

# St Benedict's SCIENCE NEWS Monthly

## Welcome to the September 2022 issue

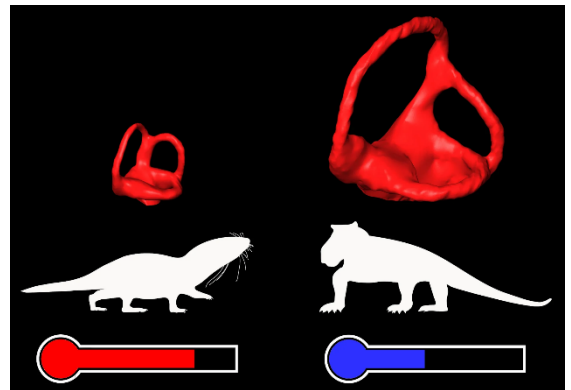
SCIENCE NEWS *Monthly* is produced by the Science Department,  
St Benedict's Catholic Secondary School, Bury St Edmunds, Suffolk, UK.

### EVOLUTIONARY BIOLOGY – When did certain animals become “warm-blooded”?

Warm-bloodedness is a key mammal trait, but it's been a mystery when our ancestors evolved it. We are very good at studying ancient fossil remains but even in a perfectly preserved specimen that might be over a 100 million years old, we cannot take its living temperature! Now, a new study published in the journal *Nature* points to an unlikely source for telling a fossil animal's body temperature: the size of its inner ears.

Among modern animals, only mammals and birds are warm-blooded, and our ability to keep ourselves warm has enabled mammals and birds to survive in icy weather and make long migrations. But it's been a mystery exactly when mammals evolved their high metabolisms and the ability to control the heat produced and, thereby, their body temperature. It's hard to tell whether a fossil animal was warm-blooded -- we can't take the temperature of a creature that lived hundreds of millions of years ago, and we can only guess at whether its behaviour matched an active, warm-blooded metabolism or a slower cold-blooded one. But a team of researchers led by London's Natural History Museum, the University of Lisbon's Instituto Superior Técnico, and the Field Museum in Chicago realized that animals' ears provide an indirect clue about their body temperatures.

All vertebrate animals' ears contain tiny canals, known as semi-circular canals, filled with fluid that helps us balance as we move around. The viscosity, or runniness, of that fluid changes based on temperature, and our inner ears have evolved different sizes so that it can flow correctly. Cold-blooded animals' ear fluid is cooler and thicker, so it needs wider spaces to travel through, while warm-blooded animals have runnier ear fluid, so our semi-circular canals don't need to be as big. The graphic on the right shows the size differences between inner ears (in red) of warm-blooded mammals (on the left) and cold-blooded, earlier reptiles (on the right). Inner ears are compared for animals of similar body sizes. Credit: Romain David and Ricardo Araújo



*"Until now, semi-circular canals were generally used to predict locomotion of fossil organisms. However, by carefully looking at their biomechanics, we figured that we could also use them to infer body temperatures,"* says Romain David, a post-doctoral researcher at the Natural History Museum and one of the study's lead authors. *"This is because, like honey, the fluid contained inside semi-circular canals gets less viscous when temperature increases, impacting function. Hence, during the transition to **endothermy**, morphological adaptations were required to keep optimal performances, and we could track them in mammal ancestors."* [**Endothermy**: physiological generation and regulation of body temperature by metabolic means : the property or state of being warm-blooded]

To track these evolutionary changes, the researchers compared the sizes of the inner ear canals of 341 animals, including 243 living species and 64 extinct ones. They found that mammal ancestors didn't develop the kinds of inner ear structures ideal for warm-blooded animals until 233 million years ago -- nearly 20 million years later than scientists had previously thought warm-bloodedness evolved. And, based on when those differently-sized semi-circular canals showed up in the fossil record, it seems that when mammal ancestors did evolve warm-bloodedness, it happened much more quickly than scientists had thought, around the same time that proto-mammals started to evolve whiskers, fur, and specialized backbones. The evolution of fur and warm-bloodedness at about the same time especially make sense because fur traps the body heat generated by a higher metabolism, helping keep the body at the high temperature it needs to thrive.

The origin of mammalian endothermy is one of the great unsolved mysteries of palaeontology. The latest research suggests that endothermy evolved at a time when many other features of the mammalian body plan were also falling into place.

<https://www.sciencedaily.com/releases/2022/07/220720121004.htm>

## EVERYDAY MATHS - Here's the quickest way to grill burgers, according to maths...

No doubt some readers will have honed their barbecue skills during our long, hot summer. There is much trial and often a lot of error that goes into our barbecue education. Take that burger, for example – one day they come out embarrassingly “rare”, yet try them again and, oops, they are all burnt to a crisp. Now, according to research published by mathematician Jean-Luc Thiffeault in the journal *Physica D*, theoretical calculations may provide the recipe for the perfectly-cooked burger. His review is entitled “*The mathematics of burger flipping*”.

