THE MOON AND MARINE ANIMALS

Narayani Subramanian

A baby wolf goes to his mother and asks, “Mom, why do we howl at the moon?’

The mother wolf pondered for a minute, sighed, took a deep breath and answered, “Because the moon is just a giant white ball we cannot fetch! We howl in disappointment”.

Jokes apart, we have all heard myths and folklore about why wolves howl at the moon. Researchers of behavioural ecology, however, dispute this. Contrary to popular belief, it is not the moon that they are howling at, they howl at each other! They use howling as a method of communication with other wolves! They have also not found any connection between the phases of the moon and the howling of wolves.

The moon might not have an impact on the wolves and their howling, but it certainly has a tremendous influence on marine habitats.

Oceanic tides:

The moon causes tides in oceans. Tides are the rise and fall of sea levels. Tides

are caused by the effects of gravitational forces exerted by the moon, the sun and the earth's rotation. We all know that the sun is so much bigger than the moon, and the laws of physics dictate that the gravitational pull exerted by an object is influenced by its mass. So, the gravitational pull of the sun must be much higher than that of the moon. But, the force of gravity also depends on one more factor: distance. The distance between the moon and earth is much lesser than the distance between the sun and the earth. So the sun exerts only half the amount of gravitational force when compared to the moon!

Tides are influenced by the lunar cycle. In Indian coastal waters, we have "Semi diurnal tides", which means there are two high tides and two low tides every day. Every six hours, the tide changes. During the new moon and the full moon, the tides reach their maximum levels. At this time the height difference between the high tide and low tide is the maximum. Although this is not related to the waves, during these times, the sea tends be very rough.

Marine animals and lunar cycles

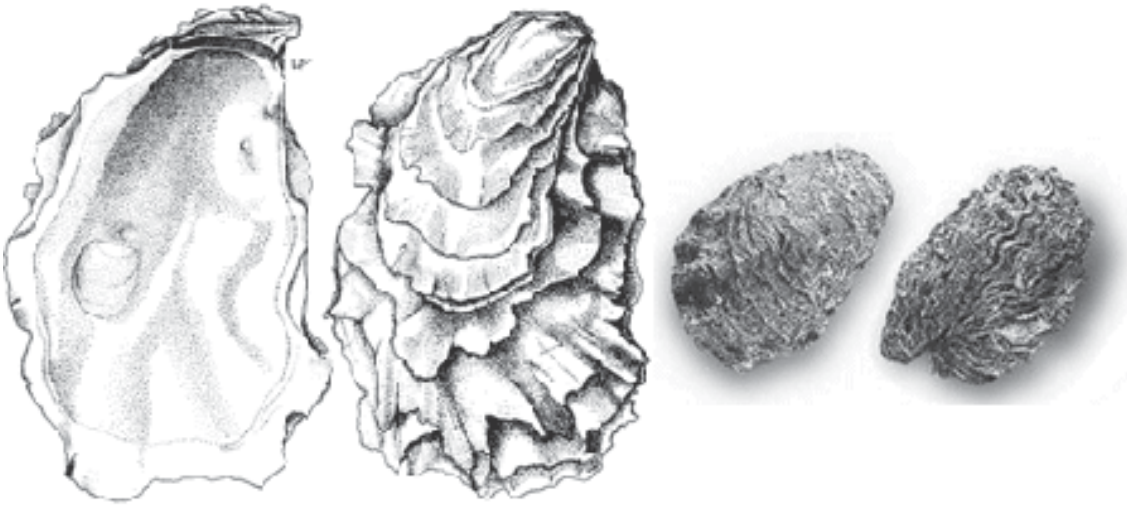
As we all know, the moon has distinct "Phases" that gradually change over a period of 29.53 days. This cycle exerts a significant influence on the behaviour of marine animals. Coral "Mass Spawning", where all the corals in a reef habitat simultaneously release their reproductive gametes into the water, happens around full moon. The annual migration of

Christmas island crabs for laying eggs is synchronised with the lunar cycle. The mating cycle of rabbitfishes is synchronised with the phases of the moon. The Pacific Palolo worm spawns exactly seven to nine days after the full moon. Many molluscs exhibit lunar periodicity in breeding activity.

Pacific Oysters:

A study in 2019 in the Southwest coast of France showed that the opening and closing of shells in Pacific oysters is synchronised with the lunar cycle. The scientists studied two different oyster species and concluded that, they are more open during the new moon period and more closed during the full moon. They have put forth the theory that this is probably due to the availability of algae during these lunar phases. Oysters are filter feeders, so if they keep their shells open during the time when there are more algae in the seawater, they will get more food to eat.

California Grunion:



Grunions are small fishes which are found around the coast of California. From Spring to summer (February to September), during full moon and new moon nights, grunions come to the beach! Just after the high tide, they gather all their energy, brave the crashing waves and reach the sandy, low water regions of the beach. Females lay eggs, males fertilize them. Popularly called “Dance of the Grunion”, this event attracts a lot of local fishermen who catch them during these beach visits.

The grunions visit the beaches for four to eight times in a year, laying about 3000

eggs. The eggs are incubated in the sand and the residual water keeps them moist. Once the next high tide reaches them in a few days, they hatch in less than a minute and return to the sea!

How does this happen?

The above mentioned are some of the many examples of how the moon influences behaviour in the marine ecosystem. How does the synchronicity happen? A lot of theories have been put forward regarding this, but the mechanisms are not understood clearly yet.

There are some studies which show that environmental triggers cause these behaviours. Deep in the ocean, there is a bristleworm species called *Platynereis dumerili.* After the new moon, this deep sea species swims to the surface, performs a dance like act, reproduces and goes back to the sea. Studies in 1950s had mentioned that moonlight is the trigger that causes this behaviour.

Scientists in 2013 decided to test this theory. They kept these worms in the laboratory - one worm was kept in complete darkness (no moon), one worm was kept in a box with a light source switched on at all times (perpetual full moon), and one worm was kept in a box where the light source was dimmed in accordance to the lunar cycle. Can you guess which of the worms swam to the surface and danced?

Yes! You guessed it right! The worm with the lunar light cycle synchronised itself to the light source, and swam to the surface after the “new moon” phase, when the light was fully switched off!

However, many other studies have shown that these periodic cycles are not just influenced by external triggers and that these periodicities follow a “Biological clock” which is genetically fixed. The authors of such studies argue that no matter where the animal is, its internal clock will work in accordance to the moon.

Science is still finding out answers to these questions and every new study is throwing more light into these fascinating patterns of nature. Do you have a pet at home? Does the behaviour of your pet change according to lunar cycles? What do you think causes these changes? Write to Jantar Mantar and let us know!

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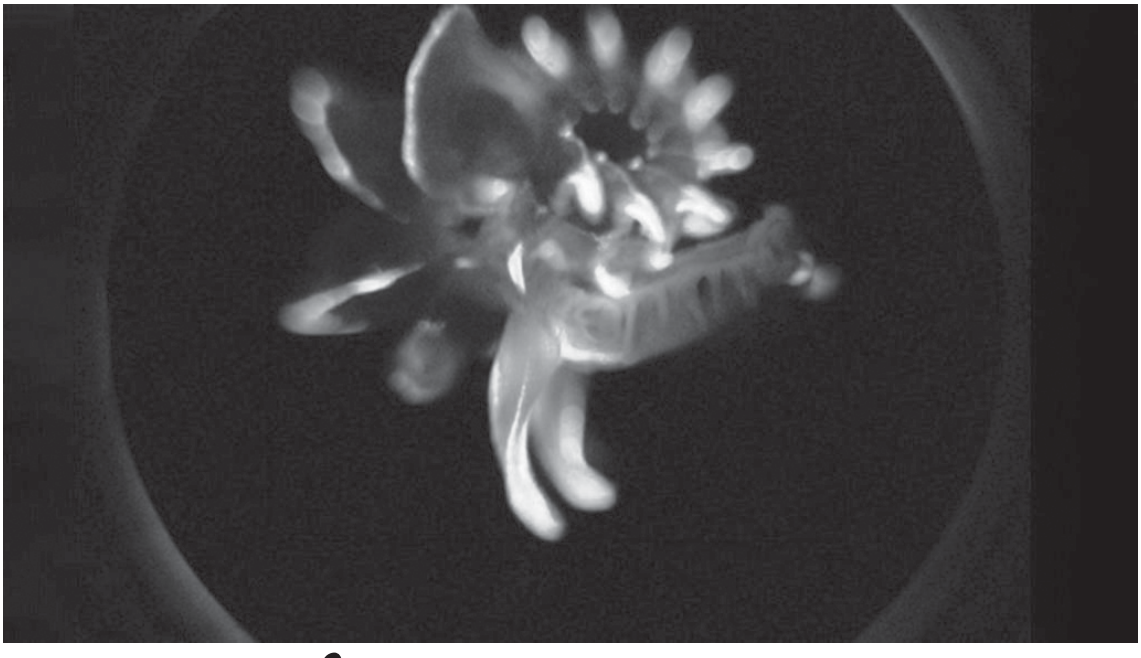


Light from living things

Carolyn Wilke

CHEMISTRY

When threatened, marine parchment tube worms ooze a sticky mucus that glows blue in the dark.

Predators that tread on a colony of parchment tube worms may find themselves slimed. The worms get their name from the papery tubes in which they live. When threatened, these ocean creatures ooze a sticky mucus that can glow blue for days.

