KNOWBEL

ENLIGHTENING THE NOBLES!

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WORLD HEART DAY

29th Sept.

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Enlightening the nobles !

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KNOWBEL is back with a pool of mind-boggling articles filled with rare facts and famous personalities from all over the world brought to you in yet another edition!

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Magical things happen when you read!
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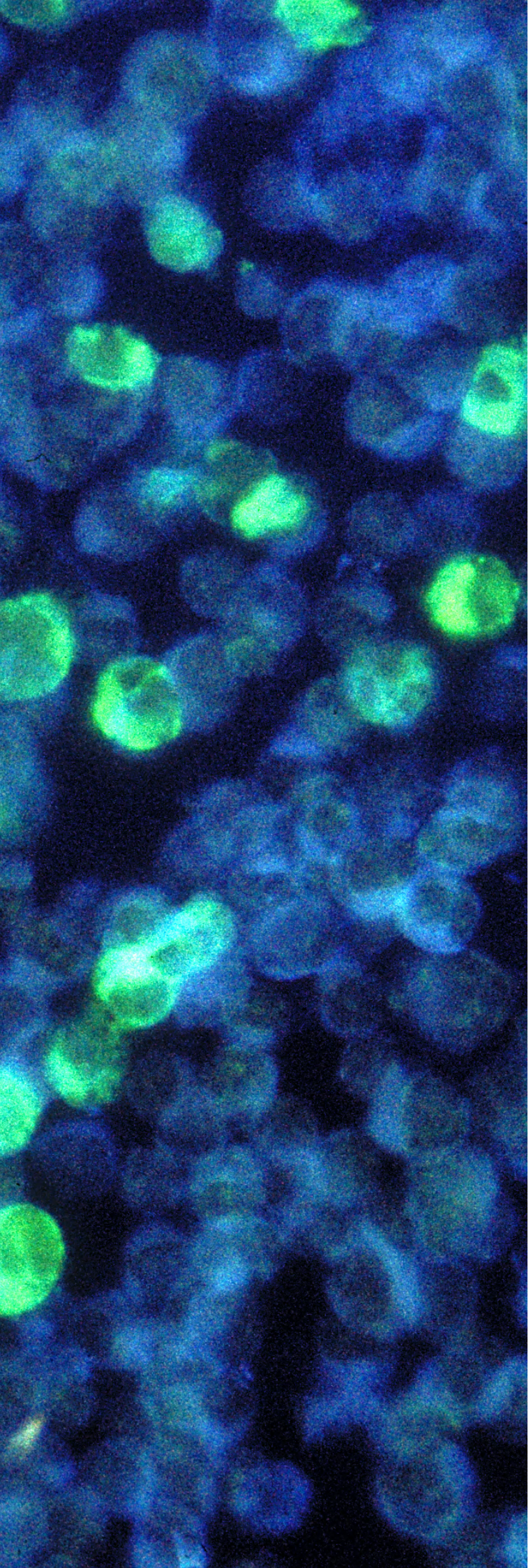