Thiffeault used maths to model how heat moves through an “infinite” slab of meat, which cooks continuously on only the bottom side and cools on the top until the meat is flipped. Flipping heated the meat evenly, speeding up cooking, the analysis showed. And more flips led to a faster cook. For example, flipping this theoretical 1-centimeter-thick burger just once gave it a cook time of 80 seconds, while flipping it 10 times at intervals ranging from six to 11 seconds resulted in a cook time of 69 seconds. Continuing to flip the burger led to a maximum decrease of 29 percent in cooking time.



Thiffeault's friends probably wouldn't want his theoretical hamburger, the mathematician jokes. The infinite slab of meat is considered cooked when it reaches 70° Celsius, or 158° Fahrenheit. “*That's no burger that they would want to eat because it's quite a well-done burger,*” he says.

<https://www.sciencenews.org/article/grill-burger-math-time-calculations>

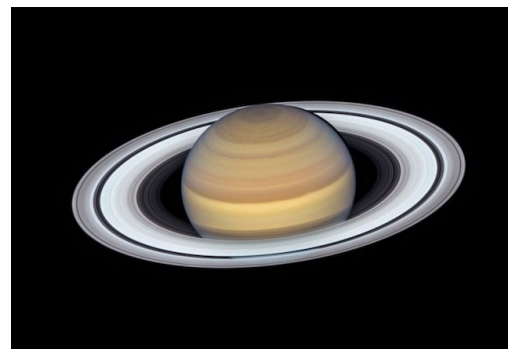
## PLANETARY SCIENCE - Why Jupiter doesn't have rings like Saturn



Jupiter's rings were discovered in 1979 during the flypast of the planet by the space probe *Voyager 1*. They had not been observed from Earth because they are so faint. The question that has puzzled space scientists ever since is why Jupiter, the most massive planet in the Solar System, does not have a glorious ring system like Saturn? Because it's bigger, Jupiter ought to have larger, more spectacular rings than Saturn has. But new research, published by the University of California – Riverside in the journal *Planetary Science*, shows Jupiter's massive moons prevent that vision from lighting up the night sky.

*"It's long bothered me why Jupiter doesn't have even more amazing rings that would put Saturn's to shame,"* said UCR astrophysicist Stephen Kane, who led the research. *"If Jupiter did have them, they'd appear even brighter to us, because the planet is so much closer than Saturn."* Kane also had questions about whether Jupiter once had fantastic rings and lost them. It is possible for ring structures to be temporary. To understand the reason Jupiter currently looks the way it does, Kane and his graduate student Zhexing Li ran a dynamic computer simulation accounting for the orbits of Jupiter's four main moons, as well as the orbit of the planet itself, and information about the time it takes for rings to form.

Saturn's rings (see right) are largely made of ice, some of which may have come from comets, which are also largely made of ice. If moons are massive enough, their gravity can toss the ice out of a planet's orbit, or change the orbit of the ice enough so that it collides with the moons. *"We found that the Galilean moons of Jupiter, one of which, Ganymede, is the largest moon in our solar system, would very quickly destroy any large rings that might form,"* Kane said. As a result, it is unlikely that Jupiter had large rings at any point in its past. *"Massive planets form massive moons, which prevents them from having substantial rings,"* Kane said. All four giant planets in our solar system – Saturn, Neptune, Uranus and also Jupiter – do in fact have rings. However, both Neptune and Jupiter's rings are so flimsy they're difficult to view with traditional stargazing instruments.

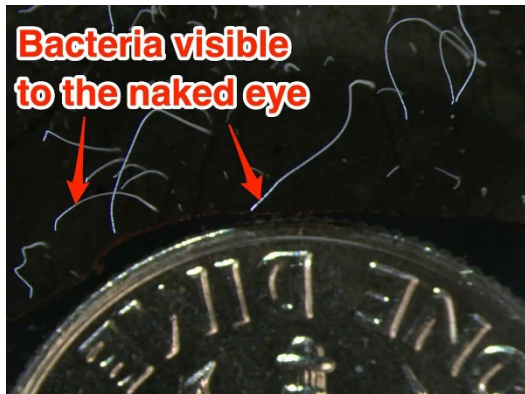


Beyond their beauty, rings help astronomers understand the history of a planet, because they offer evidence of collisions with moons or comets that may have happened in the past. The shape and size of the rings, as well as the composition of the material, offers an indication about the type of event that formed them. *"For us astronomers, they are the blood spatter on the walls of a crime scene. When we look at the rings of giant planets, it's evidence something catastrophic happened to put that material there,"* Kane said.

<https://www.sciencedaily.com/releases/2022/07/220721101508.htm>



## MICROBIOLOGY – A giant bacterium so big you can see it without a microscope!



A swamp-dwelling microbe is shaking up the scientific world. This record-breaking bacterium is so big you can see it without a microscope. The newly discovered species is around one centimetre (0.4 inch) long. Its cells also turn out to be surprisingly complex. Scientists named the new microbe *Thiomargarita magnifica* (Thee-oh-mar-guh-REE-ta Man-YIH-fih-kah). They described its discovery in the June issue of the journal *Science*.

