecular clouds have an extremely low density, and while there is a lot of alcohol present (sounds like a great party nebula) it also contains Butyronitrile, the smell of which is described as suffocating, as well as cyanide, so more bitter almonds. Do not go sniffing Sagittarius B2.

**THERE IS SOME FASCINATING CHEMISTRY HAPPENING OVER EONS IN THE SPACE BETWEEN STARS AND WHERE STARS ARE BEING BORN.**

Acetic acid has also been discovered in Sagittarius B2 and other molecular clouds. The name might not tell you much, but it is a substance that gives vinegar its characteristic odor. So all in all, Sagittarius B2 is a bit vinegary, a bit rummy, a bit almondy, and a whole lot pungent.

Researchers have found all sorts of interesting molecules in interstellar space. There is some

fascinating chemistry happening over eons in the space between stars and where stars are being born. Many of these molecules are odorless but there are a bunch with distinct smells, many of which are just strong and sharp such as methyl isocyanate or the aforementioned Butyronitrile.

**SO, THE UNIVERSE IS A MIXED BAG OF ODOROUS MOLECULES, SOME DELICIOUS AND SOME REVOLTING.**

Another interesting molecule that is commonly used on Earth and also found in the depths of space is formaldehyde, an important ingredient in embalming fluid renowned for its characteristic pungent **smell**.

So, the universe is a mixed bag of odorous molecules, some delicious and some revolting. The ability to discover these molecules from such a long distance away is phenomenal. The most distant of such molecules, also found in abundance closer to home, are Polycyclic Aromatic Hydrocarbons (PAHs), which have been **detected by JWST** in a galaxy whose light had to travel 12.5 billion years to reach us. PAHs smell like car tires or asphalt.

Among the fumes, the choking hazards, and the titillating scents, these molecules offer a window into how the Earth came to be and also how life had the building blocks to form on our planet. From foul-smelling interstellar molecules to the scent of a rose, there is a giant leap, but by studying the chemistry of the universe we can find out all the necessary steps to go from one to the other. ●