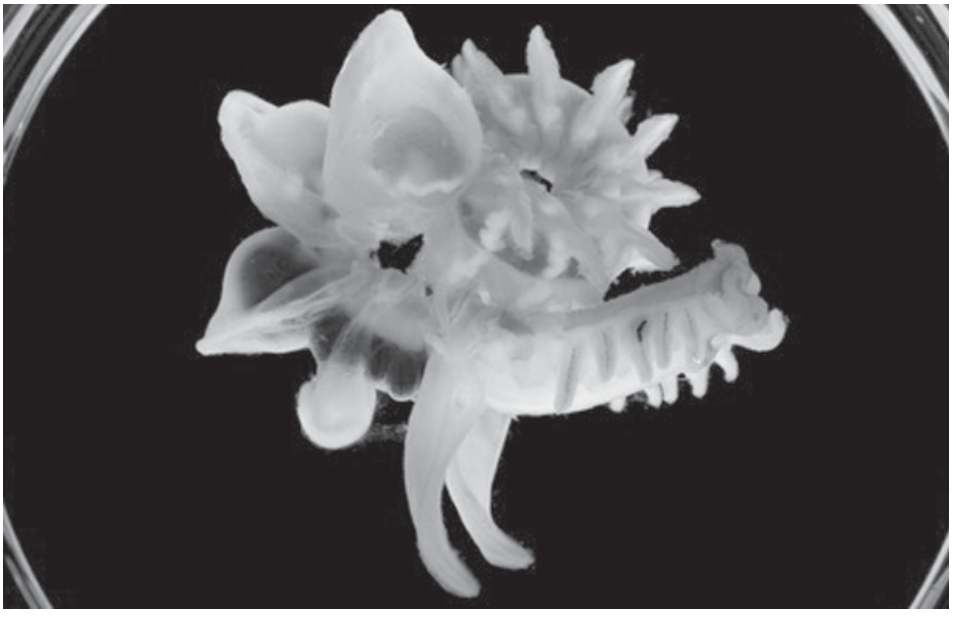
Such light produced by animals, bacteria or algae is known as bioluminescence (BY-oh-loom-in-ESS-ents). Typically, it's gone in a flash. Like the blinking light of a firefly. But the mucus oozed by *Chaetopterus* tube worms is unique. With them, "We have easily 16 hours and sometimes 72 hours of light," says Evelien De Meulenaere. She's a biochemist who works at the Scripps Institution of Oceanography. It's in La Jolla, Calif. Her team's new results suggest that the slime's own light may help it shine on. That light seems to trigger chemical reactions that sustain the glow.

Scientists Say: Luminescence

Making and sustaining bioluminescence requires energy. What powers the slime's glow is a mystery. Since it happens outside the body, it isn't drawing energy from the worms. To unlock the goo's secrets, scientists are digging into its chemistry.

De Meulenaere and her team exposed the slime to blue light. That caused a spike

in the goo's glow. "That's the weirdest thing," she says. "The mucus produces blue light itself. So is it powering itself?"



Slime detectives

To find out, her group separated molecules from the mucus based on size and other traits. That let them identify proteins, sugars and metals in the slime. A reaction involving an enzyme makes the light. Iron emerged as a possible sidekick in helping the glow last. The mucus contains ferritin. This protein stores iron. Ferritin slowly releases electrically charged iron atoms, known as iron ions. Those ions can trigger the mucus to emit bursts of blue light, the team reports.

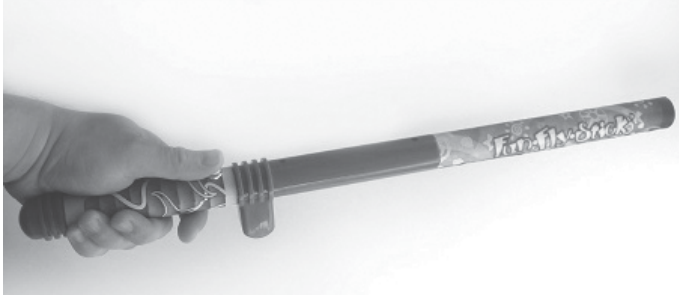
Ferritin seems to respond to blue light. This protein releases the ions more quickly in the presence of another molecule, one that absorbs blue light. That suggests that light from the slime may help trigger the production of more light. And this seems to sustain the glow. The team had planned to present its findings in early April at Experimental Biology 2020. But that meeting was canceled due to the COVID-19 pandemic. An abstract describing the research appeared April 18 in *The FASEB Journal*.

The goo's glow was first investigated in the 1960s, points out Warren Francis. Afterward, it was largely forgotten, notes this biologist. He works at the University of Southern Denmark in Odense and did not take part in the new study. The Scripps group's work is shedding light on the slime's enduring shine, he says. But, he adds, the data don't yet paint a clear picture of the roles that blue light and ferritin play in the glow's chemistry.

"Understanding how it works gives us a big clue to how these animals function in their own world," he says. And it could help people, too. The bioluminescence of jellyfish (see photo on back cover) and fireflies have given biologists tools to study the inner workings of cells. If scientists can crack the worms' glow, Francis says, "there's potentially huge numbers of applications."

Perhaps someday, the study authors suggest, the snot's secrets could help create a long-lasting light that glows on and on.

From: https://www.sciencenewsforstudents.org/article/this-tube-worms-glowing-slime-may-help-sustain-its-own-shine



Fly Stick
picture of fly stick

Atoms form the basis of electric charge creation. Atoms are the building blocks of matter, and they are extremely tiny. There are many billions of atoms in even the smallest substance, such as a grain of sand.

Atoms have an equal amount of protons and electrons. Each electron has a negative charge and each proton has a positive charge. These two charges are equal, which means that each atom has zero net charge. As a result, it is electrically neutral.

Like charges repel, which means that electrons repel other electrons and protons repel other protons. In addition, unlike charges attract which means that electrons and protons are attracted to each other.

When a substance has a negative charge it has an excess number of electrons. That is, the number of electrons in the substance is greater than the number of protons. When a substance has a positive charge it has an excess number of protons. That is, the number of protons in the substance is greater than the number of electrons.

In general, electrons are much more free to move around inside a substance than protons, and it is the flow of electrons to or from a substance which allows the substance to become either negatively charged or positively charged.

A way to give a substance either a negative charge or positive charge is by rubbing another type of material on it. This causes the two materials to exchange electrons, and one of the materials gains electrons and the other material loses electrons. This phenomenon is due to the triboelectric effect. It results in one of the materials gaining a negative charge and the other material gaining a positive charge. For example, in winter you sometimes receive a shock when touching a doorknob. This is due to you gaining a positive or negative charge while walking on the floor. When you touch the doorknob you lose that charge.

The fly stick uses the triboelectric effect to create a negative or positive charge on the wand end of the stick. This effect is created by a small battery powered Van de Graaff generator contained inside the stick. The generator has a belt powered by a motor, and this belt runs over two rollers. To understand the basics of how it works, consider first what happens with the belt and roller located at the bottommost

position of the fly stick (closest to the handle). Due to the difference in material type between belt and roller, electrons are removed from one of them (either the belt or the roller) which causes it to gain a positive charge as a result. The other material (either the roller or the belt) then gains a negative charge as a result (since it gains electrons). The belt then, being either positively charged or negatively charged, travels to the wand end of the stick where it contacts the second roller (which is made of a suitably chosen material different from the first roller), and due to the triboelectric effect the belt then gains a negative or positive charge (opposite to before). This causes the wand end at this location to either lose or gain electrons, and as a result the wand becomes either positively or negatively charged. This happens through a rather elaborate set of steps (not described here). Lastly, the belt then travels back down to the first roller and the process continues, thereby sustaining the level of charge on the wand. In summary, the charge of the wand (positive or negative) becomes the same as the charge of the belt just after it contacts the first roller at the bottommost position of the fly stick.

With the wand charged it can then be used to levitate the mylar strips.

When the wand touches the mylar strips they gain the same charge as the wand. For example, if the wand is negatively charged it will transfer excess electrons to the mylar strips and they too will become negatively charged. If the wand is positively charged it will “pull” electrons from the mylar strips and they too will become positively charged. The like charges contained inside the mylar strips repel each other which causes the mylar itself to expand as a result. And at the same time the like charge on the wand and mylar strips cause them to repel each other hence producing the levitation effect.

You can do a neat trick where you make the mylar strips jump back and forth between your hand and the fly stick. When the mylar touches your hand it loses its charge to your body and the ground you’re standing on (which can be thought of as a charge “sink”). The mylar then becomes electrically neutral. At this point the mylar becomes attracted to the charged fly stick. This happens because the like charges on the fly stick and mylar repel each other and as a result the like charges inside the mylar physically move away from the fly stick. At the same time the unlike charges on the fly stick and mylar attract each other which causes the unlike charges inside the mylar to physically move towards the fly stick. The net effect becomes one of attraction since the closer unlike charges have a stronger attraction force than the repulsive force created by the (further away) like charges. Hence the net force is one of attraction and the mylar moves towards the fly stick as a result. When the mylar touches the fly stick it once again gains the same charge as the fly stick and repels away from it until it touches your hand, and the cycle repeats.

It should be mentioned that the type of charge developed on the fly stick, either positive or negative, is something I do not know since it depends on the manufacturing specifics of the fly stick. But it can be fun trying to come up with a way to figure it out!