The giant bacterium looks a bit like a human eyelash, according to marine biologist Jean-Marie Volland. He works at the Laboratory for Research in Complex Systems. It's in Menlo Park, California. The newfound microbe is about 50 times the size of other known giant bacteria and it's some 5,000 times larger than an average

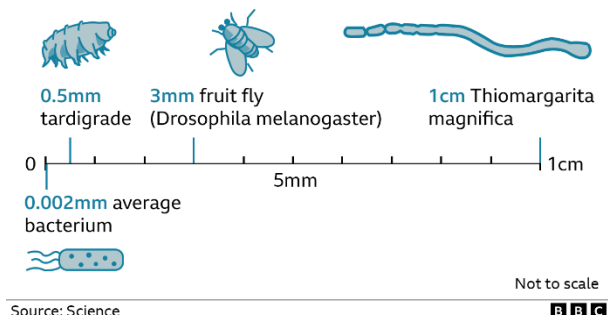
bacterium. The longest specimen of the new species measured roughly 2 centimetres.

The genetic material in most bacteria float freely inside their cells and the organisms are described as *prokaryotes*. But *T. magnifica*'s DNA is coiled in a membrane-walled sac, a compartment similar to the nucleus which is typical of the more complex cells found in *eukaryotes*. That's the group of organisms that includes plants and animals. Olivier Gros first discovered the new bacteria in a mangrove swamp in the Caribbean's Lesser Antilles. A marine biologist, Gros works at the Université des Antilles Pointe-à-Pitre in Guadeloupe, France. At first, he thought the slender, white creatures could not be bacteria — they were just too big. But genetic studies showed he was wrong. Additional studies would reveal those DNA-holding sacs in their cells.

Scientists had long thought that bacteria's lack of cellular complexity limited how large they could grow. But *T. magnifica* is breaking our way of thinking about bacteria. People think of bacteria as small and simple. But that view could have researchers missing lots of bacterial species. It's like scientists thinking the biggest animal that exists is a mouse, but then someone discovers the elephant!

What role *T. magnifica* plays among the mangroves is still unknown. Scientists are also uncertain as to why the species evolved to be so big in the first place. It's possible that being long helps the cells gain access to oxygen and sulfide, both of which are needed by the bacterium to survive.

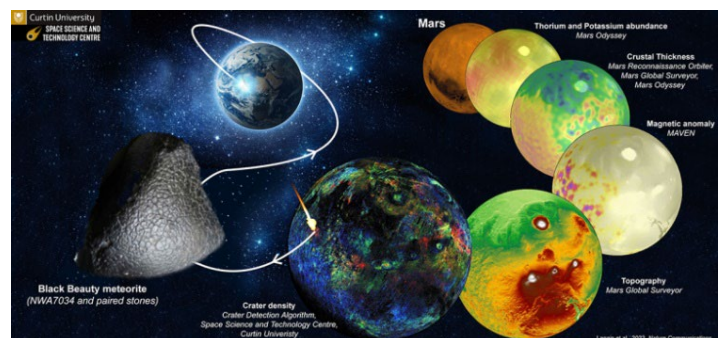
### How does the big bacterium compare?



<https://www.snexplores.org/article/giant-eukaryote-thiomargarita-magnifica-namibiensis-largest-bacterium>

## GEOLOGY - What a Martian meteorite can teach us about Earth's origins

What do Mars and Iceland have in common? These days, not so much. But more than 4.5 billion years ago, it's possible the Red Planet had a crust comparable to Iceland today. This discovery, hidden in the oldest Martian fragments found on Earth, could provide information about our planet that was lost over billions of years of geological movement and could help explain why the Earth developed into a planet that sustains a broad diversity of life and Mars did not.



Iceland is a geologist's (and volcanologist's) dream being astride the Mid-Atlantic Ridge, a region where the Earth's crust is literally coming apart. Now there is evidence that shortly after the formation of the Solar System, 4.5 billion years ago, the planet Mars could have had a crust similar to Iceland's. These insights into Earth's and Mars' past come in a new study published today in the journal *Nature Communications*, by an international team. The study details how they found the likely Martian origin of a 4.48-billion-year-old meteorite, informally named Black Beauty. Its origin is one of the oldest regions of Mars.

"This meteorite recorded the first stage of the evolution of Mars and, by extension, of all terrestrial planets, including the Earth," said Valerie Payré, a postdoctoral researcher in the Department of Astronomy and Planetary Science at North Arizona University (US). "As the Earth lost its old surface mainly due to plate tectonics, observing such settings in extremely ancient terrains on Mars is a rare window into the ancient Earth surface that we lost a long time ago. This work paves the road to locate the ejection site of other Martian meteorites that will provide the most exhaustive view of the geological history of Mars and will answer one of the most intriguing questions: why Mars, now dry and cold, evolved so differently from Earth, a flourishing planet for life?"

