

St Benedict's SCIENCE NEWS Monthly

Welcome to the May 2022 issue

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

LARGE HADRON COLLIDER RESTARTS SEARCHING FOR THE ANSWER TO THE ULTIMATE QUESTION OF LIFE, THE UNIVERSE and EVERYTHING!?

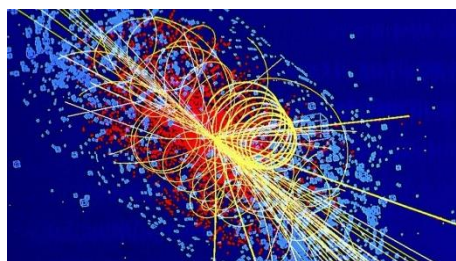
On April 22, 2022, at 11:16 BST, two beams of protons circulated in opposite directions around the Large Hadron Collider's 27-kilometre (16.8 mile) ring at their injection energy of 450 billion electronvolts (450 GeV). This marked the end of a lengthy maintenance and upgrade period during which the LHC has been inactive for more than 3 years. Now, more powerful than ever, it is ready to start a new 4 year program of research.



"These beams circulated at injection energy and contained a relatively small number of protons. High-intensity, high-energy collisions are a couple of months away," says the Head of CERN's Beams department, Rhodri Jones. *"But first beams represent the successful restart of the accelerator after all the hard work of the long shutdown."* If an energy of 450 billion electronvolts sounds impressive, eventually the LHC will achieve energies in excess of **13 trillion** electronvolts!

The LHC is now more powerful and its instruments are more sensitive, allowing researchers to study the collision of particles from the inside of atoms in higher definition. Its software has also been enhanced so that it is able to take data at a rate of 30 million times each second; and its beams are narrower, which greatly increases the number of collisions. What all this means is that there's now the best chance ever of the LHC finding sub-atomic particles that are completely new to science. The hope is that it will make discoveries that will spark the biggest revolution in physics in a hundred years. As well as believing that they may find a new, **fifth force of nature**, researchers hope to find evidence of an invisible substance that is thought to make up most of the Universe: **Dark Matter**.

For the past 20 years, Dr Sam Harper has been trying to find evidence of a fifth force of nature, with gravity, electromagnetism and two nuclear forces being the four that physicists already know about. He confesses to feeling *"a little bit terrified"* as the LHC embarks on its next set of experiments. *"We are desperately trying to get everything together and we are working really hard to make sure we don't miss any possible new physics. Because the worst thing in the world will be that the new physics is there, and we don't find it."* But overriding Sam's terror is intense excitement about what the next few years hold. *"The thing that drives all particle physicists is that we want to discover the unknown and this is why things like the fifth force and dark matter are so exciting because we have no idea what it could be or if it exists and we really want to find this out."*



HOW IT WORKS! It is an old adage that if you want to know what something is made of, you smash it up to find out what is inside. This is essentially what the LHC does. It is what is known as a particle accelerator. The "particles" are protons that, because of their positive electrical charge, can be accelerated to extremely high velocities by powerful electromagnets. Imagine, therefore, two streams of protons being accelerated in opposite directions and then being merged. Inevitably some protons will collide with each other and, because of the immense energy levels involved, will breakdown into their smaller,

component particles that fly off in different directions. Their path and energy are tracked by special detector systems, and it is this trail that tells the scientists what kind of particle it is, rather like determining the species and characteristics of an animal from its footprints. It is thus hoped that the new experiments will detect sub-atomic particles that we have never seen before, as well as a fifth force of nature.

ARCHAEOLOGY – Who invented trousers?

Trousers are technically items of clothing worn from waist to ankles, with both legs being covered separately. The word itself is very “English” – and such garments are known locally as *trews* in Scotland and *pants* in North America. But who invented them?

Like many similar questions, the answer is lost in the mists of time. There is some evidence from cave paintings that what appear to be trouser-like garments were worn during the Upper Palaeolithic Age (50,000-10,000 BCE). The oldest known trousers, recovered from mummified human remains, were from a Chinese cemetery dated to a period between 1300 and 1000 BCE.

Little rain falls on a gravelly desert in western China's Tarim Basin. In this dry wasteland lie the ancient remains of herders and horse riders. Although long forgotten, these people made one of the biggest fashion splashes of all time. They pioneered trousers. The photo on the right shows the trousers that were actually recovered back in 2014. Since then they have been further examined by archaeologists, fashion designers, geoscientists, chemists and conservators, too. The research team shared its findings in the journal *Archaeological Research in Asia*. Those vintage trousers, they now show, weave a tale of textile innovation. They also showcase the fashion influences of societies across ancient Eurasia.