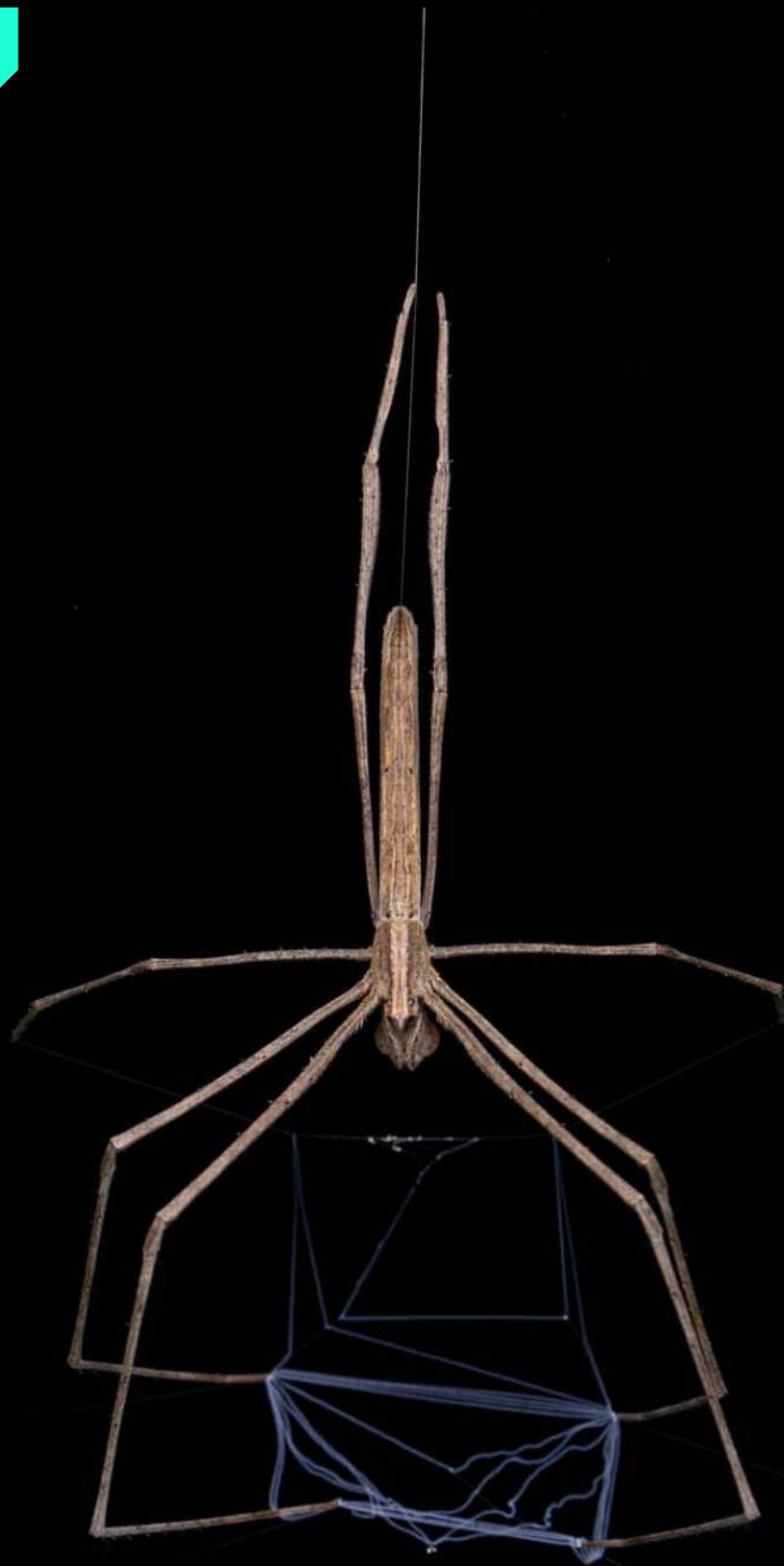


*Image Credit: GDT EWPY 2023, Kai Kolodziej – Flycatcher*

## OGRE-FACED FLYCATCHER

Net-casting spiders (Deinopidae) have massive eyes for spotting prey in low light (hence their nickname “ogre-faced spiders”) – but, incredibly, **they can hear** too. Their hairy legs detect low and high frequencies so they can grab a passing meal in their web-cum-shopping-bag. This amazing photo called “Flycatcher” was taken by Kai Kolodziej in Costa Rica and was awarded highly commended in the Other Animals category of European Wildlife Photographer Of The Year. See the full **winners gallery** [here](#).

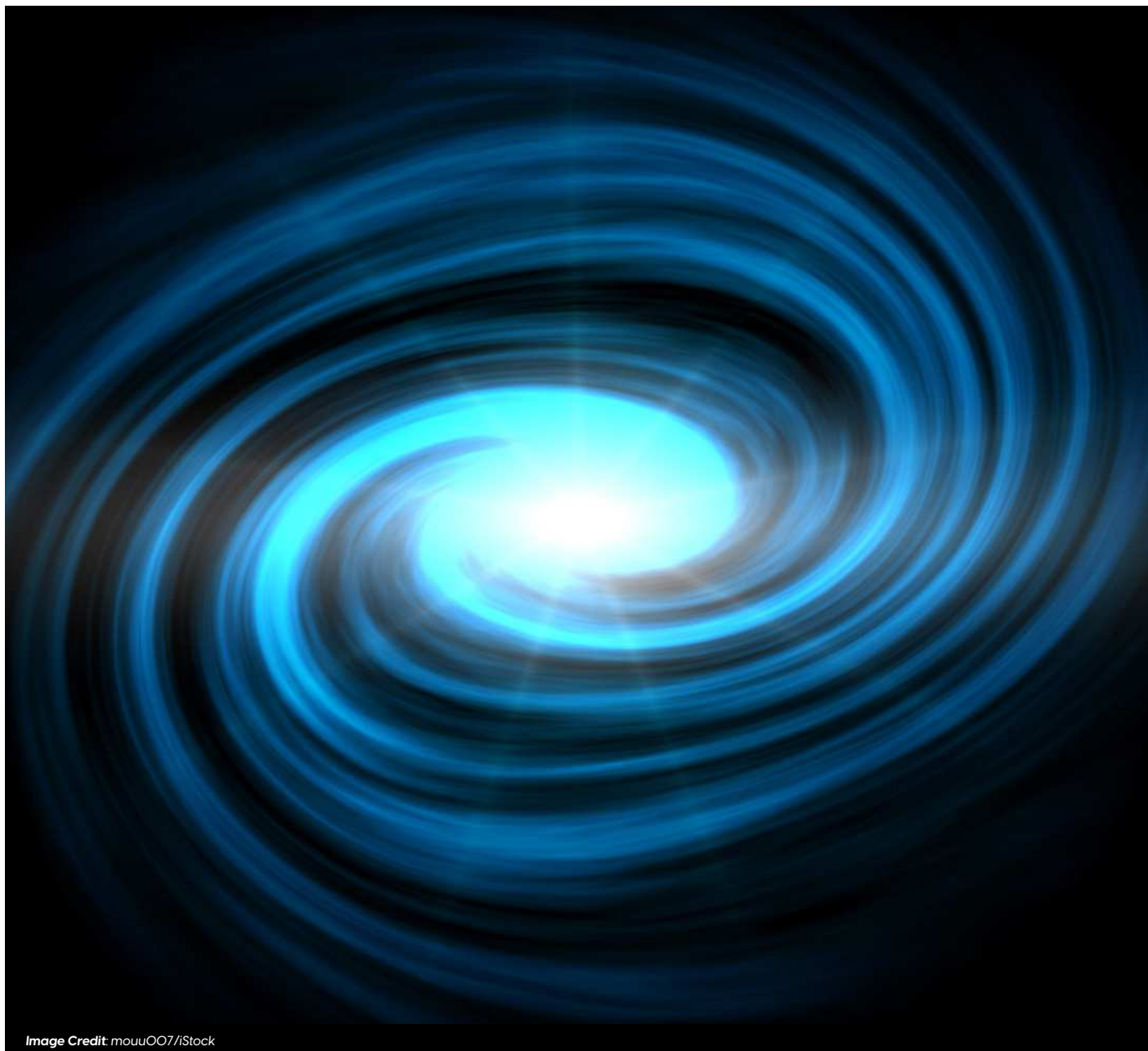


Image Credit: mouu007/iStock

# WHITE HOLES: BLACK HOLES' DESTINY?

*HOW ARE THEY DIFFERENT  
AND HOW ARE THEY THE SAME?*

Dr Alfredo Carpineti

At the cutting edge of theoretical physics research, physicists are trying to reconcile quantum mechanics with general relativity – two of the most successful scientific theories ever put forward. They can describe so much of our universe, but they do not work well together. This becomes most obvious in extreme cases, such as explaining the Big Bang and black holes.