<https://www.sciencedaily.com/releases/2022/07/220712190520.htm>

## ENVIRONMENT - Wildlife under stress as dry spell shrinks rivers and streams

It is inevitable that the lack of rainfall for much of the UK will have a knock-on effect on rivers and streams that rely on it. However, there are some streams in the south of England that are truly special – **CHALK STREAMS**.

Our chalk streams are unique – there are only about 200 chalk streams in the world, and most of them are in the southern half of England (with a few in France). Which makes them all the more special. They are home to such iconic species as salmon, otters, water voles and kingfishers, as well as a huge variety of plant and insect species. But a combination of population growth and a spiralling increase in water use have put huge pressure on our rivers and streams. And research shows that a third of the water we take from rivers is wasted. Now, there is a new threat – climate change – exacerbated by the current dry spell.



Chalk streams and rivers rise from springs in chalk bedrock - a layer of spongy rock found beneath much of southern and eastern England, that can hold vast quantities of water. This layer of white limestone is composed of the same material that makes up the white cliffs of Dover and supplies water for rivers and taps in much of the south east of England. Water is pumped out of the ground or taken directly from rivers, to the tune of millions of litres a day. Southern Water, which supplies water to Hampshire and the Isle of Wight, said the decision to introduce a hosepipe ban was a "vital step" to protect the habitats of the River Test and the River Itchen, where it extracts water. The company has said river flows were about 25% lower than they should be for July.

*"This is our Barrier Reef or our Amazon rainforest; it's our unique contribution to global wildlife and biodiversity,"* said Christine Colvin of the

Rivers Trust. She said some small chalk streams were starting to dry up, while larger rivers were experiencing low flows. *"The wildlife here is already stressed as a result of the hotter temperatures and their habitat is shrinking as the water levels are getting lower and lower,"* she added. *"We don't want them to go any lower than they are now."*

At one nature reserve on the banks of the River Itchen in Winchester, a pond has completely dried up, while low river flow is hitting food sources for fish, insects and invertebrates, with knock-on effects for animals higher up the food chain such as water voles and otters. The Rivers Trust has called for a total rethink in the way we use water to cope as dry hot summers likely become more frequent. *"We want to see government and the water companies responding in a coordinated way,"* said Christine Colvin. *"This hot spell and this prolonged dry period is a pressure test for us now to get ready for the long haul because we're going to be seeing many more summers like this in years to come."*

<https://www.bbc.co.uk/news/science-environment-62465805>

<https://www.wwf.org.uk/where-we-work/uk-rivers-and-chalk-streams>

### WORD(S) OF THE MONTH:

## **PROTON (noun, "PRO-ton")**

A proton is a sub-atomic particle with a positive electric charge. It is one of the three types of particles that make up atoms, along with neutrons and electrons. Protons and neutrons form an atom's core, or nucleus. That nucleus is surrounded by a cloud of electrons. In a stable atom, the number of protons equals the number of electrons and the electrons' negative charge balances the protons' positive charge.

The number of protons in an atom determines what element it is. Oxygen, for instance, has eight protons while gold has 79. Atoms of the same element can have different numbers of neutrons. Those different varieties of an atom are called isotopes. And atoms of the same element can gain or lose electrons. When that happens, they become ions of that element. But when atoms gain or lose protons, they become wholly different elements. A single proton more, for instance, is the difference between platinum and gold.

Protons may be tiny, but they still can be broken down into even smaller bits of matter. Those bits are called quarks. Each proton is made of two "up" quarks and a "down" quark. Particles made of quarks, including protons as well as neutrons, are called hadrons.

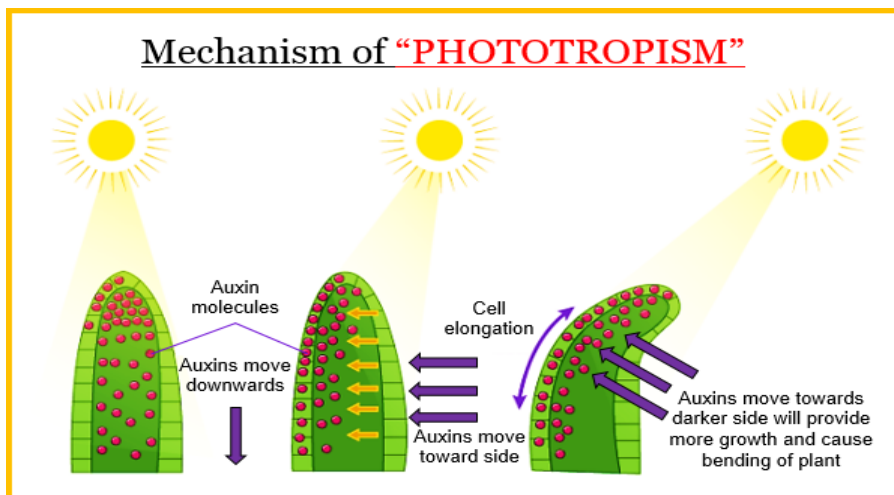


## PLANT SCIENCE – Why do plants grow towards light?

It is one of the most basic properties of the vast majority of plants – the fact that they grow towards light. This ability of a plant to re-direct the development of its shoots in the direction of a light source is known as **phototropism**. Charles Darwin's research on the Galápagos Islands and his theories on evolution are widely known; however, fewer people are aware of his contributions to plant science. A multinational research team has now achieved a significant advancement in the explanation of a key observation that dates back to Darwin.

