BRAIN BUMPS

YOUR REGULAR DOSE OF INCREDIBLE FACTS

BROUGHT TO YOU BY HOW IT WORKS

BROUGHT TO YOU BY

HOW IT WORKS

WELCOME

GET YOUR CURIOUS QUESTIONS ANSWERED

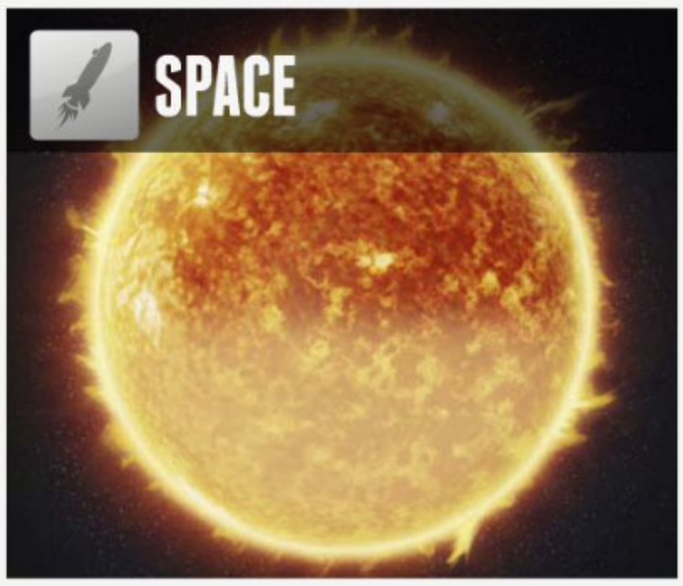
Congratulations! Another issue of Brain Dump has been delivered direct to your tablet or smartphone. As usual, it's packed with facts, stats and info encompassing a fascinating range of topics from the worlds of science, space, nature, transport and the human body. Give your brain a workout and swipe left to get started.

The Braindump Team

SCIENCE

Can gold become a gas?

SPACE



What can withstand the heat?

HISTORY

Bubonic versus pneumonic

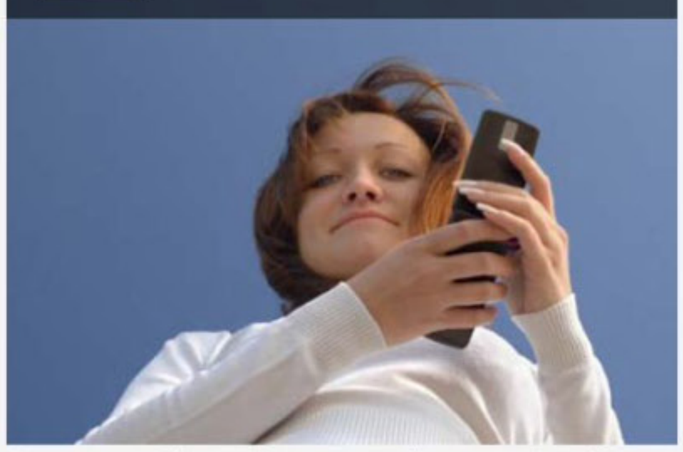
TRANSPORT

Discover Air Force One

ENVIRONMENT

Giant tortoises explained

TECHNOLOGY



Are mobile phones damaging?

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Design: Lora Barnes **Photography:** Thinkstock; Rex Features; Getty; NASA

THAT'S AMAZING

Australian researchers are attaching tiny 'backpack' sensors to honey bees in an attempt to find out what is causing the decline of the species and prevent further decline.

THAT`S AMAZING

This miniature effect on Lake Louise in Canada is quite striking due to the enormous boulders that look like small pebbles here. The stunning colour of the lake is caused by sediment from upstream glaciers.