Potato Clock

picture of potato clock

A potato clock runs by converting chemical energy into electrical energy, which is then used to power a clock. The potatoes, in combination with zinc and copper strips (which act as electrodes), act as a battery. Most people aren't aware that this is possible, which is what makes it so interesting.

Check out a video of a potato clock:

The energy comes from the chemical change in the zinc when it dissolves inside the mild phosphoric acid content of the potato. The energy does not come from the potato itself. What happens is that the zinc is oxidized inside the potato, exchanging some of its electrons with the potato acid in order to reach a lower energy state, and the energy released provides the electrical power.

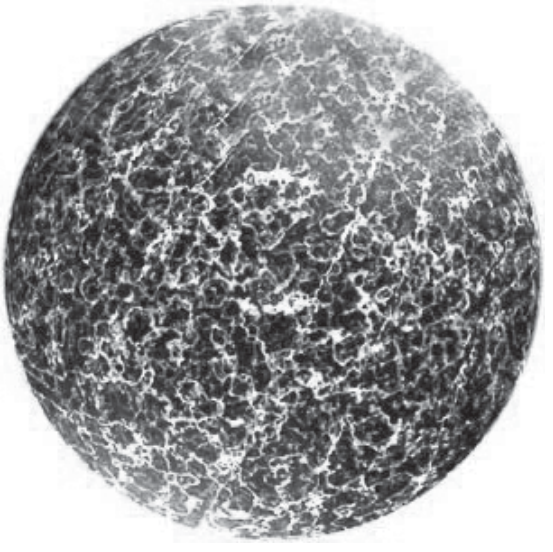
Let's imagine first that we have one potato and the zinc and copper strips are inserted into this potato, with a wire connecting the two strips. This potato battery works as follows:

1) The zinc atoms in contact with the potato dissolve in the presence of the acid. This causes some electrons to separate from the zinc atoms. As a result of this, positively charged zinc ions, and negatively charged electrons, are produced.

2) The electrons produced in the above reaction travel out through the zinc, through the wire, and into the copper strip also inserted in the potato. They do this because they are attracted to the positive hydrogen ions in the potato, located on the copper side (these hydrogen ions are there due to the acid content of the potato). Since the electrons cannot pass through the potato itself, they pass through the wire joining the zinc and copper strips. These electrons then combine with these positive hydrogen ions (on the copper side) and produce hydrogen gas, which then bubbles away.

Note that the above chemical reaction happens spontaneously. It is self-driven. The electrons are forced to travel an external path, and if this external path is connected to an electrical device, such as a clock, it powers the device.

Two potatoes can be connected together in order to double the voltage, the same way you join two batteries together to double the voltage. This voltage is sufficient to power the potato clock.

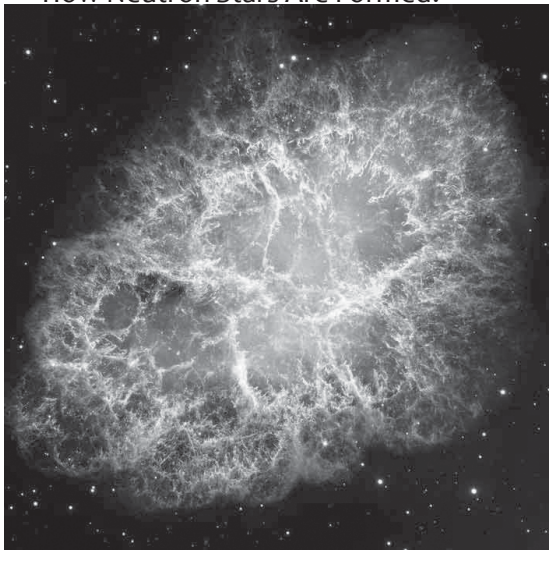


Neutron Star

Abdul Wahab

Neutron-starNeutron stars are the densest known objects after the black holes found in the universe. They are highly compressed cores of giant stars that are formed after their death as a result of a supernova. The level of their compression is so high that mass equivalent to the sun is fitted into the size of a city.

How Neutron Stars Are Formed?



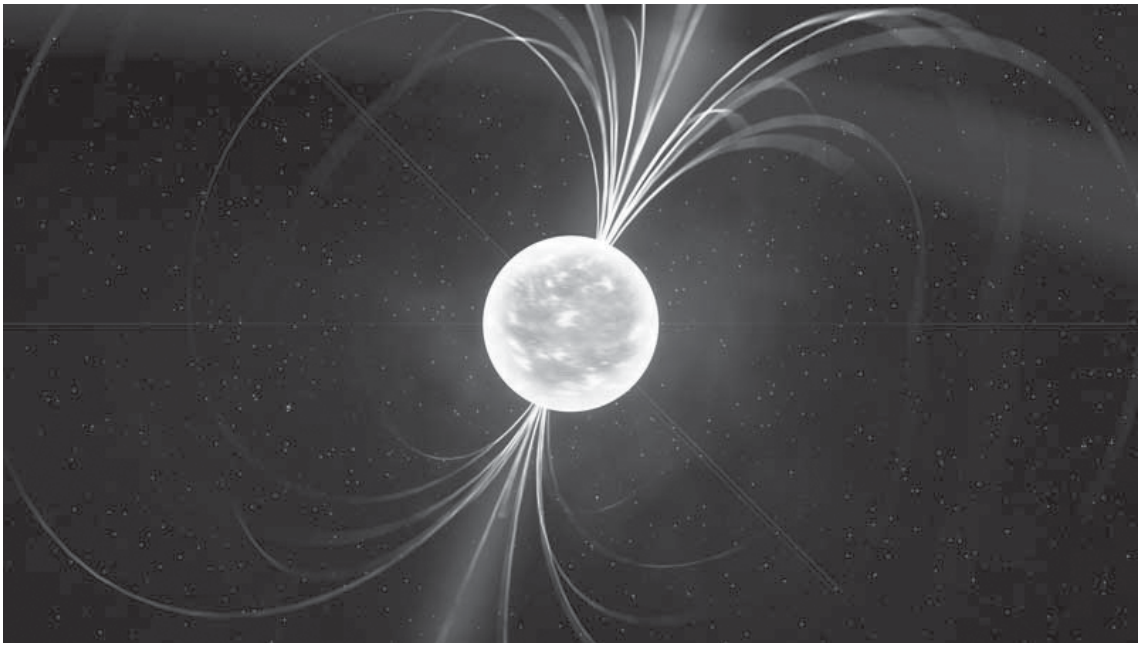
supernova

Supernova – A star after exploding into supernova

The life of a neutron star begins with the death of a giant star. Stars that are about 10 times heavier than our Sun end their life in a most violent and energetic explosion called a supernova. Supernova occurs because the dying star has consumed all of its nuclear fuel and its nuclear fusion ceases. After the ceasing of nuclear fusion, there is no way for a star to fight-off the gravitational collapse. The sudden gravitational collapse causes a star to go supernova.

During a supernova, the remaining core of a star goes further into gravitational collapse and reaches a level that subatomic particles in atoms of the core lose the battle. The electrons and protons are squeezed together to form neutrons in the remaining core. The process goes until the core gets around 90% neutrons by mass. The core of a dying star has now converted into a neutron star at this stage.

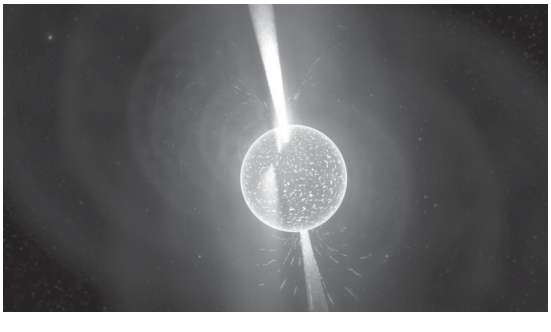
inventions/



Properties of Neutron Stars

Neutron-Star-magnetic-fieldDensity – Neutron stars are one of the most bizarre objects found in our universe. One of the most important properties for which they are known is their incredible density; around 1017 kg/m3. They are so dense that if you bring a spoonful matter of a neutron star on the Earth, it will weigh around 1 billion tons. Furthermore, if you drop that spoon of neutron star matter on the Earth, it will just pass through the Earth without getting blocked.

Gravity – The gravity of a neutron star is tremendous as compared to any object in our universe except the black holes. They have gravity around 2 billion times more as compared to our Earth. They get such tremendous gravity due to their ultra-compactness.



Magnetic Field – Much like density and gravity, neutron stars have also got the strongest magnetic field. The magnetic field of any neutron star is more than a trillion times powerful than the Earth's magnetic field. Due to this reason, they are called the universe's most strong magnets.

Types of Neutron Stars

Pulsar-neutron-star

Pulsar – It is the type of neutron star

There are various types of neutron stars in our universe that are categorized according to their properties. The two most common types of neutron stars are pulsars and magnetars.

Pulsar – They are much similar to ordinary neutron stars except that they emit pulses of matter that are accelerated to nearly the speed of light and high energy electromagnetic radiations. The particle and radiations are emitted in pulses due to the rotation of neutron stars. Scientists have even found a way to use pulsars for the navigation of spaceships in the future.