In those extremes, scientists are creating, testing, and discarding hypotheses about the nature of reality. Among them is physicist and author **Carlo Rovelli**, who looks at what happens inside black holes, and has discovered something interesting. As the material that makes a black hole tries to collapse into nothing, it reaches a point where it bounces back, creating a hypothetical object known as a “white hole”.

In Rovelli's latest book, **White Holes: Inside The Horizon**, he translates the complex mathematics of their theories into a journey into a black hole (from which nothing can escape) through its evolution over an incredibly long time into a white hole (which nothing can enter). We spoke to Rovelli about what they might look like, whether we could approach one, and visible proof of the existence of these theoretical cosmic objects that function in the opposite way to black holes.

***PERHAPS THE STRANGE  
SUBSTANCE THAT THE ASTRONOMERS  
HAVE OBSERVED IN THE SKY WHICH  
THEY CALL "DARK MATTER" MIGHT BE  
FORMED BY MANY SMALL  
WHITE HOLES.***

**In popular media, white holes are seen as the very opposite of black holes: faucets to the black holes' plugholes. But are they really like that?**

**CR:** Yes, quite so. The actual full theory of black and white holes is a bit more detailed than just plugholes and faucets. It includes the full spacetime geometry and the dynamics of these spacetimes. But to a first approximation, this is not a bad picture.

**In your book, you take readers on a journey into black holes to learn how white holes might come to be. Why is it important to imagine what physics is like in there?**

**CR:** Because we always understand things by visualizing them. When scientists began understanding DNA, they immediately made a large-scale model of this molecule to "see" it. When we study a distant planet, we try to imagine what it looks like. Our brain is largely visual and we need imagination for intuiting connections and relations. If I asked you, what does it mean to say that the Earth is round?

You would answer: imagine being on the Moon and looking at the Earth. You would see a ball so and so...

**Does a white hole look different from a black hole?**

**CR:** At a first impression, no. If you wait long enough you start seeing the difference: a white hole ends up emitting whatever is inside and disappearing. A black hole emits only a very peculiar form of thermal radiation, at a specific temperature, the "Hawking" temperature. In this way, it "evaporates".

**What happens to a black hole when it finishes evaporating?**

**CR:** It turns into a white hole.

**What would happen if we tried to approach a white hole/could we ever approach a white hole?**

**CR:** You could approach it. Before falling inside, you would hit the matter that is coming out. The time it would take to get to this clash is going to be short for you, but long if seen from a distance.

**Is there any visible proof that white holes exist?**

**CR:** There is only a possible hint: perhaps the strange substance that the astronomers have observed in the sky which they call "dark matter" might be formed by many small white holes.

**If white holes are small but massive and losing energy very slowly, could dark matter be made of white holes?**

**CR:** Yes, absolutely. This is our hypothesis.

**What astronomical observations would be needed to prove their existence?**

**CR:** The best way to confirm the existence of these objects would be to detect one of them flying by here on Earth. There are scientists studying how an apparatus for the detection could work. ●

*SCIENCE FACT OR FICTION:*

# IS THERE A LIMIT TO HUMAN LIFE?

Are we destined to expire after around a century, or could we theoretically live for much longer? Dr Katie Spalding investigates.





In 2011, a UK survey asked the public a simple question: would you like to live forever? More than five out of every six people said no.

Turn it around, though, and the opposite is equally off-putting: do you want to die?

Perhaps that's why we're seeing more resources than ever before invested in life-prolonging science – from billionaires'



"blood boys" to the diets and lifestyles of the so-called "blue zones".

And it seems to be working! As a species, humans are living longer than ever before, with life expectancy in rich nations such as the UK having more or less doubled over the past 150 years, and the number of individuals reaching their 100th birthday shooting up from about 95,000 in 1990 to a projected 25 million in 2100.

But how far can this go? Are we destined to always peter out at around the century mark, or can we increase the maximum human lifespan to, say, 150? How about 200?

What if there's no limit at all?

### Touch of grey

Creaky knees; an aching back; an increasingly hazy memory of where you left your keys – we tend to think of these as classic signs of aging. But that's not quite right. According to the simplest scientific definition, such as it exists, those bodily foibles aren't the result of aging – they literally are what aging is.

"Age and aging are not the same thing," explains the **Max Planck Institute for Biology of Ageing**. "Age is just a number and is often subjective. Aging, on the other hand, is an observable

process that can be described and defined scientifically. In aging research, aging is defined as a progressive loss of physiological integrity leading to functional impairment and an increased likelihood of death."

Why we age, therefore, is a question of what causes this degeneration – and it's here that the simple answer suddenly becomes incredibly complex. Aging, as far as we know, is the result of quite a few different, yet interconnected, factors: some nature, some nurture; some controllable, and others the product of random chance – plus some we don't even know about yet.