A lot of techniques, patterns and cultural traditions went into creating the original innovative garment, notes Mayke Wagner, an archaeologist who directed the project at the German Archaeological Institute in Berlin. “*Eastern Central Asia was a laboratory [for textiles],*” she says.

The mummified body on which the trousers were found has become known as *Turfan Man*, after the nearby Chinese city. His grave also contained a leather bridle and wooden horse bit, indicating that he was a horseman. This may give a clue as to why trousers would have been so popular among horseman – they are a much more convenient garment for sitting astride a horse! Within a few hundred years, other groups across Eurasia would begin wearing trousers like those found in China. Such garments eased the strain of riding horses bareback over long distances. Mounted armies also debuted around that same time.

<https://www.sciencenewsforstudents.org/article/pants-oldest-ancient-horseman-asia-culture-origin>



GEOPHYSICS - Ancient helium leaking from core offers clues to Earth's formation

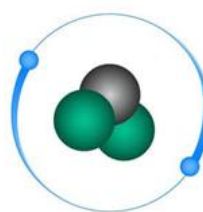
Helium-3, a rare isotope of helium gas, is leaking out of Earth's core, a new study published in the journal *American Geophysical Union* reports. Because almost all helium-3 is from the Big Bang, the gas leak adds evidence that Earth formed inside a **solar nebula**, which has long been debated. “Normal” helium, helium-4, has 2 protons and 2 neutrons in its atomic nucleus. Its rare isotope, helium-3, has 2 protons but just a single neutron.

Helium-3 has been measured at Earth's surface in relatively small quantities. But scientists did not know how much was leaking from the Earth's core, as opposed to its middle layers, called the mantle. The new study pins down the core as a major source of helium-3 for the Earth. Some natural processes can generate helium-3, such as the radioactive decay of tritium (an isotope of hydrogen), but helium-3 is made primarily in solar nebulae – massive, spinning clouds of gas and dust like the one that gave rise to our Solar System. Because helium is one of the earliest elements produced in the universe, most helium-3 can be traced back to the Big Bang.

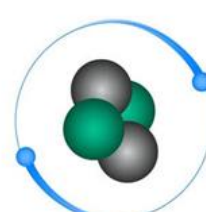
As a planet grows, it accumulates material from its surroundings, so its composition reflects the environment in which it formed. To get high concentrations of helium-3 deep in the core, Earth would have had to form inside a thriving solar nebula, not on its fringes or during its waning phase. The new research adds further clues to the mystery surrounding Earth's formation, lending additional evidence to the theory that our planet formed inside the solar nebula.

About 2,000 grams of helium-3 leak out of the Earth every year, “*about enough to fill a balloon the size of your desk,*” said lead study author Peter Olson, a geophysicist at the University of New Mexico. “*It's a wonder of nature, and a clue for the history of the Earth, that there's still a significant amount of this isotope in the Earth's core.*” However, future work looking for other nebula-created gases, such as hydrogen, leaking in similar rates and locations as helium-3 could be a “smoking gun” for the core as the source, Olson said. “There are many more mysteries than certainties.”

<https://www.sciencedaily.com/releases/2022/03/220328133609.htm>



Helium-3
2 protons, 1 neutron



Helium-4
2 protons, 2 neutrons

ASTRONOMY - The Universe's background starlight is twice as bright as expected

Even if you were to remove the bright stars, the glowing dust and other nearby points of light from the inky, dark sky, a background glow would remain. That glow comes from the cosmic sea of distant galaxies, the first stars that burned bright after the Big Bang, faraway coalescing gas — and, it seems, something else in the mix that's evading researchers.

For decades, astronomers have measured the extragalactic background light in different wavelengths, from radio waves to gamma rays. This provides a census of the universe and gives researchers hints into the processes that emit those types of light. But the **background visible light** — dubbed the **cosmic optical background**, or COB — is challenging to measure from the inner solar system. Here, lots of interplanetary dust scatters sunlight, washing out the much fainter COB. The Pluto-visiting **New Horizons** spacecraft, however, is far enough from the Sun that scattered sunlight doesn't flood the spacecraft's images. It is currently beyond the Solar System at a distance of more than 7 billion kilometres. And New Horizons' data has given us a problem!