KNOWBEL

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Never Stop Questioning

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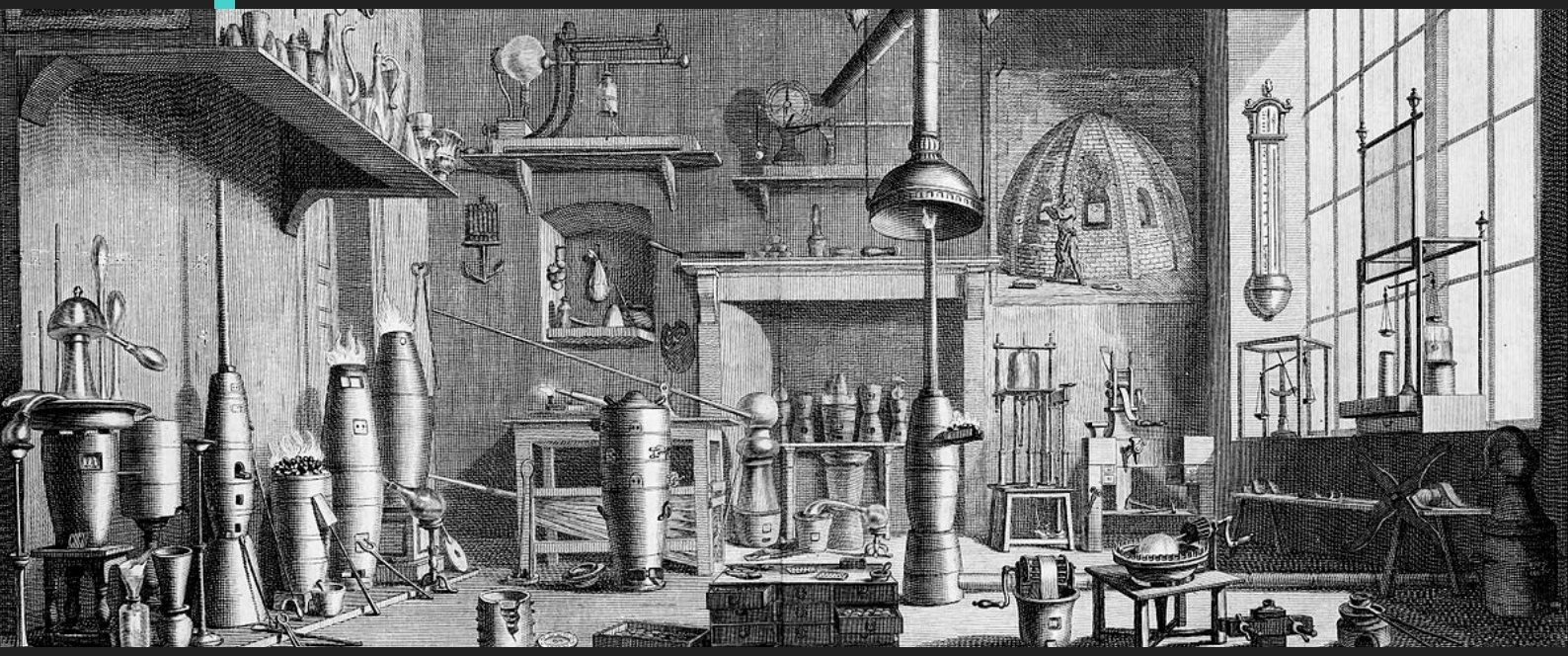
PHYSICS

ALCHEMY IN ACTION – CAN WATER TURN INTO GOLD?

by Jhanvee Khanna



Via Wikimedia Commons

Henning Brandt could have mastered alchemy had he used water rather than urine!
However, recently our modern-day alchemist scientists at the Czech Academy of Sciences were able to transform a water droplet into a gleaming metallic golden blob that miraculously lasted for a few seconds.

When exposed to enough pressure, almost any material can theoretically become metallic. Atoms or molecules can be squeezed together so tightly that their outer electrons begin to share, allowing them to travel and conduct electricity in the same manner they do in metals like iron or copper. According to physicists, cores of massive planets like Uranus and Neptune hold metallic water owing to the high pressure.

Turning water into metals would need 15 million atmospheres of pressure, which is beyond the capabilities of present lab techniques. However, water might be made conductive in another way — by using alkali metals as a source of electrons. These reactive elements in group 1 of the periodic table, sodium and potassium, tend to transfer their outermost electrons.Ammonia, which turns shiny under comparable conditions, has a similar effect, observed in the 19th century by Humphry Davy.

The researchers planned to try the same method with water instead of ammonia but faced an issue: alkali metals react violently with water. The solution was to create an experimental set-up that would substantially slow down the reaction, preventing it from becoming explosive.

The researchers placed a syringe loaded with sodium and potassium in a vacuum chamber, a liquid mixture at room temperature. They then formed metal droplets with the syringe and exposed them to tiny amounts of water vapour. The water condensed onto each droplet, creating a very thin (about one-tenth of a micrometre) coating. The droplet's electrons soon diffused into the water-along with positive metallic ions- and the water layer turned golden within seconds.