Take food, for example. Intuitively, you might think that ready access to food would increase your lifespan – it's hard to live to 100 if you starve to death aged nine, after all. But the reality is weirder than that. "It's widely known that calorie-restricted diets can prolong lifespan," **wrote** Charalampos Rallis, a Lecturer in Cellular Ageing at the University of Essex. "Short-term studies suggest that it also improves health in humans."

Similarly, a life lived in comfort may be shorter than one with a little strife. It's not as nonsensical as it may sound: "When food is plentiful and stress levels low, these genes make hay while the Sun shines by supporting growth and reproduction," **explained** Alison Woollard, Associate Professor in the University of Oxford's Department of Biochemistry. "But under difficult conditions, they take a 'things can only get better' attitude – their activities change, sparking a whole physiological shift towards cell protection and maintenance."

You see, while growth and reproduction may sound like a positive thing, what it mainly is – especially once you've finished maturing – is a waste of resources. The processes by which cells build new proteins and divide are energy-consuming and limited: after a while, a cell will become senescent, or unable to divide any further.

How quickly this limit is reached certainly seems to be linked to one's longevity. "The cells of a Galapagos turtle divide approximately 110 times before senescing," **notes** biomedical researcher

Avi Roy, "whereas mice cells become senescent within 15 divisions."

## Stand and deliver: Your money or your life

They say only two things in life are certain: death and taxes. If you're rich, however, you can get around both – at least, that's what the world's most moneyed have always hoped.

In the past, the quest for eternal youth would have your Cleopatras and your Caesars reaching for bathtubs full of donkey milk and using face masks of crocodile dung. Today – well, things aren't much better.

Case in point: the US tech billionaire **Bryan Johnson**. He spends, on average, \$2 million per year on purported anti-aging technologies, claiming that his body now "accumulates aging damage... less than the average 1-year-old." Which, if true, must be comforting, since his regimen has included weekly acid peels, starving himself for 23

hours per day, and using his own son as a portable blood bank – Elizabeth Bathory, eat your heart out.

But "there are no proven clinical benefits" of plasma or blood infusions on age-related diseases, **writes** Rachael Jefferson-Buchanan, Lecturer in Human Movement Studies (Health and PE) and Creative Arts, Charles Sturt University.

"Many of Johnson's age-reversal methods are questionable, involve dodgy science, and have known side effects," she said.

So, what can we do to eke out a few extra years on Earth? The answer is simple and, we hate to say, disappointing: "For the general population, watching your weight, not smoking, drinking moderately and eating at least five servings of fruit and vegetables a day can increase life expectancy by up to 14 years compared with someone who does none of these things," **writes** Richard Faragher, University

of Brighton Professor of Biogerontology, in an article with Nir Barzilai, Professor of Medicine and Genetics at Albert Einstein College of Medicine.

It may not be fun, but it is effective. "[The] difference exceeds that seen between the least and most deprived areas in the UK," the pair point out.

In the end, though, super-longevity may come down to sheer dumb luck. "One study found that up to 60 percent of Ashkenazi Jewish centenarians have smoked heavily most of their lives," Faragher and Barzilai note. "Half have been obese for the same period of time, less than half do even moderate exercise and under three percent are vegetarians."

## Who wants to live forever

So, there you have it: eat right, don't smoke, and try not to let your cells get carried away on the protein building. But if it's such a simple formula, can we say what the upper limit is on the outcome?



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Well, it's a tricky question to answer – amply proven by the fact that so many proposed “maximum human lifespans” have been blasted through in recent decades.

“In 1921 it was ‘demonstrated’ that ages above 105 were ‘impossible,’” **writes** Faragher. “Estimating the limits to longevity has since been criticized because every ‘maximum limit’ to lifespan so far proposed has been surpassed.”

Yet, despite all this successful aging, plus an ever-increasing population to boot, there's one data point that's remained constant for more than a quarter-century now: the age of the oldest human ever, Jeanne Calment, who reportedly died in 1997 at the frankly extraordinary 122 years and 164 days.

That figure is notably close to one commonly proposed limit on the human lifespan: about 120 years. And Madame Calment's unbroken record isn't the only reason for this figure's popularity. “[If we] look at how our organs decline with age, and run that rate of decline against the age at which they stop working,” Faragher **explains**, “most calculations indicat[e] organs will only function until the average person is around 120 years old.”

Mathematical models have predicted a similar cut-off point. **One 2016 study**, for example, used demographic data to conclude that humans have a fixed maximum lifespan of about 125 years – and that the chances of any person reaching that age is less than one in 10,000. Other studies have produced extremely similar figures: 115, 124, 126, 130, and so on.

But some scientists are not so pessimistic. Breakthroughs in our understanding of the aging process have led to a hypothesized maximum lifespan of up to **150 years**; for others, the sky's the limit.

“We're seeing death rates, among extreme ages, go down a little bit,” Ken Wachter, a professor of demography and statistics at the University of California, Berkeley, and lead researcher on a 2018 aging paper, told **PBS** at the time. “That means we're not coming up against a limit to lifespan.”