In September 2021, astronomers pointed the spacecraft's LORRI camera toward a patch of sky and took a bunch of pictures. They digitally removed all known sources of light — individual stars, nearby galaxies, even heat from the spacecraft's own nuclear power source — and measured what was left to estimate the COB. Then they used large archives of galaxy observations, like those from the Hubble Space Telescope, to calculate the light emitted by all the galaxies in the universe. The problem came when it turned out that the measurement of the COB by New Horizons was **double the calculated value**.

There are several astronomical reasons that could explain the discrepancy. Perhaps rogue stars stripped from galaxies linger in intergalactic space. Or maybe there is a very faint population of very compact galaxies that are just below the detection limits of Hubble. If it's the latter case, astronomers should know in the next couple years because NASA's recently launched James Webb Space Telescope will see these even-fainter galaxies.

Perhaps the most intriguing possibility is that there is something about the visible that we simply do not yet know. Perhaps New Horizons has seen a light that we just didn't think existed. The task now is to find out exactly what is causing it.

<https://www.sciencenews.org/article/universe-cosmic-background-light-bright-new-horizons>



EVERYDAY PHYSICS – It's thanks to Einstein and his Theory of Relativity that GPS works

For most of us in our everyday lives we have probably heard of the "Theory of Relativity", but likely have no idea really what it's all about. Some might think that it has nothing to do with them and is just in the realm of extreme physics....but they would be completely wrong.

When the Soviet Union launched the first artificial satellite, Sputnik 1, into Earth orbit in 1957 the possibility of satellite communication and navigation became a reality. One modern manifestation is the **Global Positioning System (GPS)** network of satellites – but these would be worse than useless if it were not for relativity!

First, you have to understand a little bit about relativity and moving objects, especially when it comes to the passage of time. First, every time you measure an object's velocity or how it experiences time, it's always in relation to something else. Second, the speed of light is the same no matter who measures it or how fast the person measuring it is going. Third, nothing can go faster than light. The implications of this are profound. If the speed of light is always the same, it means that an astronaut, or satellite, going very fast relative to Earth will measure the seconds ticking by more slowly than an Earthbound observer will. Time essentially slows down for the astronaut/satellite — a phenomenon called **time dilation**. Also, any object in a big gravity field accelerates, so it also experiences time dilation.

For **GPS** navigation to function as accurately as it does, satellites have to consider **relativistic effects**. This is because even though satellites aren't moving anywhere close to the speed of light, they are still going pretty fast. The satellites are also sending signals to ground stations on Earth. These stations (and the GPS technology in a car or smartphone) are all experiencing higher accelerations due to gravity than the satellites in orbit.

The satellites use clocks that are accurate to a few nanoseconds (billionths of a second). Because each satellite is 12,600 miles (20,300 kilometres) above Earth and moves at about 6,000 mph (10,000 km/h), there's a **relativistic time dilation** that tacks on about 4 microseconds each day. Add in the effects of gravity, and the time dilation effect goes up to about **7 microseconds (millionths of a second) per day**. The difference is very real: If no relativistic effects were accounted for, a GPS unit that tells you it's a half mile (0.8 km) to the next petrol station would be **5 miles (8 km) off after only one day!**

<https://www.livescience.com/58245-theory-of-relativity-in-real-life.html>



SPACE SCIENCE – Genetically modified lettuce may help astronauts keep their bones healthy on long space trips

Spending an extended amount of time in the microgravity environment of space can be hard on the human body. Recent NASA studies carried out on Scott Kelly and Christina Koch, the first two astronauts to spend a year on the International Space Station, found they had significantly reduced muscle mass and lost more than one per cent of their bone mass each month – a condition known as osteopenia. With a mission to Mars being planned by NASA for some point in the 2030s and likely lasting around three years, many scientists are searching for possible solutions to help combat these effects.



Now, a team from the University of California, Davis, have developed a genetically modified strain of lettuce capable of producing a bone-stimulating hormone that could help to protect astronauts from developing osteopenia on long journeys through space. As regular lettuce has already been grown successfully on the ISS, the team wanted to see if they could genetically engineer a strain of the lettuce plant that could produce the bone stimulating chemical **human parathyroid hormone (PTH)**.