Darwin noted that plants might grow in a certain direction in response to environmental cues like light or gravity in his book *The Power of Movement in Plants* published in 1880. He provided evidence that the portion of the plant that receives the stimulus and the portion that reacts is distinct. Darwin claimed that in order to explain this, an “influence” must move from the domain of stimulus perception to the area of reaction. However, Darwin would never be able to identify this influence. This “growth accelerating influence” was discovered to be the hormone **auxin** in 1926, and it was subsequently discovered that auxin is the growth factor that controls the majority of plant responses to environmental changes. However, directed transport of the auxin molecule across cells is necessary to make sure that the auxin response is allocated to the appropriate area of the plant and is this mechanism that has remained a mystery....until now.

The first structural basis of auxin transport by PIN proteins has been combined with a comprehensive biochemical characterization with collaborators at the Technical University of Munich led by Associate Professor Ulrich Hammes. The work is published in the journal *Nature*. The results finally provide the molecular mechanism behind auxin transport. It also helps to explain how a broad range of widely used herbicides, collectively known as synthetic auxins and anti-auxins, can be recognized by PIN proteins.



PIN proteins (a family of proteins named “PIN-FORMED”) were first identified in the 1990s and were shown to be involved in auxin transport. They got the name from the distinct morphology derived if they are dysfunctional: the plant became a needle-like ‘pin’, without shoots or flowers. Their function is vital for the establishment of auxin gradients within plant tissues. A gradient that subsequently guides plant growth and development. The results provide the molecular mechanism behind auxin transport. It also helps to explain how a broad range of widely used herbicides, collectively known as synthetic auxins and anti-auxins, can be recognized by PIN proteins.

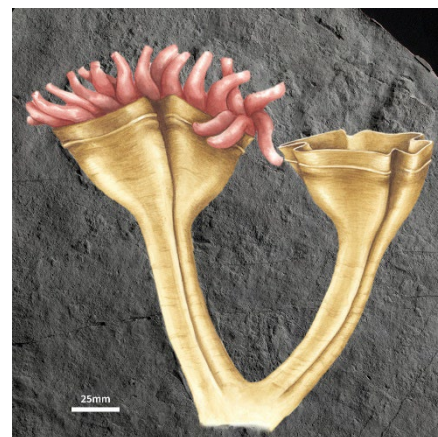
<https://scitechdaily.com/why-do-plants-grow-towards-light/>

## PALAEOBIOLOGY - David Attenborough gets a namesake: the oldest known relative of living animals

Classical scientific wisdom places the origin of modern animals about 539 million years ago during what's called the ‘Cambrian explosion’. At this time, creatures with specialized tissues, organs, guts, and symmetrical left and right sides—all traits we recognize in the animals of today—began popping up. In more recent years, fossil finds from the earlier Ediacaran period have begun to challenge this dogma. That's especially true of creatures that could be classified as *cnidarians*, a group of marine animals that includes today's jellyfish, corals, and sea anemones. However, fossil remains of these creatures are rarely distinct or complete.

Now a newly described fossil, dated to between 556 million and 562 million years old, is thought to be the oldest example of an evolutionary group of animals that is still living today. In honour of our greatest living naturalist, David Attenborough, it has been named *Auroralumina attenboroughii*.

The image on the right is an artist's impression of what the creature would have looked like when alive – about 20cm tall. The team concluded that *A. attenboroughii* is a *cnidarian* and a member of the subgroup called *medusozoans*, which contains modern jellyfish, they report in the journal *Nature Ecology & Evolution*. If true, the fossil becomes the oldest animal with direct living descendants in the fossil record—full stop.



<https://www.science.org/content/article/david-attenborough-gets-namesake-oldest-known-relative-living-animals>

## COMPUTATIONAL BIOLOGY – Using mathematics to fight malaria

The global effect of malaria is devastating. In 2020, there were more than 240 million cases and over 600,000 deaths, mostly in lower income countries in Africa. The most vulnerable are children under the age of five. The World Health Organization has set ambitious targets for eliminating malaria by 2030. However, these malaria elimination targets hinge on having effective treatments—a difficult feat given the parasite that causes malaria, *Plasmodium falciparum*, is developing resistance to the different antimalarial drugs in use and effective vaccines are not available.

The parasite, which is spread by the female *Anopheles* mosquito, is capable of developing some resistance to all currently available antimalarials, including the most pivotal artemisinin derivatives that are the most effective, and this resistance is spreading. In Africa, where by far the majority of malaria cases and deaths occur, the antimalarial drug sulfadoxine-pyrimethamine (SP) is used as a preventive treatment for infants, children and during pregnancy. However, we know resistance to SP is spreading as we can track a marker of resistance in the parasite itself—a genetic mutation in the dihydropteroate synthase (pfdhps) gene.