Magnetar – Magnetars are the type of neutrons stars whose magnetic field is more than a thousand times stronger than an ordinary neutron star. They are the universe's most powerful magnets whose magnetic field is so powerful that it disintegrates the atoms that surround it. Furthermore, the crust of neutron stars is the strongest material in our universe. But the magnetic field of magnetars can tear its own crust; the process is known as starquake. Magnetars under starquake release more energy in 0.1 seconds that our Sun releases in 100,000 years.

Facts

Astronomers have discovered 2,000 neutron stars in our universe to date.

When two neutrons stars collide with each other, a massive explosion is resulted, called a kilonova. Kilonova results in the formation of gold and other heavier elements that couldn't be formed in an ordinary supernova.

There are some neutron stars that couldn't be categorized yet due to their periodic conversion between a pulsar and a magnetar.

Cite this Page

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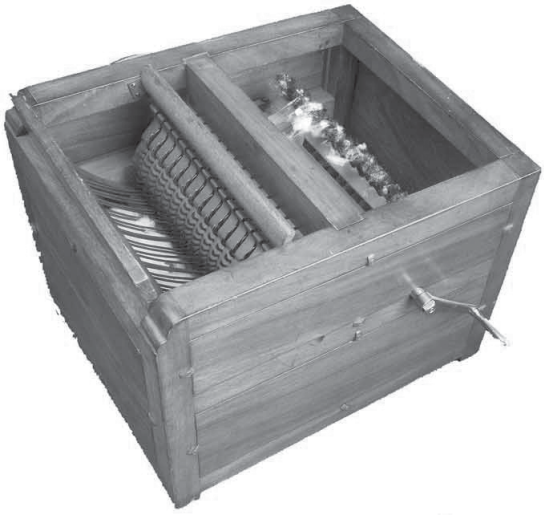
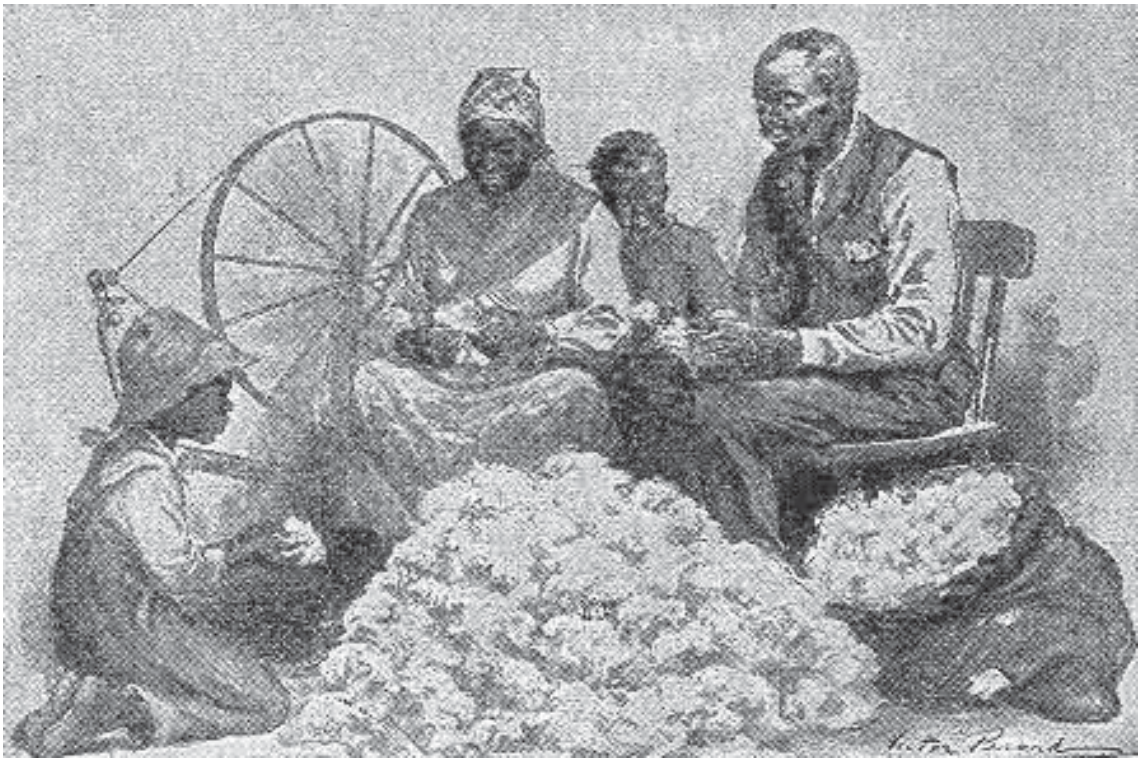


Cotton Gin

cotton-gin-eli-whitneyThe cotton gin is a machine that is used to separate the seeds from cotton fibers. Before the invention of cotton gin, people had to separate the seeds with their hands. This manual separation process was very time consuming and laborious. But the invention of cotton gin revolutionized the industry of cotton.



Cotton gin highly reduced the amount of time required to separate the seeds from the cotton fibers. As a result, the cost of the new fabrics made from cotton decreased dramatically and made the cotton a profitable business especially for the South Americans.short-staple-cotton-crop

Early Methods of Cotton Ginning

cotton-seed-separation-with-hands

Workers are separating seeds from cotton fibers with hands.

Simple machines to separate seeds from

cotton existed centuries before Mr. Eli Whitney's invention of cotton gin. But, they were only useful for long-staple cotton.

South Americans could grow only short-staple cotton, whose seeds were removed manually with hands. Early machines that were used for long-staple cotton were not useful for short-staple cotton. Due to this reason of seed separation process, the cotton was very costly and not a profitable business for South America. Eli Whitney's invention of cotton gin made the cotton a profitable business, especially for the southern state.

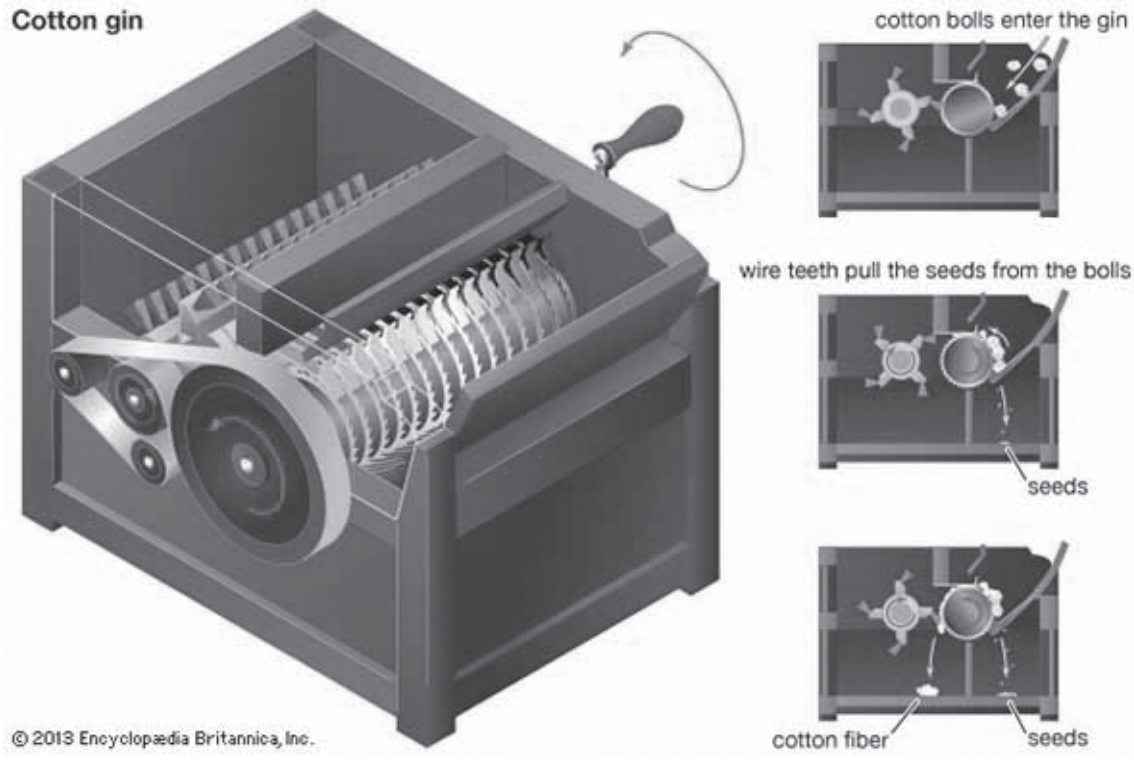
Eli Whitney – Invention of the cotton gin

eli-whitney-photographEli Whitney was a young man and a graduate of Yale. He was a poor guy and was in the need of a job to pay his debts. For this reason, he moved to the south and worked in Georgia as a private tutor on a plantation. There he observed that farmers had a lot of difficulty in separating the seeds from the short-staple cotton. They were in need of a device that can be used to easily separate the seeds to make the cotton a profitable crop.

Eli Whitney quickly understood the need of the farmers and was encouraged by his employer lady Catherine Green to find the solution to the problem. Eli Whitney started to work on the seed separation machine that will ease the workers and sped-up the seeds separation. Mr. Whitney worked for seven months and finally in 1793, he invented the machine which he called "Cotton Gin".

Cotton-Gin

Cotton gin



The cotton gin was able to separate the seeds from the short-staple cotton fibers. It was proved very successful invention which made Mr. Whitney a rich man. Mr. Whitney got the patent of the cotton gin in 1794.