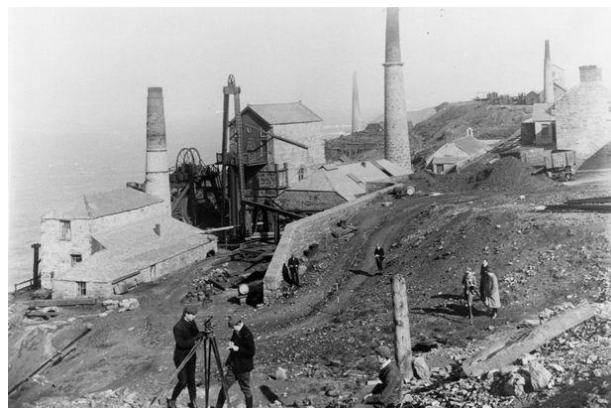
The researchers introduced a gene encoding the hormone into the lettuce by infecting the cells with *Agrobacterium tumefaciens* – a species of bacteria used in the lab to transfer genes to plants. The technique would also have the advantage of taking up far less space than large quantities of ready-made medicines. *“Astronauts can carry transgenic seeds [genetically modified], which are very tiny – you can have a few thousand seeds in a vial about the size of your thumb – and grow them just like regular lettuce,”* said co-author Somen Nandi. *“They could use the plants to synthesise pharmaceuticals, such as PTH, on an as-required basis and then eat the plants.”*

Initial test show that one kilogram of the lettuce contains around 10mg of the hormone, making the daily portion required about 380 grams. The team haven't tasted the lettuce as yet as its safety has not been sufficiently determined, though they say it is likely to taste much the same as regular lettuce. They now want to test the lettuce's effectiveness in animal models and test how well it grows on the ISS before moving on to human trials.

<https://www.sciencefocus.com/news/genetically-modified-lettuce-may-help-keep-astronauts-bones-healthy/>

GEOLOGY – How Cornwall might supply all UK's future lithium requirement

Given that within 8 years the government will require all new cars to be EV's (electric vehicles), the race is on to produce better batteries. Currently most vehicles are powered by a version of **Lithium-ion battery** and, with its high power and energy density, it is likely to remain the primary power source. As demand for batteries increases, so will the demand for lithium. Britain relies either on batteries manufactured abroad, or on lithium imported from countries where it is mined such as North and South America, Asia, South Africa, Australia, and China. But what if Britain had its own source of that essential element, lithium?



It turns out that it does - in an area of the country that was once one of the world's greatest centres for metal mining – Cornwall. Two companies are convinced that the historical mining region of Cornwall holds a bounty of lithium, but first they need to get to it. Mining for tin and copper in the region actually began during the early Bronze Age (~2150 BCE) and over time other metals, eg., arsenic, silver and zinc, were also extracted. By the 18th century Cornwall was the mining centre of the world. But the glory days would see their end; in 1866 copper prices crashed, copper deposits were depleting and new resources were being discovered abroad. By the late 19th century mining in Cornwall had diminished and only a small number of mines survived.

Now interest is turning to the possibility that there may be enough lithium in Cornwall to meet UK demand when the country moves from fossil fuel vehicles to electric ones – they just have to find a cost-effective way to get it. They think the Cornish lithium deposits could unlock the UK's electric dreams, making the extraction of lithium and manufacturing of lithium-ion batteries possible in the country for the first time, reducing the substantial ecological footprint of current battery technology.

Modern geologists are actually using some of the original, hand-drawn maps made by Cornish miners 200 years ago. By using computers to compile the maps, geologists are building up a 3-D model of the Cornish landscape. In conjunction with electromagnetic spectrum surveys it is hoped that this information will enable geologists to target the most profitable areas for lithium-ore mining.

<https://www.wired.co.uk/article/cornwall-lithium>

OCEAN BIOLOGY – ‘Aurora of the sea’: luminous plankton light up New Zealand shores

Last month a remarkable phenomenon was observed on shores in New Zealand – **bioluminescence**.

Although it is reasonably common in the ocean, it rarely manifests in such a way along shorelines as was seen recently. *“It’s also called the aurora of the sea – like the Aurora Australis you see in the sky,”* says Sajith Muraleedharan, a photographer who captured the phenomenon in Napier, New Zealand. The light is activated by movement: cresting waves begin to glow, splashes sparkle, footprints glimmer blue in the wet sand, and swimming fish can leave sparkling trails. *“Every time a wave comes in, you can see this beautiful phenomenon. It’s amazing – a lot of people were there, a lot of people with families, some of them were swimming,”* Muraleedharan said. *“It is indeed a great thing to witness.”*



The phenomenon is caused by blooms of plankton and phytoplankton species, some of which use the “luminescence” adaptation to evade or distract predators. *“Dinoflagellates produce this light when disturbed, and will give a light flash lasting a fraction of a second – disturbing the predator trying to consume them,”* said Karl Safi, algal ecologist at the National Institute of Water and Atmospheric Research. The phenomenon only occurs at night, Safi said, as the creatures have an inbuilt biological clock, and do not glow during the daytime – even if put into a dark space or container.