However, it is not as straightforward as it appears. Finding the correct time window when electron diffusion was faster than the reaction between water and metals was critical for the researchers. Fortunately, they achieved a quasi-steady state in which the physics of metallisation triumphed over chemical decomposition, which was no less than a eureka moment for them.

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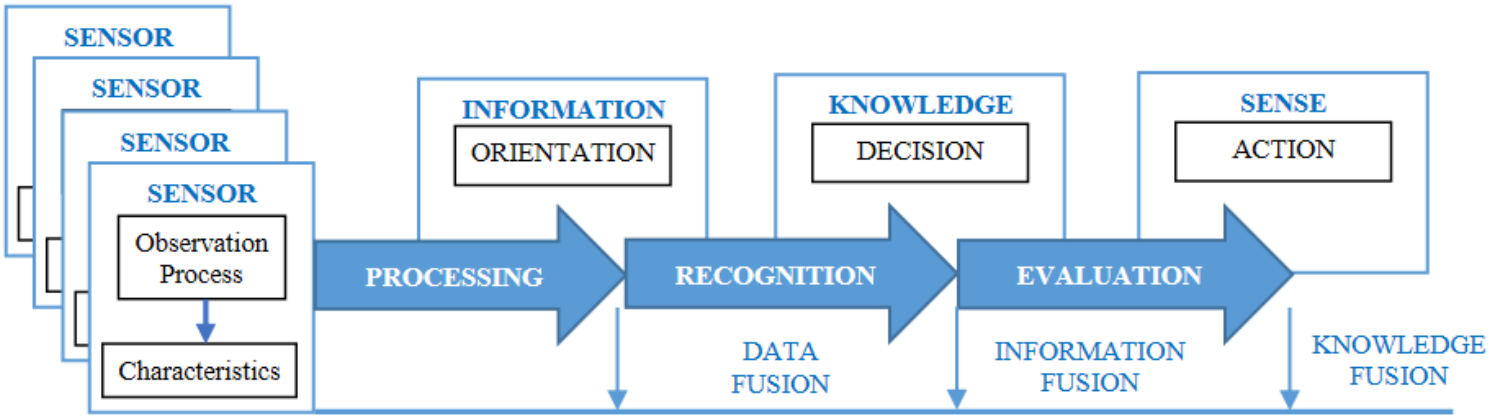
PHYSICS

ARTIFICIAL NEURAL NETWORKS IN DATA FUSION

by Anuradha Meena



Data flow scheme in multi-sensor information sensor.
Source: http://managementpapers.polsl.pl/wp-content/uploads/2020/10/149_Dudczyk-Rybak-Jezierski.pdf

Data fusion means a synergy of information, and it is extensively being used in the fields like medicine, robotics and the army. In a contemporary Sensor Network, the fusion occurs at the data level, and this concept comes down to 'multi-sensor data fusion. Depending on the level at which the fusion is carried out, it may be divided into data fusion, information fusion and knowledge fusion.

Data fusion is an effective process for combining data that comes from many different sensors. Information fusion is combining processed data, whereas knowledge fusion is a process of synthesising deeply analysed knowledge. The fusion process is often carried out offline. In the case of a multi-sensor platform, the fusion process is examined on an information platform. Different methods like adaptive neural networks and genetic algorithms, classical reasoning, Bayesian reasoning, etc., are used to solve the problem related to data fusion.

Artificial neural networks have immense potential and allow the modelling of nonlinear processes. They are not only useful in processing data fusion but also in solving decision-making problems. For example, artificial neural networks are used in a voice search system [by google] and a speech-recognition system to transcribe conversations slightly more accurately than humans. They have become a powerful and helpful tool for solving many problems like classifications, clustering, regression, pattern recognition, dimension reduction, etc.