How cotton gin works

How-Cotton-Gin-WorksWhitney's cotton gin was not very complex. Instead, it was so simple that many mechanics made copies his design and sold them on their own.

The first model of cotton gin consisted of a wooden box that contained:

Revolving cylinder

Rotating brush

Crank

Belt

Set of pulleys

comb-like grid and spikes

The cotton gin worked when the crank was turned, which turned the cylinder. The turning cylinder pulled-in the cotton from the small opening and forwarded it towards rotating brushes. Rotating brushes separates the seeds from the cotton and ejects it out of the cotton gin box. The whole machine works due to the set of pulleys and belt that transmits power to every component of the machine.

Pen & Pencil

pen-writingSince prehistoric times, humans have tried to mark their stories and presence with the help of some tools. In ancient times, people used the techniques of engraving or etching their writings on hard surfaces like smooth stones, suitable flat wood, and some metallic surfaces. After that, materials like papyrus and parchments were also used as writing surfaces by using some hard and pointed sticks and styli (singular: Stylus). Such examples of writing are found from caves, pyramids of Egypt to later stages during Chinese Dynasties, Eastern Asia, Greeks, and the Roman Empire.

When liquid ink was invented, then people developed tiny brushes made from camel hair for writing and painting. Moreover, quills were also used for writing by dipping them into inkpot to suck ink and then writing on a surface.

Pen – Invention Timeline

quill-writing-on-paper

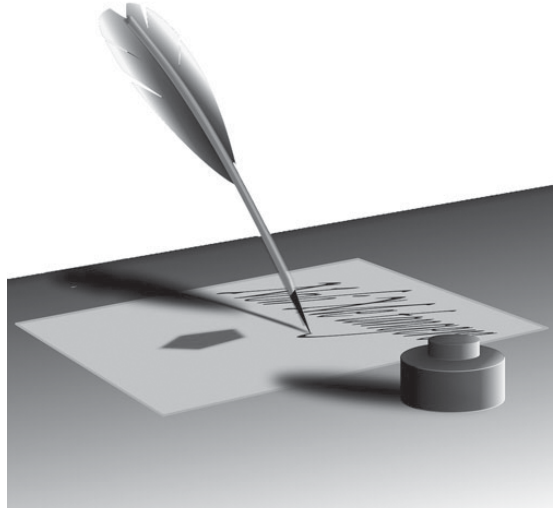
Quill writing on the paper.

Around 2,000 BCE ago, Egyptians were making writing tools from reeds (taller and slimmer family of plants). They carefully cut the tip of a reed to form a nib and filled the hollow portion of the reed with some liquid that acted as ink.

Around 600 AD, the quill pens came into vogue (fashion) and it remained so from the 7th to 19th century. The people of Europe used feathers of birds whose feathers were large such as swans. The feathers obtained from birds were properly dried to drive out the remnants (leftovers) of oil if any. After that, their tip was shaped like a nib with the help of a knife. The quill pens are also required to frequently dip them in ink-pots.

In 1822, John Mitchel started making machine-produced steel pens. By 1850, Birmingham became a large center that produced such pens. However, these pens worked like quill pens as they had to be dipped into an inkpot frequently to enable them to write.

In 1827, a Romanian inventor, Petrache



Poenaru, got his first-ever fountain pen patented. This pen relieved the users from the need to frequently dip the pen in the inkpot. For some unknown reasons he could not develop them to a greater extent and such pens remained defective.

fountain-pen

Fountain pen

In 1884, Lewis Edson Waterman developed a successful fountain pen and got it patented. His invented fountain pen, in the forthcoming years, went through many valuable developments and also become commercially successful.

The Ballpoint pen came into the picture during the 1880s. Its price was much lower as compared to fountain pens. Moreover, it was easy to use in all directions. In addition to this, it could successfully write on a variety of materials other than paper, such, wood, plastics, cardboards, or even underwater. Its ink doesn't freeze in low-temperature zones. Due to this reason, it reduced the use of fountain pens. An American inventor John H. Loud got it patented, however, his designs never reached perfection.

During the 1930s, a journalist from Hungary, named Laszlo Biro developed the idea of a quick-drying ink to prevent sudden smudges of traditional ink. Quick-drying ink eliminated the need of using blotting papers. The blotting papers were used to absorb over-spilled drops of ink left by traditional pens.

In 1943, Laszlo and his brother George obtained another patent for a ballpoint pen. Gradually, they got success with their invention and to this date, there is no rival against ballpoint pens.

The invention of pens and balls pens contributed significantly in the fields of academics to the technical arena.

Pencil Invention

pencilThe meaning of the Latin word "Pencillus" is a small tail, from which the present-day word "Pencil" is derived. Modern pencils were developed through various stages, starting from the first inventor Nicholas-Jacques Conte in 1795. He was one of the scientists who were serving in the army of Napoleon Bonaparte – the famous ruler of France. Until then, an unknown material called graphite was discovered and he used it as the core component of a pencil that writes.

Graphites are suited as a writing material due to its softness and dark gray color.

Graphite is a form (allotrope) of pure carbon and was officially found at Bavaria, Europe around the 15th century ago. However, its uses were recorded in history a few centuries earlier. In earlier days, a misnomer prevailed that graphite is a form of elemental lead, so they talked about pencil as "lead". In 1832, the first factory of pencils, Cumberland Pencil Factory" was built in Keswick, England.

How Pencils Are Manufactured?

In the original process of pencil-making, water, clay, and graphite were combined and then roasted to a temperature of 1038 C. The extent of hardness or softness of the writing component of a pencil is determined by a suitable combination of its materials and the extent of the roasting temperature.

The letter H indicates the hardness; and the letter 'B' indicates blackness. Thus, the softest pencil is marked with 9B and the hardest one is marked with 9H. Popular pencils bear the mark HB. The letter 'F' indicates fineness. The 'pencil-lead' is surrounded by rounded or angular wooden casings appropriately painted with different colors.

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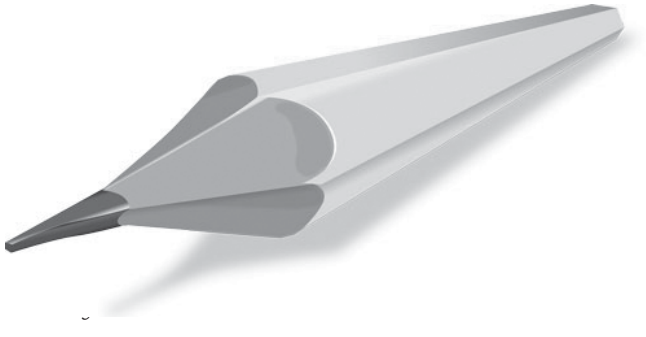


Citric Acid: Uses, Applications & Side Effects

Citric acid is a weak organic acid having the chemical formula C6H8O7. Citric acid is found naturally in citrus fruits. In biochemistry, citric acid acts as an intermediate in the citric acid cycle. Every year, more than a million citric acids are manufactured world over. Citric acid is widely used as a flavouring, as an acidifier and chelating agent.

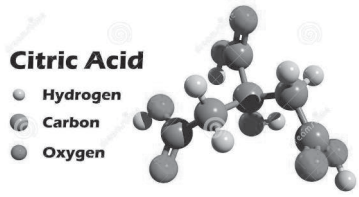
citric-acid

Uses/Applications of Citric Acid

1. In food & drink

citric-acid-in-food-and-drinks-compressed

The most common uses of citric acid are as a preservative and flavouring agent in food and beverages such as soft drinks.



Citric acid is used as an emulsifying agent in ice-creams.

2. As cleaning & chelating agent

Citric acid is considered as an excellent chelating agent. Limescale is removed from boilers and evaporators with the help of citric acid. Citric acid is used for softening water, which makes it useful in laundry detergents and soaps. It can also be used in shampoo for washing colouring and wax from the hair.

3. In cosmetics

citric-acid-in-cosmetics

It is used widely as an acidulent in gels, creams and liquids of all kinds.

4. To cure kidney disorders

In combination with sodium citrate, acetic acid is used to prevent kidney stones.

Side Effects

Taking excess of citric acetate in combination with sodium citrate may lead to kidney failure.

Taking citric acid with empty stomach may lead to stomach or intestinal side-effects.

It may also lead to muscle twisting or cramps.

It can also cause weight gain, swelling, fast heart rate, slow or rapid breathing, etc

Why Study Chemistry?

Reasons to Study Chemistry

Chemistry is the study of matter and energy and the interaction between them. There are many reasons to study chemistry, even if you aren't pursuing a career in science.

Chemistry is everywhere in the world around you! It's in the food you eat, clothes you wear, water you drink, medicines, air, cleaners... you name it. Chemistry sometimes is called the "central science" because it connects other sciences to each other, such as biology, physics, geology, and environmental science. Here are some of the best reasons to study chemistry.

Chemistry helps you to understand the world around you. Why do leaves change color in the fall? Why are plants green? How is cheese made? What is in soap and how does it clean? These are all questions that can be answered by applying chemistry.

Basic knowledge of chemistry helps you to read and understand product labels.

Chemistry can help you make informed decisions. Will a product work as advertised or is it a scam? If you understand how chemistry works you'll be able to separate reasonable expectations from pure fiction.

Chemistry is at the heart of cooking. If you understand the chemical reactions involved in making baked goods rise or neutralizing acidity or thickening sauces, chances are you'll be a better cook.