## Don't fear the reaper

OK, so living off one hour of eating kale per day and milking your offspring for young blood doesn't sound fun, but presumably it would be worth it – this is immortality we're talking about, after all.

Unfortunately, the smart money's probably on a limited lifespan. “I'm a little surprised that anyone today would question whether or not there is a limit,” S. Jay Olshansky, an expert on longevity and a professor in the School of Public Health at the University of Illinois at Chicago, told the **New York Times Magazine**.

“It doesn't really matter whether there is a plateau of mortality or not in extreme old age,” he argued. “There are so few people that make it up there, and the risk of death at that point is so high, that most people aren't going to live much beyond the limits we see today.”

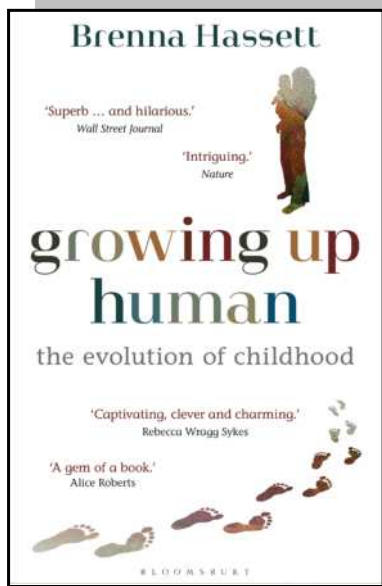
Sure, there are plenty of proposed “cures” to aging and death: research has shown, for instance, that removing senescent cells from mice can improve their health and lifespan; improvements in machine learning have made artificial intelligence (AI)-discovered anti-aging drugs a **realistic possibility**; clinical trials abound in an attempt to target hallmarks of aging such as stem cell supply and cell communication. But for Olshansky, attempting to live forever is akin to trying to run a two-minute mile. “The human body is incapable of moving that fast based on anatomical limitations,” he said. “The same thing applies to human longevity.”

And perhaps, in the end, that's not such a bad thing. Society moves on – and so, to our detriment, do our bodies. Our lifespans may be longer than ever before, but those extra final years are invariably still spent lonely, frail, and increasingly tired of life.

“Do we really want to live longer and longer?” asked Joris Deelen, a molecular epidemiologist at the Max Planck Institute for Biology of Aging, in an interview with the journal **Erstrebenswert**.

“As a scientist, I don't aim for people to live to be 130 or 140 years old,” he said. “What is much more important is that they stay healthy for longer and we can delay the onset of age-related diseases or, ideally, prevent them altogether.” ●





# BABIES ARE WEIRD

In this excerpt from Brenna Hassett's *Growing Up Human*, the bioarchaeologist highlights just how messy and peculiar our species' childhood is.

We humans are animals – and animals, as we all know, are weird. Everything from high school biology classes and David Attenborough documentaries, straight through to the rather striking performance art oeuvre of Isabella Rossellini (if you're ever in need of a brief break from the monotony of science, watch Rossellini's *Green Porno*. It is safe for the working environment, though not for those easily disquieted by the grim realities of snail sex) has shown even the most casual observer of the world that creatures great and small have developed a vast array of techniques for surviving on this planet. Animals burrow, swim, and fly; some walk, some run, and some sort of squelch along. The great fascination of generations of naturalists has been the plethora of responses to life's ultimate question, loosely interpreted as: how are you going to get through it? Leave it to humans to come up with

outside-the-box answers: a childhood that is waving farewell to its evolutionary origins from the back of a cab on the way to who knows where.

You are weird. Your baby is weird, and you were weird as a baby. And after that? You just got weirder. And that is for reasons that include planetary domination, but also a long tale of penis spikes and hidden ovulation and fertile fat and monogamy and unripe and unready babies and the evolution of dads and the secret purpose of grandmas and some very, very strange parenting practices ancient and modern that make us the miracle that we are: the ape that never grew up. We, alone among the animals, have decided that not only do we want to live forever, we want to be forever young. We take an extraordinary amount of time to grow up. Our childhood is incredibly drawn out – not just compared with other animals but other apes. We are terrible at getting pregnant, then when we do we undercook the baby and end up with a ridiculously helpless infant. We throw that infant off the breast and into a world of toddling terror sooner than any other species, but then we just sort of... stay kids. For a really long time. When other apes are getting down to reproducing, we are still off in Neverland, playing and learning and doing what kids do.

Why should this be? The answer is in our evolutionary history, way out in the badlands of speculation, fossils, and other subjects of the science of the past. The weirdness of us is the result of an uncountable number of tiny little decisions made by our parents' parents' parents and so on back for millions of years. To carry a baby or to park it? What kind of milk and how often? Prioritise fat or free-ranging? What to teach the baby and when? Stone tools or Babylonian schools? These types of incremental decisions are still ones parents are making every day and this matters because evolution isn't static. It isn't an arc of progress leading to our sublime selves, perfect and unchanging. Each parenting choice we made – or that was made for us – has resulted in the kind of human we are today. And the choices we make today are the ones that determine what kind of humans we are tomorrow.