Bioluminescence is light produced by a chemical reaction within a living organism. Bioluminescence is a type of **chemiluminescence**, which is simply the term for a chemical reaction where light is produced.

<https://www.theguardian.com/world/2022/apr/05/aurora-of-the-sea-luminous-plankton-light-up-new-zealand-shores>

PALAEONTOLOGY - Fossil of dinosaur killed in asteroid strike found

On a day 66 million years ago the reign of the dinosaurs on land and in the oceans ended and the rise of mammals began. It is now widely accepted that a roughly 12km-wide space rock hit our planet to cause the last mass extinction. The impact site has been identified in the Gulf of Mexico, off the Yucatan Peninsula, and is known as the **Chicxulub Impact site**.

Scientists have presented a stunningly preserved leg of a dinosaur, complete with skin, in just one of a series of remarkable finds emerging from the Tanis fossil site in the US State of North Dakota. But it's not just their exquisite condition that's turning heads - it's what these ancient specimens purport to represent – that the Tanis creatures were killed and entombed on the actual day the giant asteroid struck Earth, 66 million years ago. Very few dinosaur remains have been found in the rocks that record even the final few thousand years before the impact, so to have a specimen from the cataclysm itself would be extraordinary.

Along with that leg, there are fish that breathed in impact debris as it rained down from the sky. We see a fossil turtle that was skewered by a wooden stake; the remains of small mammals and the burrows they made; skin from a horned triceratops; the embryo of a flying pterosaur inside its egg; and what appears to be a fragment from the asteroid impactor itself. *“We’ve got so many details with this site that tell us what happened moment by moment, it’s almost like watching it play out in the movies. You look at the rock column, you look at the fossils there, and it brings you back to that day,”* says Robert DePalma, the University of Manchester, UK, graduate student who leads the Tanis dig.

The remains of animals and plants seem to have been rolled together into a sediment dump by waves of river water set in train by unimaginable earth tremors. Aquatic organisms are mixed in with the land-based creatures. The sturgeon and paddlefish in this fossil tangle are key. They have small particles stuck in their gills. These are the spherules of molten rock kicked out from the impact that then fell back across the planet. The fish would have breathed in the particles as they entered the river. The spherules have been linked chemically and by radiometric dating to the Mexican impact location, and in two of the particles recovered from preserved tree resin there are also tiny inclusions that imply an extra-terrestrial origin – ie., from the asteroid itself.

Prof Paul Barrett from London's Natural History Museum looked at the dinosaur leg. He's an expert in ornithischian (mostly plant-eating) dinosaurs. It's a *Thescelosaurus*. It's from a group that we didn't have any previous record of what its skin looked like, and it shows very conclusively that these animals were very scaly like lizards. They weren't feathered like their meat-eating contemporaries. This looks like an animal whose leg has simply been ripped off really quickly. There's no evidence on the leg of disease, there are no obvious pathologies, there's no trace of the leg being scavenged, such as bite marks or bits of it that are missing. So, the best idea that we have is that this is an animal that died more or less instantaneously.

Whether this dinosaur really did die on the day of the impact is still open to question, although there is good evidence that it did. Scientists will continue to work at the Tanis site to try and achieve a positive conclusion.

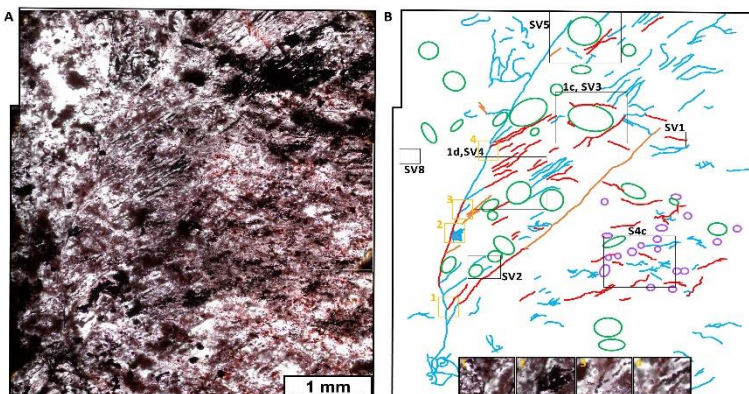
<https://www.bbc.co.uk/news/science-environment-61013740>



GEOLOGY - Diverse life forms on Earth may have evolved earlier than previously thought

In a paper published in the journal *Nature* in 2017, scientists from UCL (University College London) published their results having examined a fist-sized piece of rock from Canada, dated to between 3.75 and 4.28 billion years old (the Earth itself is dated at 4.55 billion years old). The team found tiny filaments, knobs and tubes in the rock which appeared to have been made by bacteria. However, not all scientists agreed that these structures – dating about 300 million years earlier than what is more commonly accepted as the first sign of ancient life – were of biological origin. Now, new research on the same rock may prove the doubters wrong.