A command of chemistry can help keep you safe! You'll know which household chemicals are dangerous to keep together or mix and which can be used safely.

Chemistry teaches useful skills. Because it is a science, learning chemistry means learning how to be objective and how to reason and solve problems.

Helps you to understand current events, including news about petroleum, product recalls, pollution, the environment and technological advances.

Makes life's little mysteries a little less... mysterious. Chemistry explains how things work.

Chemistry opens up career options. There are many careers in chemistry, but even if you're looking for a job in another field, the analytical skills you gained in chemistry are helpful. Chemistry applies to the food industry, retail sales, transportation, art, homemaking... really any type of work you can name.

Chemistry is fun! There are lots of interesting chemistry projects you can do using common everyday materials. Chemistry projects don't just go boom. They can glow in the dark, change colors, produces bubbles and change states.

Cite this Article

Helmenstine, Anne Marie, Ph.D. "Why Study Chemistry?" ThoughtCo, Aug. 27, 2020, thoughtco.com/reasons-to-study-chemistry-609210

Can I get the coronavirus twice?

There have been some cases, but is it too early to tell what is actually happening here?

By Dr Jeremy Rossman

There have been a few stories in the press of people apparently being re-infected by the coronavirus SARS-CoV-2. These people reportedly became infected and hospitalised, and then were sent home once they'd tested negative for the virus. Then, days or weeks later, they tested positive again.

But this doesn't necessarily mean that they caught the coronavirus twice.

First, during recovery from infection, a person may have very low amounts of the virus remaining in their body – low enough that our tests can't accurately detect it. In this case, the person may be sent home on the assumption that they're virus-free. However, their body may still be fighting the virus, and a resurgence of the virus (and symptoms) can occur, resulting in a positive test. In this case, it would just be one protracted infection, not a re-infection.

Second, we know that in most people, SARS-CoV-2 generates a strong response from the immune system. With the related coronavirus SARS-CoV, this response creates an immune memory of the virus that prevents re-infection for one to two years, and it's likely that this is also the case for the new virus. SARS-CoV-2 also has a fairly low mutation rate, which means that it (hopefully) won't change enough that our immune system no longer remembers it (this is what the flu virus does and why we need a new jab every year).

If this all turns out to be true, then it would suggest that re-infections are unlikely and that the cases in the news reflect testing sensitivity. However, SARS-CoV-2 is so new that we won't know for sure until we've found out just how protective our immune response to the virus is, and how long it lasts.

Can I get the coronavirus from a parcel?

Wash your hands, just wash your hands.

By Dr Jeremy Rossman

It's hypothetically possible, but parcels pose a very small risk.

A US study found that the coronavirus can survive for up to 24 hours on cardboard (and paper is likely to be similar). So for the parcel to be contaminated, someone with COVID-19 would have had to touch or cough on your parcel within the past day.

The chances of this are low, but common sense advice would be to wash your hands with soap and water after opening the parcel, and then again after you've disposed of the packaging – especially if you or anyone else in your household is in one of the vulnerable groups.

The same study found that the virus can survive for up to three days on hard, shiny surfaces such as plastic and stainless steel – which is why door handles are particularly good vectors for the virus. So, if you receive anything packaged in plastic, such as takeaway deliveries, make sure to wash your hands after touching it, and especially before eating.

We don't yet know how long the virus can survive on smartphone screens, but it's likely to be up to three days. This means that you should ideally clean your phone with disinfectant wipes (Apple recommends 70 per cent isopropyl alcohol wipes), at least once a day.

Coronavirus: Is hand-washing really the best thing we can do to stop the spread of COVID-19?

The Government's advice on coronavirus asks the public to wash their hands more often. But how could hand-washing protect us?

By Sara Rigby

Why is the Government advising us to wash our hands?

Coronavirus is a respiratory illness, meaning it is mostly spread through virus-laden droplets from coughs and sneezes. If you don't catch your coughs and sneezes in a tissue and safely dispose of it, the virus can end up on surfaces. If someone else touches that contaminated surface, the virus can transfer onto their hand.

If you have the virus on your hands, you can infect yourself by touching your eyes, mouth or nose. You might think that you don't touch your face very often, but it's much more than you realise. A 2015 study found that people touch their faces an average of 23 times an hour.

While washing your hands is useful in preventing yourself from getting infected, this is not the main reason the Government recommends it.

"It's all about stopping the spread," says Sally Bloomfield, honorary professor at the London School of Hygiene and Tropical Medicine. "When it comes to stopping the spread of the serious infection in this country, the public have a huge role to play."

Does soap kill coronavirus?

Coronavirus is an 'enveloped virus'. This means it has a protective outer layer known

as a 'lipid bilayer'. The molecules making up this layer are shaped like a tadpole, with a water-loving (hydrophilic) round head and a water-hating (hydrophobic) tail.

These molecules arrange themselves into a 'bilayer': two layers piled on top of each other into a sheet, with tails pointing inwards and heads pointing outwards.

The molecules are pulled closely into each other to protect the hydrophobic tails from the water in your respiratory droplets when you cough or sneeze.

The hydrophilic heads are very 'sticky', meaning the virus is very effective at sticking to your hands – perfect for a microbe that's trying very hard to infect you.

A lipid bilayer with the round, hydrophilic heads pointing outwards and the hydrophobic tails pointing inwards © LadyofHats / Public domain

A lipid bilayer with the round, hydrophilic heads pointing outwards and the hydrophobic tails pointing inwards © LadyofHats / Public domain

Soap molecules also have this tadpole structure, which is what makes it so useful. When you have something oily on your hands, running water won't get rid of it. Add soap to your hands – the hydrophobic tail will cling to the oil, and the hydrophilic head will stick to the water. Now, the oil will come straight off.

Because the soap molecules are so similar to the ones making up the outer layer of the virus, the molecules in the lipid bilayer are as strongly attracted to soap molecules as they are to each other.

This disrupts the neatly-ordered shell around the virus, dissolving it in the running water and killing the virus.

Read more about coronavirus:

Coronavirus: is it a cause for panic?

Coronavirus: aggressive 'L type' strain affecting 70 per cent of cases

Coronavirus breakthrough: scientists grow virus in laboratory

Does antibacterial hand sanitiser kill viruses?

Yes. Alcohol-based hand sanitiser will kill viruses if soap and water are not available. Alcohol is an antiseptic and can kill enveloped viruses such as coronavirus, but make sure it contains 60 to 95 per cent alcohol.

However, if your hands are visibly dirty, you need to use soap and running water to clean the dirt off.

Will washing my hands stop me from catching coronavirus?

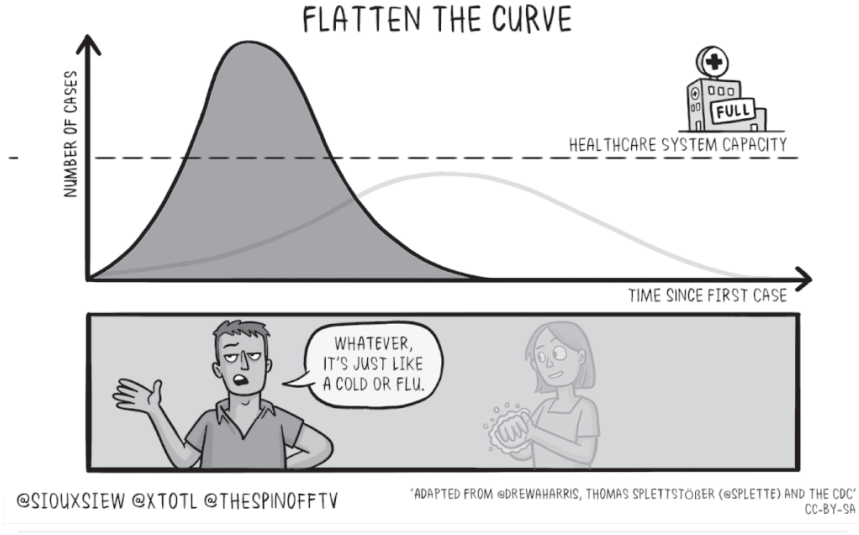
Unfortunately, it's impossible to know whether any particular case of coronavirus could have been prevented by better hand-washing.

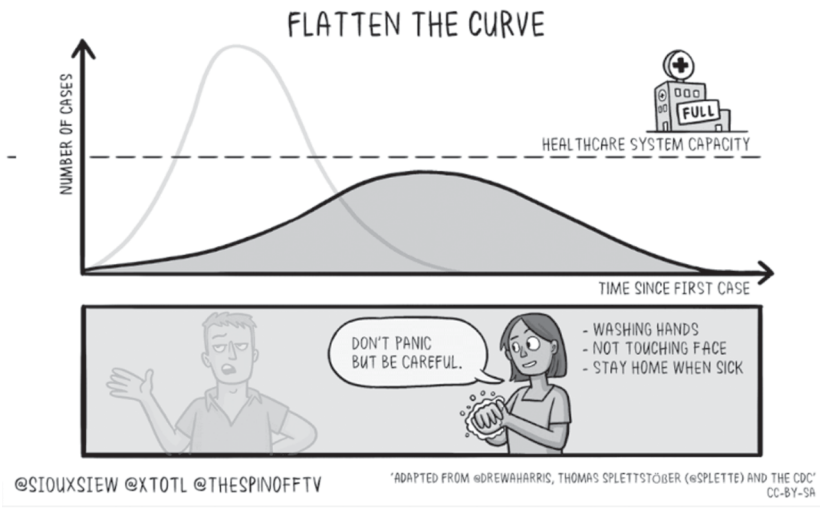
While it is possible to contract coronavirus from touching your face with virus-contaminated hands, you can also catch it directly from the coughs or sneezes of an infected person.