Without the Artificial Neural Network technique, it would not be possible to solve the problem quickly because they process the information fastly and respond in nanoseconds. Artificial neural networks have made it possible to predict solutions based on previously stored data and provide incredible accuracy in the data fusion process. There are some possibilities of predicting unknown solutions based on implemented neural networks. The most significant advantage of using an Artificial Neural Network is finding a general solution to the problem and can be effectively used with the unknown value parameters.

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CHEMISTRY

MOVING INTO THE FUTURE WITH AUTONOMOUS SELF-HEALING

by Atharva Valanju

Illustration by Aishwarya

Have you ever dropped your phone and had a glaring crack left on the screen as a reminder? Scientists have recently made a discovery which in the future may allow such cracked screens to heal by themselves without any external influence.

Self-healing materials have become the subject of intense research in recent years; however, all discoveries until now have been limited to soft materials, especially polymers and gels. In the new study published, scientists have found an autonomous self-healing piezo-electric crystal made of organic bipyrazole molecules. They have essentially created a dense material made of molecules arranged in a regular way that heals when ripped apart.

Piezo-electric molecular crystals are a type of crystal that is capable of converting mechanical energy into electric energy. This means that whenever the crystals are compressed or struck, they generate an electric charge. Because of this electric charge, the two broken ends of the crystal are attracted to each other and fuse perfectly back together.

A surprising thing about this research is that it was serendipitous. The scientists at IISER-Kolkata saw that a crystal healed itself on breaking and were puzzled about why and how such a phenomenon took place.

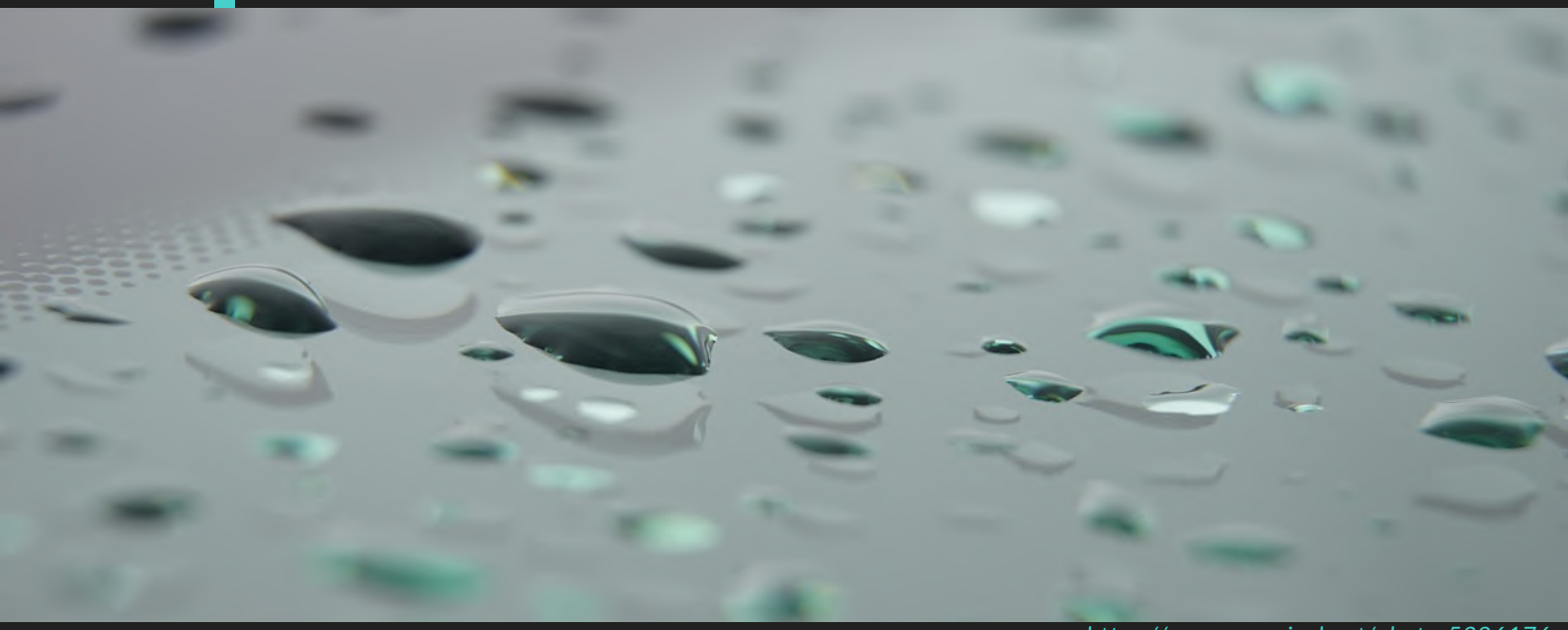
Further studies revealed the causal mechanism of the healing to be piezo-electricity which allowed the molecule to fuse again when the existing hydrogen bonds were broken. To make sure that their discovery was reproducible, the scientists grew multiple rounds of sample crystals in tiny needle shapes. Next, they applied just enough pressure to make the crystals break into two pieces and then watched as the crystals bounced back from the break into straight-line needles again with no evidence of the break remaining. It was as if they were never broken in the first place!