After extensive further analysis of the rock, the team have discovered a much larger and more complex structure – a stem with parallel branches on one side that is nearly a centimetre long – as well as hundreds of distorted spheres, or ellipsoids, alongside the tubes and filaments. The researchers say that, while some of the structures could conceivably have been created through chance chemical reactions, the "tree-like" stem with parallel branches was most likely biological in origin, as no structure created via chemistry alone has been found like it.



The team also provide evidence of how the bacteria got their energy in different ways. They found mineralised chemical by-products in the rock that are consistent with ancient microbes living off iron, sulphur and possibly also carbon dioxide and light through a form of photosynthesis not involving oxygen. These new findings, according to the researchers, suggest that a variety of microbial life may have existed on primordial Earth, potentially as little as 300 million years after the planet formed.

Lead author Dr Dominic Papineau (UCL Earth Sciences, UCL London Centre for Nanotechnology, Centre for Planetary Sciences and China University of Geosciences) said: *"Using many different lines of evidence, our study strongly suggests a number of different types of bacteria existed on Earth between 3.75 and 4.28 billion years ago. This means life could have begun as little as 300 million years after Earth formed. In geological terms, this is quick – about one spin of the Sun around the galaxy. These findings have implications for the possibility of extra-terrestrial life. If life is relatively quick to emerge, given the right conditions, this increases the chance that life exists on other planets."*

For the study, the researchers examined rocks from Quebec's Nuvvuagittuq Supracrustal Belt (NSB) that Dr Papineau collected in 2008. The NSB, once a chunk of seafloor, contains some of the oldest sedimentary rocks known on Earth, thought to have been laid down near a system of hydrothermal vents, where cracks on the seafloor let through iron-rich waters heated by magma. They compared the structures and compositions within the ancient rock to more recent fossils as well as to iron-oxidising bacteria located near hydrothermal vent systems today. They found modern-day equivalents to the twisting filaments, parallel branching structures and distorted spheres (irregular ellipsoids), for instance close to the Loihi undersea volcano near Hawaii, as well as other vent systems in the Arctic and Indian oceans.

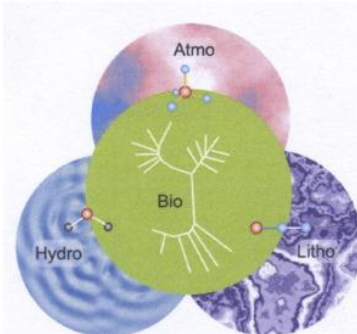
Prior to this discovery, the oldest fossils previously reported were found in Western Australia and dated at 3.46 billion years old, although some scientists have also contested their status as fossils, arguing they are non-biological in origin.

<https://www.sciencedaily.com/releases/2022/04/220413141532.htm>

GEOBIOLOGY – interpreting structures in ancient rocks as fossils may be dubious

Trying to prove that the ancient rock structures described in the item above are actually fossils is hugely difficult, as such structures are open to many interpretations and similar, more modern, structures are known to form through non-biological processes that take place over time in the rock as it is forming. Such ancient fossils have even been given a name of their own – *"dubiofossils"*.

The fact that microbial communities exist in deep fractured bedrock here on Earth is serving as a model for the search for life on Mars where, historically, habitable conditions may have been restricted to the subsurface. Some examinations of meteorites of Martian origin have shown structures within them that could be ascribed to ancient bacterial processes, although the current consensus is that they are not of actual biological origin.



Nevertheless, the belief remains that if such ancient 4 billion year old bacterial fossils can be proven on Earth, then we may well find them in rocks of a similar age on Mars. Thus an age-old question will finally be answered: is life on Earth unique....or is it truly Universal?

<https://onlinelibrary.wiley.com/doi/full/10.1111/gbi.12445>

HUMAN BIOLOGY - Rare identical Cheshire triplets were 'one-in-200 million'

The parents of "one-in-200 million" identical triplet boys are reflecting on the "best but hardest job" as they celebrate their sons' first birthday.