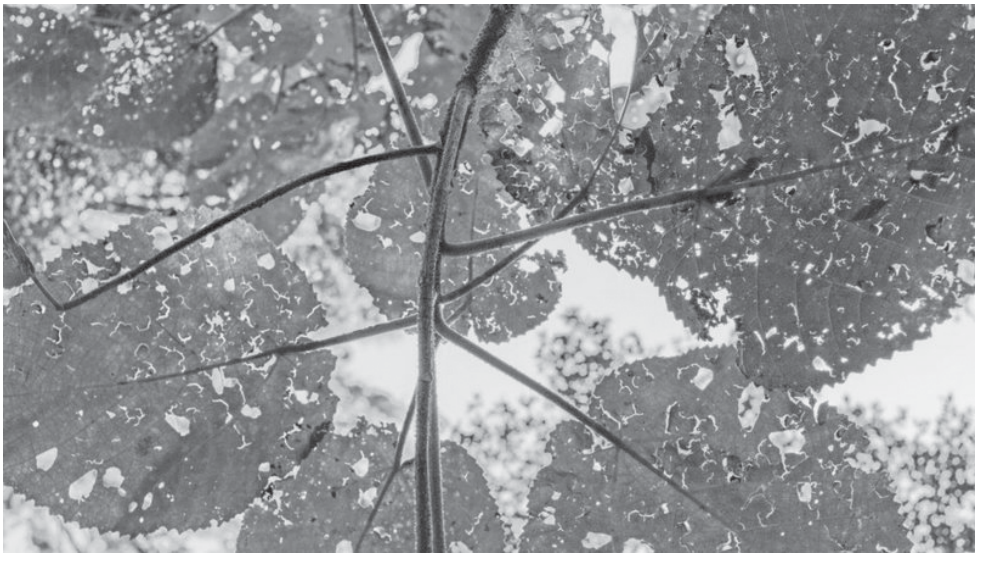
So, while washing your hands won't eliminate your risk of infection, it's a sensible and powerful safety measure.

"It's a little bit, I think, like wearing a car seatbelt, in that it's unlikely you'll get infected at the present time, in the same way as you're unlikely to have a crash when

you go out in your car," says Bloomfield. "You still go out in your car, but you always belt up your seatbelt."







Spider-like toxins found in Australia's stinging trees

Published1 day ago

Leaves of Dendrocnide excelsa or the Australian stinging treeIMAGE COPYRIGHTGETTY IMAGES

image captionThe trees - known as the gympie-gympie among Australians - are primarily found in north-eastern Queensland

Toxins produced by Australia's stinging trees bear a strong resemblance to those of spiders and scorpions, scientists have found.

The findings, published in the Science Advances journal, come from University of Queensland researchers.

Those stung by the leaves of such trees first feel an intense burning.

It changes after several hours to a pain akin to the affected area having been slammed in a car door. This may last for days or even weeks.

The scientists say they have found that the molecular structure of the venom is knotlike, allowing the toxin to tangle and repeatedly target pain receptors in the victim.

Nature's most painful stingers

The tree - Dendrocnide excelsa - is also known as the gympie-gympie.

It has broad oval- or heart-shaped leaves covered with needle-like hairs, and is primarily found in rainforests in the north-eastern areas of Queensland.

"The Australian stinging tree species are particularly notorious for producing [an] excruciatingly painful sting," Irina Vetter, associate professor at the University of Queensland's Institute for Molecular Bioscience, told CNN.

She said those needle-like appendages "look like fine hairs, but actually act like hypodermic needles that inject toxins when they make contact with skin".

The authors of the report named the newly-discovered type of neurotoxin "gympietides".

Until recently, scientists were unable to figure out which molecules inside the plant caused such severe pain.

"By understanding how this toxin works, we hope to provide better treatment to those who have been stung by the plant, to ease or eliminate the pain," Prof Vetter said.

California and Oregon 2020 wildfires in maps, graphics and images

By The Visual and Data Journalism Team

BBC News

Dozens of wildfires have been burning their way through swathes of the US West Coast over the last month, killing more than 30 people and forcing tens of thousands from their homes.

Lightning strikes in August sparked a number of the blazes, while warm temperatures and dry conditions have fuelled additional fires.

Here's a visual guide to what's happening - a month on from a state of emergency being declared in California.

The fires are record-breaking

Wildfires are burning millions of acres in California, Oregon and other parts of the western US, devastating towns and blanketing communities in thick smoke.

Smoke from the August Complex fire in CaliforniaImage copyrightMAXAR

Scientists say the region's wildfires are the worst in 18 years and have linked their increasing prevalence and intensity to climate change. However, US President Donald Trump has blamed poor forest management for the blazes.

Plumes of smoke from the fires are so large, they have crossed the US and the Atlantic Ocean, carried by the jet stream, and have reached the skies of Europe.

Nasa captured the high-altitude smoke and associated aerosols - particles in the air - as they travelled east to New York City and Washington DC in the middle of last week.

Nasa satellite image showing plumes of smoke crossing the US

By the end of last week the smoke had reached Northern Europe, scientists from the European Commission's Copernicus Atmosphere Monitoring Service (CAMS) say. It is forecast to do so again in the coming days.

The fact the fires are emitting so much pollution that can be detected thousands of miles away reflects "just how devastating they have been in their magnitude and duration", says Mark Parrington, a CAMS senior scientist.

Data from CAMS also shows the fires are "significantly more intense" than the average for 2003-2019 and are the worst in 18 years.

Nasa has described a "perfect storm of meteorological factors" contributing to the period of "extreme burning". Record-breaking temperatures, unusually dry air and fierce winds - on top of drought in some areas - have exacerbated the fires.

Vincent Ambrosia, from Nasa's Earth Applied Sciences Program's wildfire research team, said these conditions, alongside the "long-term drying and warming of both the air and vegetation", meant larger, higher-intensity fires.

Some have estimated the economic impact of this year's fires could be more than $20bn (£15.5bn).

The wildfires are devastating California and Oregon

The US National Interagency Fire Center

has said firefighters are battling 106 large wildfires across the western US, with higher-than-normal levels of burning in a number of states.

California and Oregon have seen some of the worst of the blazes.

Map showing wildfires in California and Oregon

Many of the fires are in California, where fire officials have said more than 17,000 firefighters are battling more than 20 major blazes.

And with no rain forecast, the state remains "dry and ripe for wildfires", the state firefighting agency Cal Fire has warned.

California Governor Gavin Newsom says the state has seen 7,606 blazes this year compared with 4,972 in 2019. And according to Cal Fire, five of the top 20 largest fires in California's history have occurred in 2020.

US Senator Jeff Merkley of Oregon described the scene in his state as "apocalyptic", with affordable housing, apartment blocks and commercial districts burned to the ground.

"It's overwhelming," the Democratic senator told Reuters news agency.

The area of burned land is massive

The fires have devastated millions of acres.

According to the National Interagency Fire Center, 6.7m acres (2.7m hectares) have been burned this year, so far.

Map showing the size of US wildfires - over London, New York and New Delhi

The August Complex fire, in Tehama County, California, has become the state's biggest recorded fire ever, covering more than 750,000 acres.

Lives across the region have been devastated

The fires have devastated several small towns, destroying thousands of homes and killing more than 30 people.

Tens of thousands of people have been left homeless or have been evacuated, and search teams are continuing to scour the ruins of burned-out homes for the missing.

Before and after image showing fire damage in Talent, Oregon

In Oregon, the Almeda fire has been wreaking havoc since it started in the city of Ashland on 8 September.

Strong winds drove the blaze's flames north through towns and communities along a 13-mile stretch of the N5 highway.

In the city of Talent, Jackson County, businesses, homes and trailer parks were razed. Dozens more properties were destroyed in neighbouring Phoenix.

A fire service spokesman said 42,000 people in the area had been affected. Many had lost their homes, while others had to be evacuated or had been left without electricity.

Before and after image showing fire damage in Phoenix, Oregon

High school teacher Tracy Koa fled Talent with her partner, Dave Tanksle, along with their 13-year-old daughter. They returned to find their home and neighbourhood had gone up in smoke.

"We knew that it was gone," she told

Reuters. "But then you pull up, and the devastation of just every home, you think of every family and every situation and every burnt-down car, and there are just no words for it."

Air quality is so poor it is off the scale

The states of Oregon, Washington and California are experiencing some of the most unhealthy air on the planet, according to global air quality rankings.

In some parts of Oregon, air quality has been so hazardous that it has gone beyond the scale of the state's Air Quality Index.

Pollution has hit historic levels in five of the state's cities - Portland, Eugene, Bend, Medford and Klamath Falls, officials said this week.

Map showing air quality index for California and Oregon

Pollution from wildfires, contains soot and other fine particles dangerous to human health, as well as noxious chemicals.

Residents who smell smoke or see haze are advised to take precautions against breathing it in and to stay informed about local air quality warnings.

All of the smoke also translates into significant carbon emissions, Nasa says.