THAT'S AMAZING

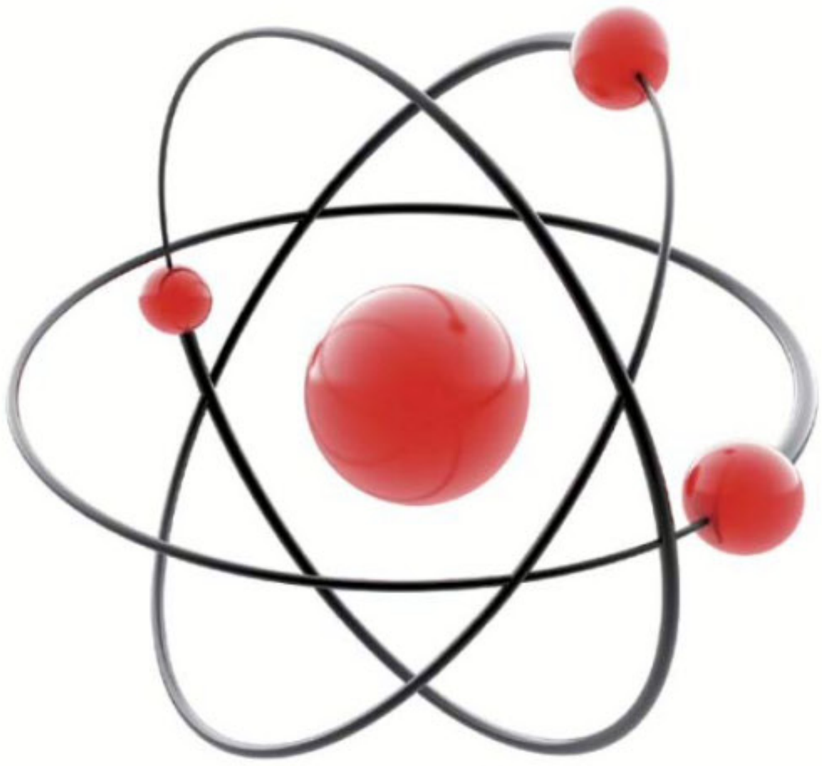
This rare two-headed cobra was adopted by a zoo in China in order to give it better care. At 20cm (8 inches) in length and weighing 50g (1.7oz), the snake has two brains but only one digestive system.

WHAT ARE PINECONES?

Pinecones contain the reproductive structures of the tree. A female cone produces seeds and a male cone produces pollen. The female cone is the large woody one that people are more likely to be familiar with. Its scales become seeds when fertilised from pollen from the less conspicuous male cones. The male cones are very similar among all species of conifers, whereas the female cones are more varied, making them the ideal way to identify the species. Pinecone scales overlap each other like fish scales in order to protect the seeds.

WHY ARE THE TORTOISES IN GALAPAGOS SO BIG?

Galapagos giant tortoises are most closely related to the smaller Chaco tortoise in South America, but their ancestors split before any reached the Galapagos Islands. Giant tortoises floated or rafted 1,000km (621mi) on ocean currents to reach the Galapagos. Their large size meant they could survive up to six months living off stored fat and water, and float along. Once there, they maintained their size as there were no predators or competitors, so they could reach high for vegetation. The variable climate meant they were buffered against food shortages and extreme temperatures.



WHY DO ATOMS HAVE ELECTRONS?

Electrons neutralise the charge of an atom, their negative charge balancing out positively charged protons - that is why there's an equal number of electrons and protons in an atom. Electrons are also responsible for atom bonding. Atoms want a full outer shell of electrons, and they gain, lose or share electrons with other atoms, often forming new materials in the process. As electrons are the part involved in bonding, the configuration of electrons in an atom is what gives an element its specific chemical and physical properties.

5 COOL THINGS AIR FORCE ONE

1 The first presidential aircraft was introduced in 1945 and was a converted C-54 Skymaster. It was nicknamed the Sacred Cow and carried Roosevelt and Truman.

2 Ex-US presidents also sometimes travel on Air Force One to large state occasions, such as in 1981 when Nixon, Ford and Carter all flew to Cairo, Egypt, for a funeral.