The question this book is asking is what that weird, unique human childhood is for. What purpose does it serve in the functioning of our societies and our lives? What is the possible adaptive value of teenagers? Taking the biological stages of growth as a starting point, we can build a framework of how we shoehorn in different adaptive benefits to different parts of our childhood. ●

AUTHOR  
Q&A

## BRENNA HASSETT

AUTHOR OF *GROWING UP HUMAN*

unique aspects of humanity, and absolutely mission critical to species survival, so we are missing a lot if we miss out on understanding childhood.

**Any favorite discoveries from your research?**

There were too many things to list here that were just fascinating to do a deep dive into – like why grandmothers are so suspicious, how awful it was to go to school in Babylon, and why adorable bug-eyed tarsiers are, well, like adorable bug-eyed tarsiers. I could do a whole book on them...

**Who is it for?**

I wrote this book while expecting my first child, as a scientist on a mission to find out what, *precisely*, the business of reproduction is all about for our species. As an anthropologist and a researcher, I wanted hard data on how to have a baby, and how to raise it – this book is for all of those people who have had the same questions that I had: why is it difficult to get pregnant? Why are our pregnancies so dangerous? How are you supposed to carry a baby without fur? Milk does WHAT? What should you do with a baby? What do you need to teach it? Why are human babies so weird?

**What do you hope they will take away from it?**

What I ended up with at the end of this was a detailed understanding of the absolute outrageousness of human evolution, and just how brilliant we have been as a species to come up with our many, many different ways to raise and care for our babies. I hope people come away from reading this book with the knowledge that our childhoods are truly an amazing evolutionary adaptation – and that there is no “one correct way” to experience them. ●

Growing up isn't easy, but it's something that every animal has to do. What that “childhood” looks like can vary wildly across species, and as bioarchaeologist Brenna Hassett reveals, what we face in our formative years is no accident.

**How does human childhood differ from what we see elsewhere in the animal kingdom?**

The number one difference to my mind is how very, very long our species takes to grow up. We spend far more of our lifespan as dependents than any other species. This suggests that whatever is happening in our childhoods, it's pretty evolutionarily important.

**What have been some of the key evolutionary steps in the development of human childhood?**

Our childhoods are the result of so many small incremental changes, it's astonishing to think we got here at all. From the ancestor of all mammals who captured a bit of virus RNA in order to make a placenta, to the development of milk, to carrying our babies around to teaching them Akkadian – nearly every evolutionary choice we make affects the childhoods we have.

**Why is it important to understand the evolution of childhood?**

The continuation of a species is the be all, end all of evolution, but for a host of reasons – like kids and childhood being too girly a subject, and not as important/manly/exciting as imagining fighting lions on the savannah – a lot of evolutionary research seems to have skipped over the part where you actually grow the next generation. However, our childhoods are one of the most

*Growing Up Human*  
by Brenna Hassett  
is published by  
Bloomsbury Sigma  
and is available now.

Fancy an adventurous spa trip with a twist? The Fjallabak Nature Reserve in Iceland is home to the Landmannalaugar Hot Springs. Visitors here can enjoy the warm waters with views of the Rhyolite mountains – but they'll have to share, because wolf spiders have made a winter home for themselves here, hunting amidst the steam.

# A HOT SPRING FOR WOLF SPIDERS

The hot springs in Fjallabak Nature Reserve, Iceland, are a tourist trap for adventurous humans looking to bask in the restorative warm waters and take in an unbeatable mountain view. However, as the BBC's new three-part series *Wild Scandinavia* demonstrates, it's also a popular spot among eight-legged arachnids.

Reaching the Landmannalaugar Hot Springs is something of a quest in itself, requiring specialist vehicles that can handle the tricky off-road terrain. But succeed in making the journey and you'll be rewarded with rich hues of yellow, green, and blue splashed across the mountains where lava, rich minerals, and moss have painted the landscape.

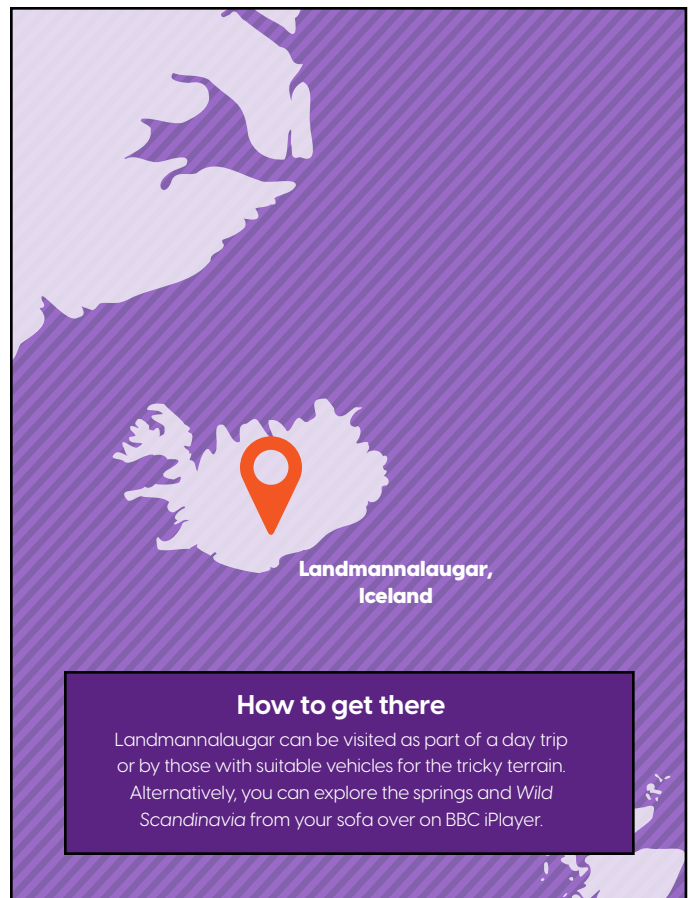
That is unless you're traveling in the depths of winter. For episode producer Poppy Riddle and her team, the reward was capturing world-first footage of one of the region's smallest of national treasures – but the season didn't make it easy.