There is an urgent need to be able to track and predict the levels of SP resistance so as to guide its use and indicate to health agencies whether an alternative antimalarial should be used in particular regions. Indeed, as resistance to other antimalarials spreads, so too will agencies want to know how resistance to other antimalarials is varying across different regions and at different times. How can we do this? **With mathematics.**

Working with the WorldWide Antimalarial Resistance Network (WWARN), based at the University of Oxford and funded by the Bill and Melinda Gates Foundation, a team of international researchers have developed sophisticated mathematical models to reliably predict genetic resistance to SP in Africa in place and in time. The research, published in the journal *PLOS Computational Biology*, used data on the prevalence of the pfdhps mutations in Africa to develop a statistical model. This allowed the researchers to map the estimated prevalence of the SP resistance marker in Africa from 1990 to 2020. These maps fill in the gaps where no information is available and can be used by health agencies to guide new policies about where and when the drug is appropriate to use—providing much needed insight about where SP can be used as part of preventive treatments.

These predictive maps will have a direct public health impact. Spatial information like this on the spread of antimalarial resistance is critical for health organizations to prioritize surveillance measures, and plan control and elimination efforts.

<https://phys.org/news/2022-08-mathematics-malaria.html>

## CAT SCIENCE - You can't hide from your cat, so don't even try

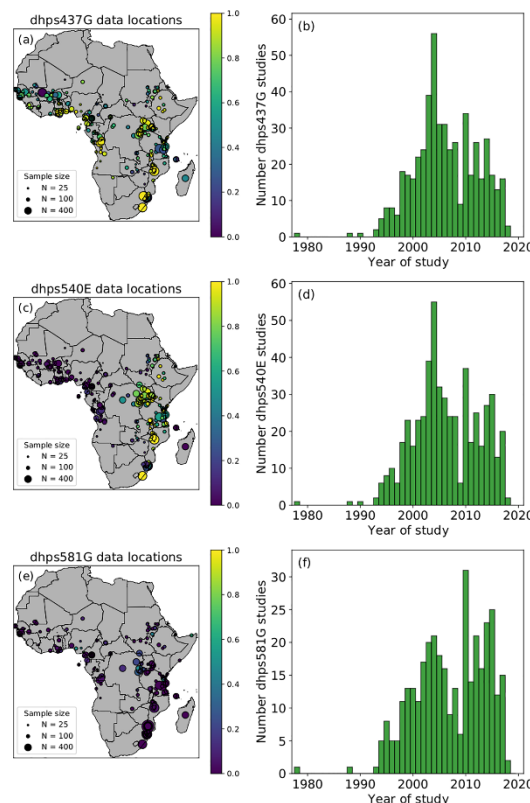
Cats create "mental maps" using audio cues, scientists have discovered. Your cat is probably keeping track of where you are, even if your feline friend isn't in the same room with you.

Scientists recently learned that domestic cats create "mental maps" that tell them where nearby humans are located, based on where sounds are coming from. The researchers tested cats by playing recordings of human voices calling the cats' names; they then played those recordings again, only this time through a speaker in a different place, so that the same sounds came from farther away. The cats acted surprised when the familiar voice came from a location that they didn't expect, based on what they had already heard. This suggests that cats spatially orient their unseen human companions using audio cues — a cognitive ability that was previously unknown in felines.

Knowing that something continues to exist even if it's out of sight (as the cats demonstrated in their responses) is called object permanence, and it's a test that researchers use to measure animal intelligence. Human infants typically begin to develop object permanence when they're around 8 months old, and this ability becomes more refined when babies reach 10 to 12 months old; at that stage, babies can find hidden objects, and they begin to realize that their parents and caregivers don't disappear just because they can't be seen.

Being able to form a mental picture of the outside world is an important feature in complex thinking, and these findings offer new insights that could inform future studies of feline cognition. Further proof, if any were needed, that cats have got us just where they want us!

<https://www.livescience.com/cats-track-owners>





## LOCAL ORNITHOLOGY NEWS – Rare birds nesting in town!

St Edmundsbury Cathedral has welcomed rare birds as its newest visitors to the grounds this summer. The RSPB has confirmed that the birds nesting in The Yard at St Edmundsbury Cathedral are **BLACK REDSTARTS**. With fewer than 50 nesting pairs in the UK, the black redstart is on the **Red List** of Birds of Conservation Concern.

The birds appeared in The Yard, an area being redeveloped as part of a social action project for young people. Due to their protected status, the Cathedral is moving planned holiday activities to a different area of the grounds to ensure minimal disruption until the birds fledge. The Yard project lead, Jane Dow, said: *"We're thrilled by our new visitors. To think there are so few in the UK and they've chosen our Yard to make their summer home. By moving our activities out of their way for the time being, we hope to provide them with a space in which they can flourish."*



The black redstart is a member of the chat subfamily - a group of related birds that includes robins, redstarts, nightingales, stonechats, and wheatears. Black redstarts generally breed in mountainous regions, nesting on rocky crags, scree slopes, cliffs, and boulder fields. However, in recent decades they have adapted to living in the hearts of cities and industrial areas, swapping cliffs and crags for old and damaged buildings, power stations, cranes, and other aspects of urban infrastructure. They need nooks and crannies to nest in, and weedy, stony areas for foraging.