Testing of the crystals with a polarisation microscope showed that the material had truly healed. The scientists are now working on finding many such other self-healing materials that may be of immense use in the future.

CHEMISTRY

GLASS SURFACES ACT LIKE STRONG BASES!

by Aditya Bhattacharyya



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New research from Yangjie Li and colleagues from Graham Cooks' lab at Purdue University, US, show that glass can accelerate various base-catalyzed reactions and enhance the degradation of base-labile biomolecules like phospholipids. This research follows their 2020 paper, which reported that the base-catalyzed Katritzky transamination reaction accelerated when performed on glass surfaces. Doubting then that they had miraculously found the 'only' response to be glass-catalyzed, they decided to observe the changes in the rate of various reactions when in the presence and absence of tiny glass spheres.

To their surprise, they found that all base-catalyzed reactions (including elimination, solvolysis, condensation, and oxidation) were accelerated by the glass. They achieved up to 1000 times rate enhancement on glass! Li and co attribute this increase in reactivity to the Si-O- groups present on the surface of the glass microsphere, which can withdraw protons from reactant and solvent molecules and thereby act as a base. The acceleration effects were more pronounced at low reactant concentrations as a greater fraction of the reactant molecules were found near the glass surface. Li and co also found that glass accelerates the base-catalyzed degradation of phospholipids.

The author believes that the work would serve as a reminder for chemists to think carefully about the nature of containers they use for running reactions and storing chemicals. For example, lipids are commonly stored under methanol in glass containers to prevent the entry of plastic contaminants. However, based on these findings, using methanol could be tricky as they can get deprotonated by the basic glass surface, which can subsequently lead to the breakdown of the lipids. This would lead to both false identifications as well as inaccurate quantification in lipid analysis.

On the other hand, the findings also highlight the potential of glass as an eco-friendly heterogeneous catalyst. The glass microspheres need to be washed in water at the end of every reaction to recover their catalytic activity. In this way, the glass balls can be re-used several times, thus making them an excellent potential alternative to traditional surface catalysts.

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BIOLOGY

WHY SITTING FOR LONG HOURS COULD BE BAD FOR YOU - BOTH PHYSICALLY AND MENTALLY!

by Asmi Gaikwad

Illustration by Aishwarya

Since the time the pandemic struck us, we've been spending a lot of time at home. Moreover, movement at home is entirely restricted as we spend most of the time sitting down at our favourite places at home! Staying seated for a few moments is okay. But, the longer you sit, the more agitated your body becomes. It sits there counting down moments until you stand up again! This may sound ridiculous, right? You might think that your body loves to sit, isn't it? No, not really. Sitting down for brief periods can help us recover from stress or recuperate from exercise, but a long-term goal might not be healthy.