Gina Dewdney and her husband Craig were shocked when doctors at Liverpool Women's Hospital told them their naturally-conceived babies were such a rare occurrence. When born a year ago the boys spent six weeks in hospital before going home. Now Jimmy, Jensen and Jaxson are celebrating their milestone first birthday.

Mrs Dewdney, 34, said she had an "inkling" she was having twins at first - which was later confirmed with a scan - before the couple spotted a third head on the scan. *"Twenty minutes into the scan Craig said 'is that a third head?' and there was silence,"* she said. *"The consultant said in 25 years of scanning they'd never seen triplets, and they were all sharing one placenta which is super, super rare."*

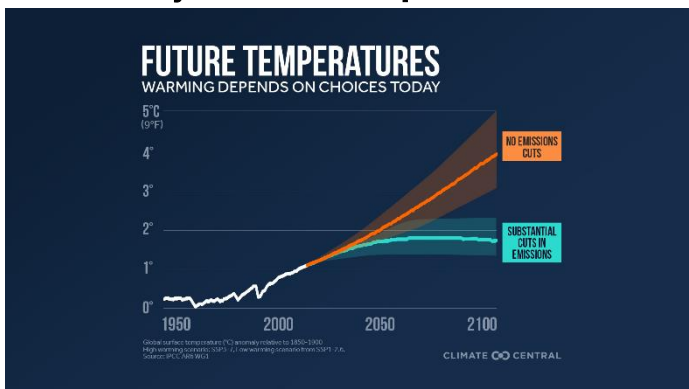


The odds of having identical twins is 3-in-1000, so not extremely rare at all. However, the odds of having identical triplets becomes almost astronomical, especially when they are conceived naturally, without the mother having received any fertility treatments as was the case with the Cheshire triplets.

<https://www.bbc.co.uk/news/uk-england-merseyside-60995514>

GLOBAL ENVIRONMENT - IPCC scientists report five ways to save the planet

The dangers of global warming and climate change have been well reported for years. But what's had less attention is how the world could effectively tackle the issue. UN scientists have now laid out a plan that they believe could help people avoid the worst impacts of rising temperatures. The report, by the UN's Intergovernmental Panel on Climate Change (IPCC), essentially calls for a revolution in how we produce energy and power our world. To avoid very dangerous warming, carbon emissions need to peak within three years, and fall rapidly after that. Even then, technology to pull CO2 from the air will still be needed to keep temperatures down. Here are five key ideas that the researchers say are critical to keeping the world safe:



temperatures down. Here are five key ideas that the researchers say are critical to keeping the world safe:

1. Coal is on the dole....again! The scientists' central message is this - If the world wants to steer clear of dangerous warming, burning fossil fuels, especially coal, has to be discontinued. Keeping the world under 1.5C requires emissions to peak by 2025, the researchers say, and shrink by 43% by the end of this decade. The most effective way of making that switch is to generate energy from sustainable sources like wind and solar.

2. "Pie in the sky" gets real. A few short years ago, the idea of a technological fix to climate change was generally seen as the preserve of the eccentric. From spraying things into the atmosphere to cool the Earth to blocking out the Sun with space-based shields, various ideas were mocked, knocked and quickly forgotten. But as the climate crisis has escalated and cutting carbon emissions has proven difficult, researchers have been forced to look again at the role of technology in both limiting and reducing CO2 in the atmosphere. The idea of carbon dioxide removal (CDR) has now gone fully mainstream with the endorsement of the IPCC in this latest report.

3. A "secret weapon": curbing demand. One of the big differences with this report from previous releases is that social science features heavily. This is mainly focussed on the ideas of reducing people's demand for energy in the areas of shelter, mobility and nutrition. This covers a multitude of areas - including low carbon diets, food waste, how we build our cities, and how we shift people to more carbon friendly transport options. The IPCC believes changes in these areas could limit emissions from end-use sectors by 40-70% by 2050.

4. Cooling the planet with cash! Tackling climate change has often been delayed due to the perceived high-cost implications. But that sense has changed in recent years as the financial toll of climate disasters has steadily climbed. Now the IPCC are weighing in with some new guidance on the costs. The bottom line is that transforming our world, won't (and please pardon the pun) cost the Earth. If fossil fuel subsidies from governments were removed, this would reduce emissions by up to 10% by 2030, according to Greenpeace.