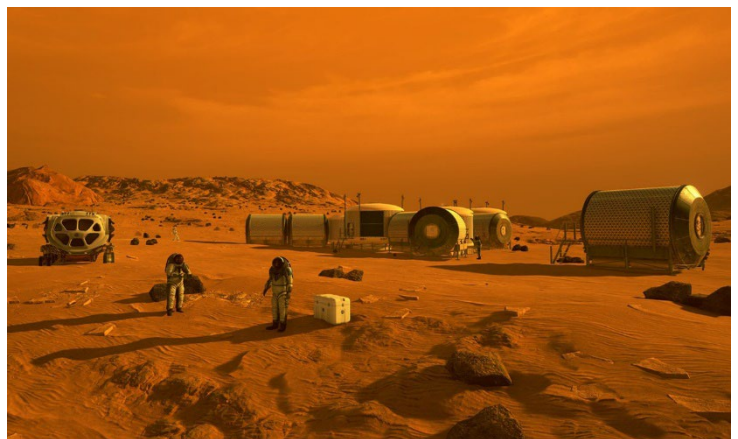
Black redstarts are widespread throughout Europe, the Middle East, Asia, and North Africa, but the first breeding record in Britain wasn't until the 1920s. The population boomed after the Second World War, with buildings damaged by the Blitz providing perfect nesting sites - this preference earned the black redstart the nickname of the 'bomb-site bird'. They spread throughout London and have since established populations in other urban centres. The population has fluctuated since then but is still fewer than 50 nesting pairs. Our breeding black redstarts are at risk from redevelopment, which can remove the stony, sparsely-vegetated places in which they forage and the cracks and gaps in buildings they use for nest sites.

<https://www.eadt.co.uk/news/rare-birds-arrive-on-cathedral-grounds-9199230>

## PLANETARY EXPLORATION - 'Plasma' breakthrough could let humans live on Mars

Numerous space agencies hope to send humans to live on Mars in the coming years. But the planet is hostile: it does not have the oxygen for humans, or the fuel for the machinery and equipment they will require to live. Permanent colonies could only be sustained by all their supplies being ferried from Earth, which is not feasible.

Engineers hope to solve this with technology that would produce the oxygen and other materials needed for the years that humans hope to spend on the planet. If those issues cannot be solved, humanity may never be able to survive on the 'Red Planet'. As engineers look to produce the requisite oxygen for human life on Mars, they are hit by problems. But a new breakthrough could help, according to new research described in a paper, **'Plasmas for in-situ resource utilization on Mars: Fuels, life support, and agriculture'**, published in the *Journal of Applied Physics*.



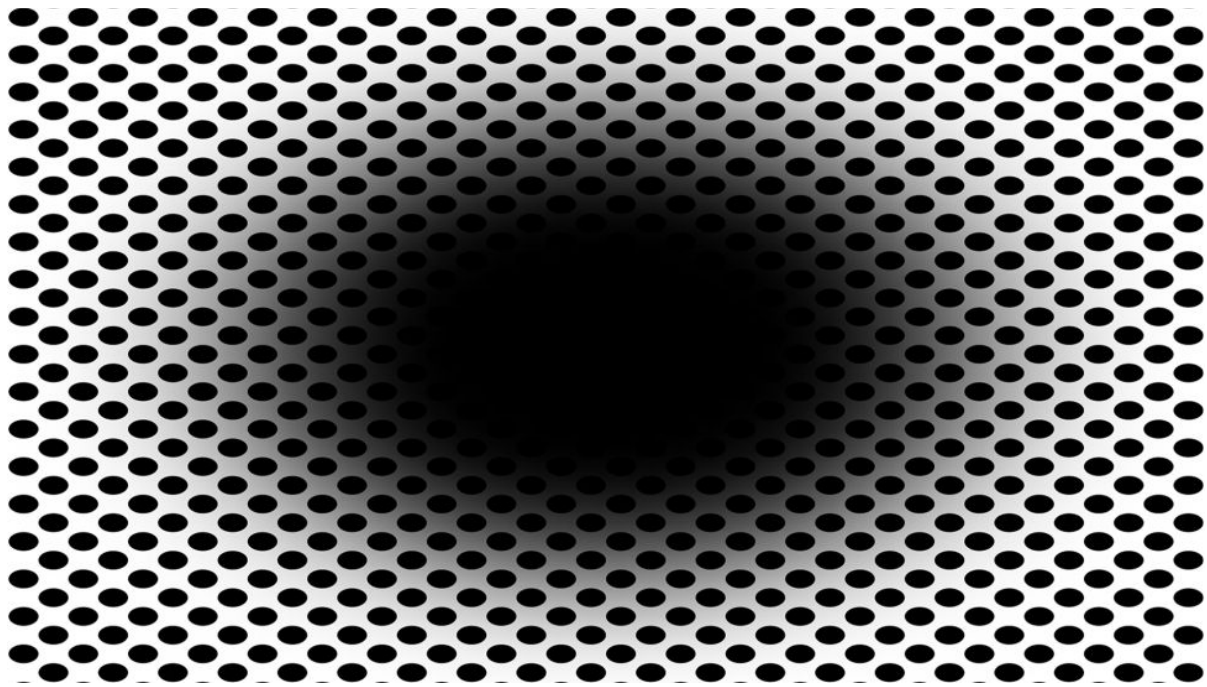
Plasma is the fourth natural state of matter. It contains free charged particles, such as electrons and ions, which can be used to help make oxygen. The basic material will be carbon dioxide, which is plentiful as it makes up 95% of the Martian atmosphere. Unfortunately, CO<sub>2</sub> is a very difficult molecule to break apart to release its O<sub>2</sub>. However, scientists have shown experimentally that the high energies and temperatures in 'plasma' can aid the process. *"When bulletlike electrons collide with a carbon dioxide molecule, they can directly decompose it or transfer energy to make it vibrate,"* said Vasco Guerra, of the University of Lisbon, an author on the new paper. *"This energy can be channelled, to a large extent, into carbon dioxide decomposition."*