3 The 'Air Force One' call sign was created in 1953 after a presidential plane carrying Eisenhower entered the same airspace as a commercial airliner using the same name.

4 The two VC-25As currently in use by the US president are set to be replaced in 2017 with three new jetliners. These will either be Boeing 747-8s or Boeing 787 Dreamliners.

5 In March 2012 President Barack Obama invited the British Prime Minister David Cameron to fly on Air Force One to a basketball game taking place in Ohio.

CAN MOBILE PHONES MAKE US ILL?

The World Health Organisation (WHO) classified mobile phone radiation as 'possibly' carcinogenic in the Nineties. Mobiles create minute spikes in electromagnetic (EM) radiation and temperature, which are absorbed by anything in close proximity, including the skull. No study has shown that this has any worse effect than other forms of radiation. There's been more concern about mobile base stations that continuously pump out EM radiation at much higher doses, but there's been no evidence of an increased risk to health.

T-REX VS SPINOSAURUS

What if we could have arranged a meeting between these two super-dinosaurs? Both were very powerful flesh eaters. In both, a large skull with an array of dagger-like teeth was the principal weapon. However, T-rex had a more robust skull and probably the more powerful bite of the two. The narrower, more elongated snout of the spinosaurus suggests a quicker but less powerful bite. Resembling a crocodile's snout, the spinosaurus may have been better adapted to eating fish. Our vote goes with T-rex winning a fight, but both would have been wary of each other and avoided fighting.

COULD WE TERRAFORM MARS?

Some scientists believe that it's possible to make Mars habitable. First, it needs a new atmosphere. That of Mars is about 95 per cent carbon dioxide, and very thin in comparison to Earth's. It also needs liquid water. Mars is currently a desert planet. On average it has a temperature measuring about -60 degrees Celsius (-76 degrees Fahrenheit), so we'd need more heat.

Finally, Mars would need a magnetic field to hold in that atmosphere, heat and water, as well as protect life on its surface from solar radiation.

We could help along some of these issues by creating a greenhouse effect on the planet. This would require importing or creating gases on Mars. So the answer to whether we could actually live on Mars one day is, for now, a decided 'maybe'.

WHAT IS IT?

SWIPE TO REVEAL

SPIDER WEB

This Labyrinth spider (*Agelena labyrinthica*) was captured on camera in its web in Exmoor, UK. The funnel-web spider produces a sheet web with a funnel-shaped retreat. It inhabits gorse in lowland heaths and is common in the UK, feeding on flies and other small insects that get caught in its snare.

WHY DO FLAMINGOS STAND ON ONE LEG?

This is all down to conserving heat. Although flamingos are native to tropical climates, they spend most of their time standing in cold water - and their long legs mean lots of exposure to it. Tucking one leg up helps to regulate their body temperature. They usually vary which leg is up and, when the weather is warmer, they're more likely to stand on two legs. For a long time this was a mystery. Then, in 2009, two American psychologists studied a captive flamingo colony and concluded the above.