It already estimates that 2020 is the highest year of fire carbon emissions for California in its Global Fire Emissions Database, which goes back to 1997.

"Fire emissions this year far outpace the annual totals for all other years, and it is only September 11," says Douglas Morton, chief of the Nasa Goddard biospheric sciences laboratory.

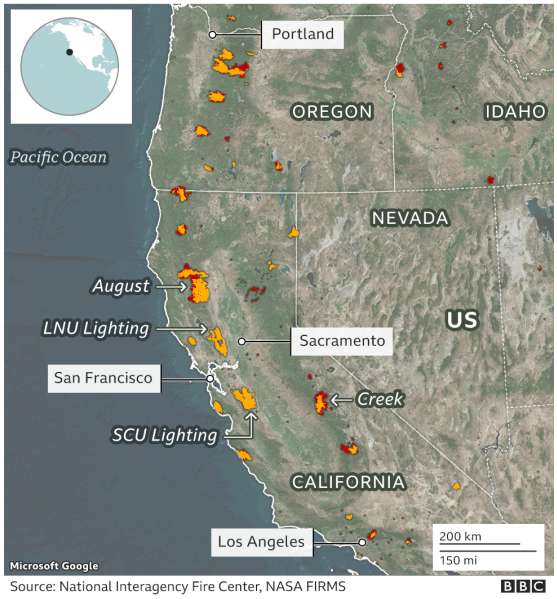
California's peak fire season usually runs until October, but can continue until further in the year.


MAXAR

Wildfires in California and Oregon

Current fires (last 48 hours)

Burned areas since 1 September

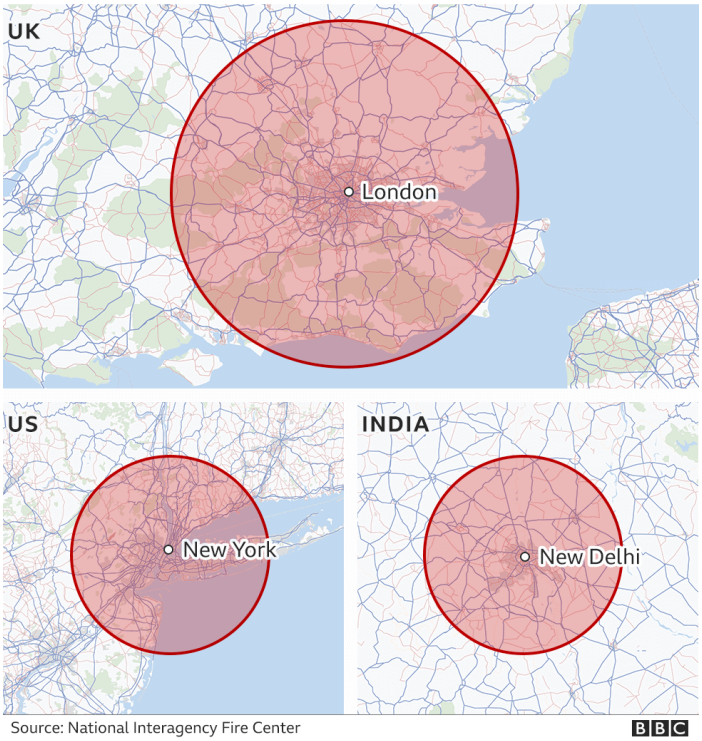


Source: National Interagency Fire Center, NASA FIRMS

BBC

How big are the fires?

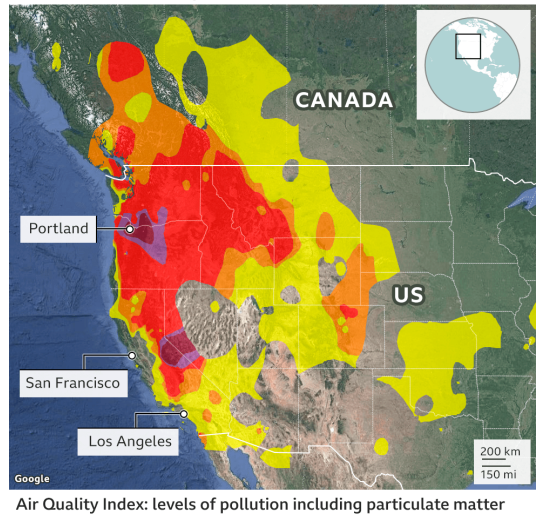
An estimated 6.7m acres has burned since the start of the year, equivalent to



Source: National Interagency Fire Center

BBC

Worst air quality on record for US West Coast



Air Quality Index: levels of pollution including particulate matter

- Moderate 51-100
- Unhealthy for sensitive groups 101-150
- Unhealthy 151 - 200
- Very unhealthy 201-300
- Hazardous 300 -500

Source: AirNow

BBC

Extinction: Urgent change needed to save species, says UN

By Victoria Gill

Science correspondent, BBC News

Humanity is at a crossroads and we have to take action now to make space for nature to recover and slow its "accelerating decline".

This is according to a report by the UN Convention on Biological Diversity.

It sets out a bullet point list of eight major transitions that could help stop the ongoing decline in nature.

"Things have to change," said Elizabeth Maruma Mrema, the convention's executive secretary.

"If we take action, the right action - as the report proposes - we can transition to a sustainable planet."

Tackling climate change will be critical in the endeavour to "bend the curve" on biodiversity loss

What's the link between exploiting nature and human health?

New diseases emerge in the human population probably three or four times every year. It is only when they are easily transmitted from human to human - like the coronavirus - that they have the potential to kick-start a pandemic. But increasing the chances of a new disease emerging increases the chances of that disease becoming the "next Covid".

And these are not truly new diseases - they are just new to our species. The vast majority of outbreaks are the result of an animal disease spilling over into the human population. Ebola and HIV came from primates; scientists have linked cases of Ebola to consuming meat from infected animals. A bite from a rabies-infected animal is a very effective mode of disease transmission. And in the 20 years before Covid-19, SARs, MERs, swine flu, and avian flu all spilled over from animals.

As we reengineer the natural world, we encroach on reservoirs of animal disease and put ourselves at risk.

"More and more we are affecting wildlife populations, deforesting and causing animals to move and enter our environment," explained Prof Matthew Baylis, a veterinary epidemiologist from the University of Liverpool.

"That causes [disease-causing] pathogens to be passed from one species to another. So our behaviours on a global scale are facilitating the spread of a pathogen from animals into humans."

How are humans doing when it comes to protecting nature?

The convention (CBD) has called this the "final report card" on progress against the 20 global biodiversity targets that were agreed in 2010 with a 2020 deadline.

"Progress has been made, but none of [those] targets will be fully met," Ms Maruma Mrema told BBC News. "So a lot still needs to be done to bend the curve on biodiversity loss."

As well as a stark warning, this report sets out an instruction manual about how to bend that curve.

"It can be done," said David Cooper, deputy executive secretary of the CBD.

"Next year in China we'll have the UN biodiversity conference, where countries are expected to adopt a new framework that will represent global commitments to put nature on a path to recovery by 2030."

Bornean orangutan (c) Joel SartoreImage copyrightJOEL SARTORE

It is one of our closest primate relatives, but the Bornean orangutan is on the brink of extinction

How can the impact of humans on nature be limited?

That framework - which has been dubbed a "Paris climate agreement for nature", will encompass eight major transitions that all 196 nations will be expected to commit to:

Land and forests: Protecting habitats and reducing the degradation of soil;

Sustainable agriculture: redesigning the way we farm to minimise the negative impact on nature through things like forest clearance and intensive use of fertilisers and pesticides;

Food: Eating a more sustainable diet with, primarily, more moderate consumption of meat and fish and "dramatic cuts" in waste;

Oceans and fisheries: Protecting and restoring marine ecosystems and fishing sustainably - allowing stocks to recover and important marine habitats to be protected

Urban greening: Making more space for nature in towns and cities, where almost three-quarters of us live;

Freshwater: Protecting lake and river habitats, reducing pollution and improving water quality;

Urgent climate action: Taking action on climate change with a "rapid phasing out" of fossil fuels;

A 'One Health' approach: This encompasses all of the above. It essentially means managing our whole environment - whether it is urban, agricultural, forests or fisheries - with a view to promoting "a healthy environment and healthy people".

"Covid-19 has been a stark reminder of the relationship between human action and nature," said Ms Maruma Mrema. "Now we have the opportunity to do better post-Covid.

The pandemic itself has been linked to wildlife trade and human encroachment into forests, which scientists say increases the risk of a "spillover" of diseases from wildlife into humans.

Media captionScientists believe another pandemic will happen during our lifetime

Has there been any progress over the past decade?

The report does highlight some successes: deforestation rates are continuing to fall, eradication of invasive alien species from islands is increasing, and awareness of biodiversity appears to be increasing.

Malayan tiger (c) Joel SartoreImage copyrightJOEL SARTORE, NATIONAL GEOGRAPHIC PHOTO ARK

Image caption

Photographer Joel Sartore is on a mission to document threatened species, like the Malayan tiger, before they disappear

"Many good things are happening around the world and these should be celebrated and encouraged," said Ms Maruma Mrema. Nevertheless, she added, the rate of biodiversity loss was unprecedented in human history and pressures were intensifying.

"We have to act now. It is not too late. Otherwise, our children and grandchildren will curse us because we will leave behind a polluted, degraded and unhealthy planet."

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