These days, our daily workloads often drag us towards a sedentary lifestyle. The human body is destined to move around rather than be crouched in an isolated place!
Inside us, there are 360 joints and nearly 700 muscles that enable easy fluid motion. The body's unique physical structure gives us the ability to stand up straight against the pull of gravity. This posture helps in the circulation of blood evenly. It also helps maintain the skin's elasticity (when the skin moulds itself according to the body's motions). So, if every inch of your body is just waiting for you to move,and when you just don't, what do you think will happen? Beginning with the backbone- the spine is a long structure made of bones containing the cartilage that sits in the intervals of these bones. Joints, muscles and bones that are attached help to keep the spine in position. A common way of sitting involves having a curved back, slumped shoulders, a stance that puts uneven pressure on your spine! As time passes, this causes wear and tear of the spinal discs, overwork specific ligaments and puts strain on the muscles that stretch to accommodate your back's curved posture!

This hunched shape eventually shrinks your chest cavity while you sit, meaning less space to expand while you breathe. It ultimately limits the amount of oxygen that fills your lungs and filters your blood. Some of the other body's soft tissues in the vicinity are also squashed and pressurised.

Have you ever experienced numbness and swelling in your limbs while you sit for long hours? Did you think of what could be its underlying cause? In most tight areas, your nerves and blood vessels can get blocked, limiting nerve signalling, causing numbness and reducing the blood flow, leading to swelling. Moreover, a sitting posture for a long time also deactivates lipoprotein lipase- a special enzyme in the walls of blood capillaries that helps in the breakdown of fats. Hence, burning fat is relatively less while sitting down as compared to while the body is moving!

How do you think the brain gets affected? Most of the time, we probably sit down to use our brains while solving complex problems. But, ironically, lengthy periods of sitting act as a counter effect! The blood and oxygen flow are reduced eventually. Due to this, concentration levels are likely to dip, which slows down the brain's activity!
Unfortunately, the ill effects aren't visible in the short term! Many Scientists predict this could be the source of the various comorbidities seen in people these days. Moreover, recent research also found out that inactivity is responsible for nearly 9% of premature deaths worldwide! So, it's necessary to gaze upon these severe consequences!
Some suitable alternative measures that you can try out include switching the slouch for a straighter spine, moving around much more, perhaps by setting a reminder for yourself every half an hour.
Remember that the human body is built for motion and not stillness. And good mental and physical health is humankind's first wealth!

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https://youtu.be/wUEl8KrMz14

BIOLOGY

CAN DONATING YOUR DNA HELP CURE DISEASES?

by Asmi Gaikwad

Illustration by Aishwarya

Developing a drug and making it available to the consumer takes a lot of time as the cause of the condition has to be worked well. For example, in diseases like multiple sclerosis or heart disease – making a new drug takes a significantly large amount of trial and error and lots of money which is why we have drugs only for a small proportion of diseases.

The history of drug development dates back to hundreds of years. Most of the medicines in olden times were discovered by chance. Natural philosophers then took this and identified the active chemicals inside and pharmaceutical companies then turned those chemicals into drugs. The interesting fact is that for a long time, people were unaware of the fact of how drugs actually function in our body. Why didn't we know that? How was it possible without knowing the drug action that medical practitioners simply administered drugs to their patients? Some brilliant minds pondered over this for a long time until they finally figured out the obscure mechanism. The diseases happen when molecular machines- proteins in your body start misbehaving. Drugs treat diseases by targeting those disruptive proteins.

What if instead of targeting those disruptive proteins, we make changes in the DNA itself as we all know DNA is the source of proteins? That's exactly what the Scientists also tried out! They wanted to know which small changes in someone's genome can lead to the production of those dodgy proteins. Collecting multiple genomes from various people can help identify certain patterns which can reveal what population of the people suffer from untreatable genetic diseases, identify faulty proteins and this is how it is formulated. Those are brand new therapeutic targets for such diseases. Now the researchers have three options: -

1. Has any of those new target proteins been previously linked to a different disease that is treatable? If so, the drug for that disease may target this protein and work for this protein too.
2. If not, has one of those new target proteins been previously linked to a different disease that had a promising drug that didn't ultimately work? If so, its promise might have come from successfully targeting this protein and it may work for this disease.
3. If this brand-new protein target was never identified before for any particular disease, could they design a new drug to affect it? It involves a lot of machine learning and chemistry too along with time, money and effort.