The same system could help break apart carbon dioxide molecules to make green fuels and recycle chemicals, scientists suggest – helping address climate change on Earth, too.

<https://www.msn.com/en-gb/news/techandscience/plasma-breakthrough-could-let-humans-live-on-mars/ar-AA10J0r2?ocid=msedgdhp&pc=U531&cvid=f31d89dc547a4b3085aef8fd4b526dcd>

## STRANGE SCIENCE - How this illusion will make you see an 'expanding black hole'!

A brand new optical illusion tricks the majority of people into thinking that a dark "black hole" region at the centre of a stationary image is rapidly expanding, as if the observer were moving toward it. Researchers now suspect that the image literally tricks the brain into thinking that the observer is moving into a darkened space, like a cave or tunnel.



The illusion consists of a large black ellipse surrounded by a dark halo on a white background filled with smaller black ellipses. Typically, as a person stares at the image, the dark elliptical region will appear to expand outward for a couple of seconds, which is why the design has been nicknamed the "expanding hole." In a new study, published in the journal *Frontiers in Human Neuroscience*, researchers found that 86% of the 50 participants who looked at the optical illusion reported seeing the expanding darkness. The team suspects that the illusion plays on the brain's perception of changing light levels.

"The expanding hole is a highly dynamic illusion," lead researcher Bruno Laeng, a psychologist at the University of Oslo in Norway, said in a statement. "The illusion tricks the mind into seeing a change in brightness that isn't really there, as if the observer were heading forward into a hole or tunnel," Laeng added.

The illusion hijacks a natural reaction in the brain that predicts when light is about to change, the researchers said. The dark region at the centre of the image mimics the entrance to a cave or tunnel, and the surrounding pattern gives the observer the impression that they are moving toward that cave or tunnel. When the brain registers a potential change in light intensity, such as walking into a cave, it can trigger the pupils to contract or dilate to prepare you for the upcoming disruption in advance.

The illusion is so good at tricking the brain that it also causes people's pupils to dilate as if they were actually moving into a darker space. The researchers used special cameras to track observers' eye movements as they looked at the illusion, and the scientists found that their subjects' pupils were expanding just like the dark region of the illusion appeared to expand in their minds. Those who saw a bigger dark hole showed more dilation than those who saw a less-stark "black hole," the researchers said.

The researchers also exposed observers to versions of the illusions where the colour of the ellipses had been changed. When this happened, the illusion's expanding effect was reduced and the observer's pupil dilations were less noticeable. And when the colours were inverted (placing white ellipses on a black background), the observers' pupils contracted, instead of expanding, as if they were moving toward a bright light.

There is one mystery that the researchers have, as yet, been unable to resolve: the researchers have no idea why some people who look at the expanding hole are unable to see the dark region moving. The team hopes to test the illusion on other animals and see if they can learn more about how those visual systems differ from that in humans, to solve this mystery.

<https://www.livescience.com/expanding-hole-optical-illusion-explained>

Although there are examples of 14,000-year-old palaeolithic art in which we can infer optical illusions, it is impossible to say exactly when humans first consciously produced such illusions. What is certain, however, is when we first wrote about visual effects in nature – ARISTOTLE (the ancient Greek philosopher, 384-322 BC) wrote the first known descriptions of perceptual illusions in his *Parva Naturalia* (short treatises on nature). Aristotle's observations included phenomena such as pareidolia (our predisposition to see faces in meaningless visual patterns), afterimages, and various kinds of adaptation illusions, such as the motion aftereffect (also known as the waterfall illusion).