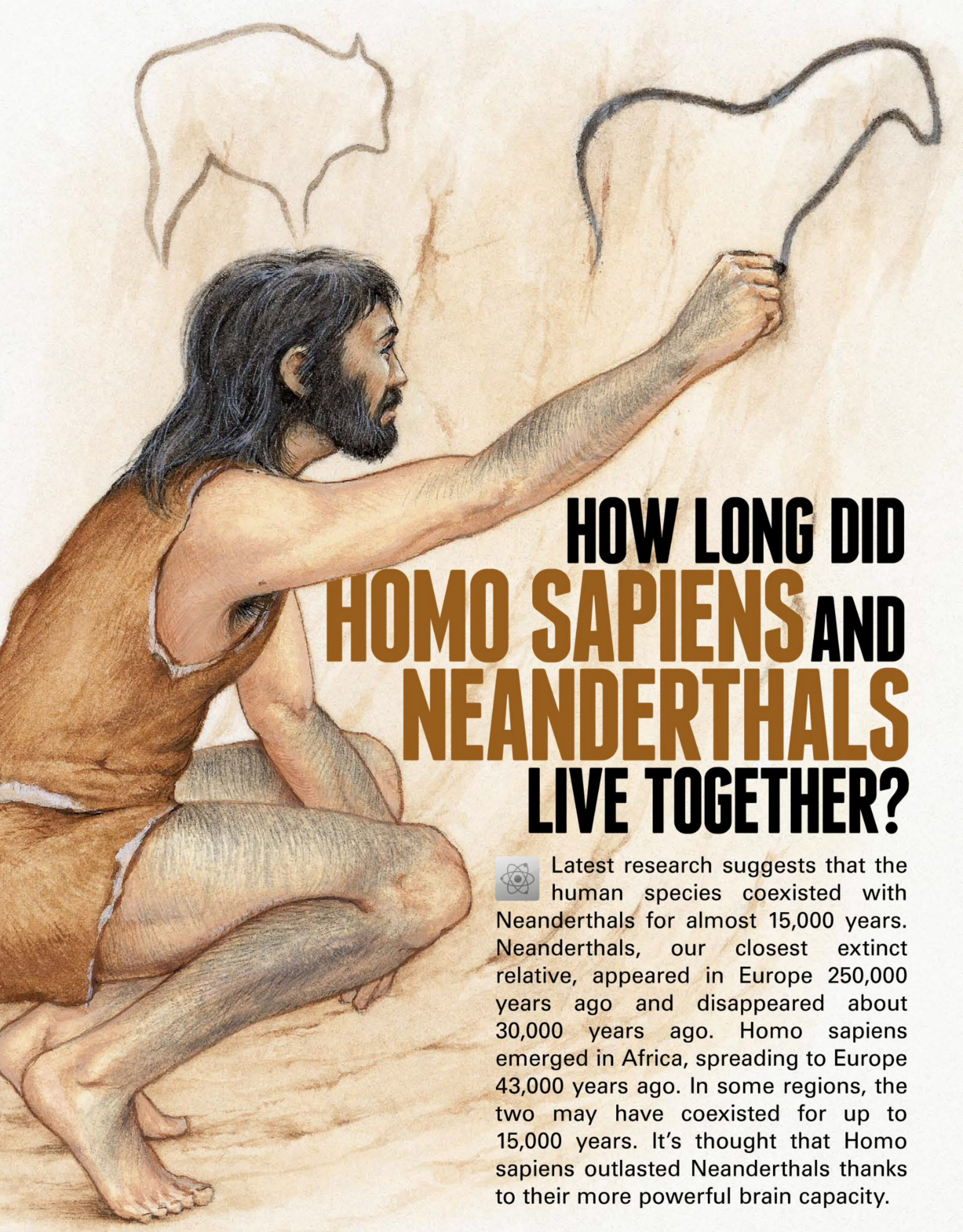
CAN ANYTHING WITHSTAND THE HEAT OF THE SUN?

The Sun is surrounded by a layer of plasma, which extends millions of miles into space, with some places reaching up to 3 million degrees Celsius (5.4 million degrees Fahrenheit). There are no known materials that can exist as solids, liquids or gases at such extreme temperatures. Protons, neutrons and electrons can withstand this heat as they are virtually indestructible, however they can only exist as a plasma. If you could somehow get past it and get to the surface of the Sun, where it is 'only' 5,500 degrees Celsius (9,900 degrees Fahrenheit), some liquids could exist.

HOW DO WE BRING PEOPLE OUT OF A COMA?

When we talk about bringing someone out of a coma, we refer to medically induced comas. Doctors induce a coma using a controlled dose of drugs. To bring the person out of the coma, they simply stop the treatment.

Bringing the patient out of the coma doesn't wake them immediately. They gradually regain consciousness over days, weeks or sometimes longer. Some people make a full recovery, others need rehabilitation or lifetime care, while others may remain unaware of their surroundings.