"The biggest problem we had was that the macro lenses would regularly fog up, particularly when we started filming each day because the glass was cold from our Arctic surroundings and hadn't had a chance to reach the same ambient temperature as the air," Riddle told IFLScience. "We'd have to keep a hawk eye on the spider for our cameraman, so that we could relocate our miniature star whenever the cameraman lost focus from the lens fogging up."

Fortunately, the hassle paid off.

"Once I had seen them, I couldn't unsee them – they were everywhere, coating every strand of moss in a thick mat all around us," Riddle said in a **release**. "I lifted up one of the mineral-stained rocks and five spiders ran out in different directions towards the clusters of tiny black flies that I had also managed to miss... but I had my eye in now, and it seemed as if the ground was heaving with spiders."

If soaking among the "Laugakönguló" wolf spiders (*Pirata piraticus*) isn't action enough, Landmannalaugar also boasts several hiking trails that weave through the Fjallabak reserve. As a geothermally active region, the trails are rich in hot springs, rivers, and steam vents nestled among the colorful mountains. However, not every spring is safe, so for the most relaxing steam experience be sure to check with a guide – or you can always follow the spiders... •



## ESCAPE



### Poor Things

Film from Searchlight Pictures

Unorthodox scientist Dr Godwin Baxter (Willem Dafoe) crudely resurrects a young woman named Bella, played by Emma Stone, following her death by suicide. As she gains her independence, Bella escapes her creator to travel the world with Duncan Wedderburn, a debauched lawyer played by Mark Ruffalo. Based on the book of the same name by Alasdair Gray, it's a reimagining of *Frankenstein* – and one we can't wait to watch.

Available in cinemas from **January 12**.

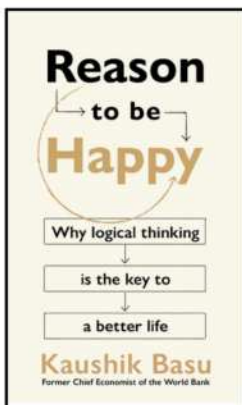
## READ

### Reason To Be Happy

Book by Kaushik Basu

New year, new mindset? This release from Kaushik Basu, Professor of Economics at Cornell University, reveals how our capacity to reason is one of *Homo sapiens'* most underrated skills. Find out how game theory – the logic of social situations – can help you achieve better outcomes and lasting happiness through a series of thought experiments and puzzles.

Available **January 18**.



## SEE



### Blank

Film by Sparky Pictures

Ever had writer's block? Yeah, us too. Ever got it so bad you agreed to attend a writer's retreat that locks you in with an Artificial Intelligence for as long as it takes to get the job done? We wouldn't recommend it after seeing this sci-fi nightmare of what can happen when you let The Bots take over.

Available on digital platforms from **January 8**.

## WATCH



### Society of the Snow

Film from Netflix

In 1972, disaster struck Uruguayan Air Force Flight 571 as the chartered flight carrying a rugby team to Chile crashed into a glacier in the heart of the Andes. The true story is explored in this new film from Netflix, documenting the conditions the survivors had to face in one of the most challenging environments on Earth.

Available from **January 4**.

# SCIENCE IN MEDIA

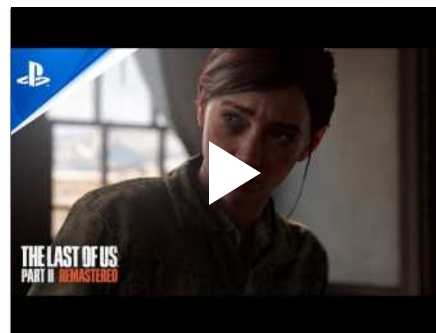


## PLAY

### The Last Of Us II Remastered Game from Naughty Dog

Fans of HBO's take on *The Last Of Us* will remember Joel got a bit trigger-happy come the end of series one. Find out what happened next in the most stressful way possible as you tackle runners, stalkers, clickers, and bloaters in the remastered version of *The Last Of Us II*, the second installment in the gaming phenomenon.

Available **January 19**.





## DATES TO REMEMBER

You may be busy setting resolutions or generally getting ready for the year ahead, but don't forget these awesome events coming your way in January. As ever, we kick off the year with Veganuary. There's also the Quadrantids meteor shower to behold, and opportunities to toast our feathered friends and win prizes for your stunning space snaps.