5. Eat the rich...or copy them? There is renewed emphasis in this report on the outsized impact that richer people are having on the planet. According to the IPCC, the 10% of households with the highest per capita emissions contribute up to 45% of consumption-based household greenhouse gas emissions. The report suggests that the "rich" could reduce their effect while still maintaining their lifestyle.

<https://www.bbc.co.uk/news/science-environment-60987614>

CLIMATE CHANGE – WORLDWIDE PASTA SHORTAGE!

OK, so last month's feature article was an "April Hoax". Probably, in this day and age, no one fell for it. But this was not always the case.....

It was, in fact, based on arguably the most famous (and successful!) April hoax ever tried in Britain, back in 1957, which has gone down in history as the "**Spaghetti-tree Hoax**".

Back then the BBC was not much given to pranks and tomfoolery on television, especially not when it involved the serious and hugely respected current affairs program, Panorama. What gave the story even more *gravitas* was that Panorama was presented by none other than Richard Dimbleby, who was a revered and trusted public figure on TV and radio. And so it came to be that on the evening of 1st April 1957, the British public (at least those who were fortunate enough to own a television set!) sat down to watch that week's edition of Panorama.



When Dimbleby authoritatively informed viewers that spaghetti trees were experiencing a bumper crop that year because of an early spring and "*the virtual disappearance of the spaghetti weevil*," viewers were inclined to believe him, despite Dimbleby pointedly noting the date as he signed off! One possible reason why the hoax worked so well was that, back then, spaghetti was regarded as a rather exotic delicacy and was not widely known or available in the UK, unlike today.

The film scenes showing a family farming its spaghetti were actually shot in the canton of Ticino in southern Switzerland. Local women were signed up to appear in their local costume apparently harvesting spaghetti from trees. Other scenes were shot at a hotel in Castagnola, a village on the northern shore of Lake Lugano, also in Ticino canton. All is explained in the following clip.....

<https://www.youtube.com/watch?v=MEqpox6ajGE>

The producer of the Panorama program had not told his superiors at the BBC in case they vetoed the idea, so the BBC was completely unprepared for the flood of telephone calls from viewers asking about the item of news. Many of the calls were asking the BBC to settle family arguments: where some believed the "spaghetti-tree" to be real, while others in the family claimed to know that the pasta is actually made from flour and water! A few even wanted to know where they could get their own spaghetti tree. BBC operators were told to respond, "*Place a sprig of spaghetti in a tin of tomato sauce and hope for the best.*"

According to the *Museum of Hoaxes*, the idea for the Panorama hoax came from cameraman Charles de Jaeger, a Vienna native. Apparently, while he was in school, his teacher once told his class that they were "*so stupid they would believe him if he told them spaghetti grew on trees!*"

The origins of April Fools' Day are not clear but it is known that the tradition of practical joking and mischief-making dates back to Ancient Roman times. Ancient Romans and Celts celebrated a festival of practical joking at about the time of the Spring Equinox, as do millions of India's Hindus as well as others. The French also mark April 1st but instead of April Fools they call it *Poisson d'Avril* (April Fish).

WORD(S) OF THE MONTH:

DOPPLER EFFECT (noun, "*DOPP-ler ee-FEKT*")

The Doppler Effect is a change in the apparent wavelength of light or sound waves. This change is caused by the source of those waves moving toward or away from an observer. If a wave source moves toward an observer, then that observer perceives shorter waves than the source actually emitted. If a wave source moves away from an observer, then that observer perceives longer waves than those actually emitted.

You may have heard the Doppler Effect at work in the sound of a siren or vehicle. As it approaches you, you perceive its sound waves as shorter. Shorter sound waves have a higher frequency and pitch. Then, when the siren passes you and gets farther away, its sound waves seem longer. Those longer sound waves have a lower frequency and pitch.

The Doppler Effect plays an important role in astronomy. That's because stars and other celestial objects give off light waves. When a celestial object moves toward Earth, its light waves appear bunched up. These shorter light waves look bluer. This phenomenon is called blueshift. When an object moves away from Earth, its light waves seem stretched out. Longer light waves look redder, so this effect is called redshift. Blueshift and redshift can expose slight wobbles in stars' motions. Those wobbles help astronomers detect the gravitational pull of planets. The redshift of distant galaxies also helped reveal that the universe is expanding.

The Doppler Effect is also use in a wide variety of other applications: such as medical ultrasonography; military and police radar; fluid flow measurements; satellite navigation; musical audio.

It is named after the Austrian physicist Christian Doppler, who first described the phenomenon in 1842.