HOW LONG DID HOMO SAPIENS AND NEANDERTHALS LIVE TOGETHER?

Latest research suggests that the human species coexisted with Neanderthals for almost 15,000 years. Neanderthals, our closest extinct relative, appeared in Europe 250,000 years ago and disappeared about 30,000 years ago. Homo sapiens emerged in Africa, spreading to Europe 43,000 years ago. In some regions, the two may have coexisted for up to 15,000 years. It's thought that Homo sapiens outlasted Neanderthals thanks to their more powerful brain capacity.

BUBONIC PLAGUE VS PNEUMONIC PLAGUE

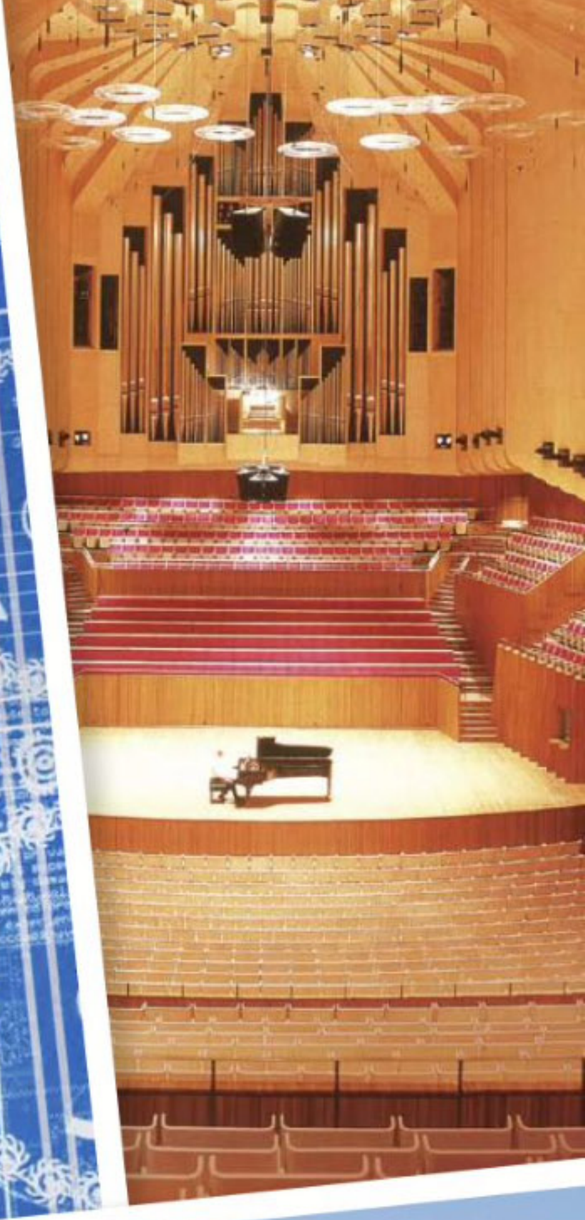
Both are caused by the bacterium *Yersinia pestis* and result in fever and pain. Whereas pneumonic plague affects respiratory organs, bubonic plague is an infection of the lymphatic system. Both can be cured if diagnosed within 24 hours. Severe symptoms produced by pneumonic plague and the fact it can spread person-to-person make it dangerous. The chances of surviving it in the 14th century would have been almost zero.

HOW DO OXBOW LAKES FORM?

Natural meandering in a slow-flowing river's course exaggerates over time as the current will erode on the outside edge of a loop and deposit sediment on the inside. This widens the loops until they almost double back on themselves. A flood washes away the narrow bank separating the loops, and the river bypasses the loop altogether. The connections to this isolated loop silt up and you are left with a crescent-shaped lake, known as an oxbow.

Man Made Marvels

Sydney Opera House acoustics



More than 8.2 million people visit the Sydney Opera House each year

SWIPE FOR MORE

HOW DOES THE CONCERT HALL INSIDE THIS FAMOUS LANDMARK DISPERSE SOUND SO WELL?