# JANUARY



### Veganuary

Since 2014, Veganuary has inspired millions of people to try going vegan for the month of January. Now in its 10th year, it hopes to evoke real change and promote a healthier future for our planet and ourselves by supporting people in their efforts to ditch meat and dairy in favor of plant-based alternatives. For more information, or to sign up and receive free meal plans, nutritional advice, recipes, and a celebrity cookbook, visit Veganuary's [website](#).



### National Bird Day

For those in the US, January 5 is National Bird Day – a chance to celebrate all things avian. Our feathered friends face unique threats – from the illegal pet trade and **disease** to habitat loss – making this the perfect opportunity to raise awareness for their needs.

# 5

# 3

### Perihelion

In early January, Earth will reach perihelion – its closest point to the Sun. Our planet's orbit is not circular, but elliptical, meaning that on Jan 3, it will be roughly 5 million kilometers (3 million miles) closer to its star than when it's at aphelion (its farthest point from the Sun), which takes place in early July.



### Quadrantids peak

If you were hoping to start the year with some meteors, you're in luck. The Quadrantids will be whizzing by until January 12, peaking on 3-4 at approximately 12:53 am UTC. The shower, which appears to originate from the constellation Boötes, near the Big Dipper, is one of the strongest and most consistent – you can expect to see up to 110 meteors per hour on a clear night.

# 3/4



### Astronomy Photographer of the Year

Attention astrophotographers: entries for this year's Astronomy Photographer of the Year award open on January 5. You will have until March 4 to submit your best snaps, so what are you waiting for? Find out more info [here](#), and check out our **exclusive interview** with one of the judges for tips on how to take award-winning photos of space. We can't wait to see your out-of-this-world images!



# **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 reasons why New Year's resolutions can end up being disastrous. If you like your science lighter, find out how keeping secrets can sometimes be a good thing.

## GO EASY ON THE GOALS

The temptation to set yourself *all* the resolutions come January can feel pretty overwhelming, particularly when it seems like everyone around you has a never-ending list of goals for the year. It turns out, though – depending on what goals you set and how you do so – resolutions may well be destined to fail from the start, and might not even be that good for you.

If it feels like you're the only one who ever fails at New Year's resolutions, you'll be relieved to know that the vast majority of people are in the same boat. In fact, a **study** in 2021 found that two-thirds of participants had given up on their resolutions within the first month of the year.

As a way of preventing that from happening, we often hear messages suggesting that flexibility and tenacity are key – if something gets in the way of your goal, either change the target or persist through. However, the aforementioned study also discovered that these factors don't actually make good predictors of whether someone will achieve their New Year goals.

And if you're thinking about setting New Year's resolutions in the workplace, it might be wise to take caution. A **paper** from the Harvard Business School described goal setting as "a prescription-strength medication that requires careful dosing, consideration of harmful side effects, and close supervision."

**THERE'S A "CULTURAL EMPHASIS" ON NEW YEAR'S RESOLUTIONS, MAKING THEM MORE ABOUT SOCIAL PRESSURE AND LESS ABOUT WHAT YOU ACTUALLY WANT.**

The authors suggest that some of the side effects of over-prescribing goals in a professional setting can include people ignoring issues unrelated to their target, increases in risky or unethical behavior, and even a loss of motivation.

Whether or not your resolutions satisfy you or other people can also make a difference. Research suggests there's a "cultural emphasis" on New Year's resolutions, potentially making them more about social pressure and less about what you actually want for yourself – which sounds like a recipe for disaster when it comes to wellbeing.

## A SUNNY SIDE TO SECRECY

If your New Year's resolution is to be more honest, you might want to go back to the drawing board – not only are resolutions hard to stick to (just read the other side of this page), but keeping secrets might not actually be all that bad.

There's such a thing as a positive secret; an engagement, a pregnancy, a surprise gift. According to one **study** of over 2,500 people, keeping such good news to yourself, regardless of if you eventually intend to spill it, can help people to feel more energized.

**"WHEN WE FEEL THAT OUR ACTIONS ARISE FROM OUR OWN DESIRES RATHER THAN EXTERNAL PRESSURES, WE ALSO FEEL READY TO TAKE ON WHATEVER LIES AHEAD."**

The researchers found that, on average, people held 14 to 15 pieces of good news, of which an average of five to six were kept secret. Those who had kept their good news to

themselves reported feeling more energized than those who had not. The personal choice involved in deciding to keep it secret may have been the reason for this newfound energy.

"People will often keep positive secrets for their own enjoyment, or to make a surprise more exciting. Rather than based in external pressures, positive secrets are more often chosen due to personal desires and internal motives," said lead author Michael Slepian in a **statement**. "When we feel that our actions arise from our own desires rather than external pressures, we also feel ready to take on whatever lies ahead."

This might have something to do with the feeling of enjoyment building up to a surprise – even when participants simply imagined choosing to hold back good news to make it more of a surprise, they still felt more energized than if they were simply unable to share it.

"People sometimes go to great lengths to orchestrate revealing a positive secret to make it all the more exciting. This kind of surprise can be intensely enjoyable, but surprise is the most fleeting of our emotions," said Slepian. "Having extra time – days, weeks or even longer – to imagine the joyful surprise on another person's face allows us more time with this exciting moment, even if only in our own minds."



**The Darker Side of Science**



**THE LIGHTER SIDE OF SCIENCE**