ANGLES
The surfaces immediately to the side of the stage are angled away and down into the seating area. These angles are used to prevent sound from bouncing back and forth across the room, which would otherwise create distortion.

CLOUDS
18 doughnut-shaped acrylic rings, or 'clouds', hang above the sound stage. These are used to reflect sound into more beneficial areas of the hall and back to the stage.

WOOD
The hall's walls and floor are made of laminated Australian brush box. This material is used as it does not just reflect sound, but resonates slightly, granting it a much softer quality.

Sydney Opera House

Essential info

Organ The Sydney Opera House features a very grand organ with a staggering 10,500 pipes!

Reverberation When there is a full audience, the reverberation time is approximately 2.2 seconds from 100 to 8,000 Hertz.

Completion The Sydney Opera House was completed 10 years late and a whopping seven times over the original budget.

WOOL
All the seats are lined with wool. This is used as the material is especially good at absorbing sound and, as the seats are the point of destination, stop it from rebounding and distorting.

WHY ARE SHIPS CALLED ‘SHE’?

Some say it’s because the captain revered his ship like a goddess or religious icon. Columbus named his ship Santa Maria after the Virgin Mary. Seafarers relied upon their ship to nurture them and keep them nourished, like their wives and mothers did. It was considered bad luck to have women on board, so ship owners used their loved ones’ names to keep them in mind. There is another less romantic possibility, though. In some European languages, nouns are considered to be either masculine or feminine. Some believe the word ‘ship’ was just one of the feminine words.

WHY DO MY LEGS LOOK WEIRD UNDER WATER

Legs look bent under water due to a certain property of light called refraction. When light enters the water, it slows down. When it enters at an angle, the change in speed is great enough to make the light's path bend, so to your eyes, your legs appear to be bent. Remember the school experiment that required you to put a pencil in a glass of water? The straight pencil appeared to bend halfway down if you let it lean and looked at it from the side.

CAN GOLD BECOME A GAS?

Any element can become a gas if you're able to heat it past its boiling point. For gold, that's 2,856 degrees Celsius (5,173 degrees Fahrenheit), which is hotter than the temperature in an arc furnace, so boiling a bar of it is challenging. However, you can create small amounts of gas by bombarding gold with a beam of high-energy electrons in a vacuum. This knocks gold atoms free from the solid mass and they'll fly around and coat everything in the vacuum chamber. Electron beam vapour deposition is used to create very thin gold coatings for the electronics, medical and space industries. Gold coatings can also be used as a lubricant in machinery.

WHAT WILL REPLACE THE ISS?

Nobody knows for sure. China is developing its own space station, so they might spearhead another international effort. Commercial space companies, some of whom already ferry supplies to the International Space Station (ISS), could develop and launch their own space stations with NASA's support. The ISS is supposed to remain in operation until at least 2020, and there are proposals to extend its working life beyond that to around 2028, after which it will be deliberately de-orbited into Earth's vast oceans.

AMAZING SCIENCE EXPERIMENTS

THAT YOU CAN DO AT HOME

MENTOS AND COLA JET

EQUIPMENT

Cola
Diet cola
Diet lemonade
Orangeade
Mentos
Toothpicks

1. Place one of your fizzy drinks on a flat surface outside, away from any electrical equipment, and open the lid (ensure as little gas as possible escapes).

2. Align two toothpicks on top of the bottle, and place one of the Mentos between them. Take care not to drop it in.

3. Quickly pull the toothpicks away and step back. After a second or two, the whole bottle fizzes up and the liquid shoots upwards in a vertical column.

4. Repeat the experiment with other fizzy drinks, and observe the different heights of the ejected liquids.

Variables
Would other sweets work? What else could you use to cause this reaction?

WHAT HAVE YOU LEARNED?

This reaction is due to thousands of tiny pits on the surface of the Mentos. The intensity of the reaction is determined by the surface tension of the soda used, ranging from the lowest (diet orangeade) to highest (diet cola). As Mentos come into contact with the soda, a huge number of bubbles are created at their surface, covered in a surfactant known as 'gum arabic'. The sweets are dense, so sink rapidly, producing more bubbles as they pass through the liquid, which makes more bubbles. Some drinks outperform others due to the artificial sweetener aspartame, which makes the surface tension of the liquid less than without it. This was in our diet cola and lemonade, but not the regular cola or orangeade. The lower the surface tension in the liquid, the faster the bubbles form.

ANATOMY OF

BOMB-DISPOSAL SUITS

MATERIALS AND TOOLS OF THE ADVANCED BOMB SUIT (ABS) EXPLAINED

1. RAISED COLLAR
As an explosion can cause differential acceleration between the head and torso, each ABS is equipped with an articulated spine protector and supportive neck collar.

3. COOLING SYSTEM
Due to the multiple thick layers, a Nomex body suit with a woven capillary tube network is worn next to the skin. This is connected to a 2L (0.5 gal) water reservoir that pumps ice-cold water around the ABS.

6. LUNG OVERPRESSURE DEFLECTOR
Special rigid ballistic panels are placed over the chest. These offset panels are designed to absorb the high pressure that is generated on detonation, consequently stopping lung compression.

2. HELMET
The ABS's helmet is made from lightweight but high-strength fibre and weighs only 3.6kg (7.9lb). The visor is constructed from laminated acrylic and polycarbonate.

4. COMMS SYSTEM
The helmet is also equipped with a MIL-SPEC communications system, consisting of a microphone and set of speakers. It is powered by an internal battery pack that can last for about five hours.

5. BALLISTIC PANELS
Composite ballistic panels are fitted to the outside of the suit in order to prevent bomb fragments entering at high speeds.

7. MATERIALS
The suit is made from a mix of flame-retardant Nomex and Kevlar layers. These specialise in protecting the wearer from the intense heat generated in a blast.

MYTH BUSTER

1 COMTE D'ARTAGNAN

THE REAL COMTE D'ARTAGNAN WAS NOTHING LIKE THE FICTIONAL HERO PORTRAYED IN ALEXANDRE DUMAS'S FAMOUS NOVEL, *THE THREE MUSKETEERS*, WHICH ITSELF WAS BASED ON A SEMI-FICTION.

2 FOR RICHER, NOT POORER

IN FACT, FAR FROM EMERGING FROM POOR AND HUMBLE ORIGINS, THE REAL-LIFE D'ARTAGNAN WAS THE SON OF A NOBLEMAN WHO LIVED IN A LARGE CHATEAU IN SOUTH-WEST FRANCE.

3 MORE THAN THREE

DESPITE THE DUMAS NOVEL BEING CALLED THE 'THREE' MUSKETEERS, HALFWAY THROUGH, D'ARTAGNAN OFFICIALLY JOINS THEIR RANKS, TAKING THE NUMBER OF MUSKETEERS IN THE TALE TO FOUR.

4 BEHIND THE TIMES

DESPITE DUMAS'S NOVEL STATING THAT D'ARTAGNAN LEFT HIS HOME TO BECOME A MUSKETEER IN 1625, IN FACT THE REAL MAN DID NOT DO SO UNTIL LATER – DURING THE 1630S.

5 MORT REALISTIC

INDEED ONE OF THE ONLY THINGS IN DUMAS'S FICTIONALISED ACCOUNT OF D'ARTAGNAN THAT IS 100 PER CENT ACCURATE IS THE DATE OF THE SOLDIER'S DEATH – HE DIED IN MAASTRICHT IN 1673.

5 MYTHS ABOUT MUSKETEERS

GROWING TO A LENGTH OF:

13-23FT (4-7M)

LIFESPAN:
70+ YEARS

272 (IN 2012)
DOCUMENTED UNPROVOKED ATTACKS ON HUMANS

STATISTICOOL

GREAT WHITE SHARK

15 SPEED
MPH

WEIGHING UP TO
5,000
POUNDS