Researchers are also excited about this because they think 1 in 5 of the proteins in your body either have or are likely to have a drug that will bind to them and as any common disease is likely to have hundreds, possibly thousands of proteins involved. They are hopeful that they'll be able to identify a few of those proteins they've already got a drug for. But all of this requires a person's genetic data and health history data so that they can compare genomes of people with similar conditions.

Now the next question arises is who can have access to your personal data (DNA)? One group could be health care providers who are starting to consider using genetic analysis to give patients more personal care. The other group- private consumer genetic testing companies.

However, one may also think, if your data goes towards making new drugs, should pharmaceutical companies recognize that contribution and offer drugs at a cheaper rate? Well, that's altogether a different topic to discuss. But the bottom-line is – Genomics is a powerful tool to cut upon time for development of drugs for some of the untreatable diseases !

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https://youtu.be/j836dsMHAkY

WHY ARE WE SO LONELY?

by Gayatri S

Image by David Mark from Pixabay

Snow leopard, tiger, and lion — these three, out of the many species, belong to the same genus Panthera. Consider any genus. You will find a multitude of species belonging to that genus. But, there's a catch. Consider us Homo sapiens. We're completely alone on the earth. We have cousins but no siblings. There are no other species that belong to the genus Homo that exists today. But let's go back to the Earth 300,000 years ago. There were as many as nine hominin species that walked on Earth. At various points in history, many hominin species existed in different parts of the world, like the wildly popular Neanderthals, the recently discovered Homo naledi, denisovans, and luzonensis. It might surprise you that 1-4% of modern human DNA belonged to Neanderthals.

What happened to all these species? How did we become the only species bearing the tag of Homo? Did we massacre all of them? Let's look at what science says. Let's first consider Homo floresiensis, nicknamed hobbits. Evidence suggests that they could've lived as recently as 18,000 years ago.

Then, how did they get extinct?
Their remains have been identified only on the island of Flores in Indonesia. They're supposed to have inhabited just this island. When that happens, the chances of their disappearance are huge. After analysing the geological data, researchers think that a volcanic eruption might have led to their disappearance.

Let's now explore the various possible factors that led to the disappearance of the very famous Neanderthals. They're an extinct hominin species that lived in Eurasia about 40,000 years ago. Several reasons have been suggested for their extinction. Some of the possible causes suggested are disease, the assimilation of their genome into the modern human genome, great climatic changes, or a combination of these factors. It's well known that modern humans and Neanderthals coexisted. Some authors have suggested that the violent conflict between the two species has led to the disappearance of Neanderthals. Another reason could be that Homo sapiens carried pathogens and parasites from Africa to Eurasia and spread them to Neanderthals. The latter were unexposed to these pathogens, might have had limited immunity to these unfamiliar pathogens, and fell extinct. One might ask whether Neanderthals transferred pathogens to modern humans. But researchers have sufficient evidence to believe that the flow of pathogens was largely unidirectional.

A multitude of reasons has been suggested for the disappearance of the various hominin species that walked on the surface of planet Earth. Explaining all of them here is beyond our scope. But whatever the cause be, now we're a lonely species with no other species belonging to the same genus.
Just imagine what the world would have been like if at least some of them existed with us today. That would have given ample scope for a sci-fi movie to turn real!

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http://www.bbc.com/earth/story/20150929-why-are-we-the-only-human-species-still-alive

WORLD'S OLDEST ANIMAL FOSSIL?

by Aditya Bhattacharyya

Labechia sp. (fossil stromatoporoid sponge), https://flic.kr/p/TFXcGQ

We are all very familiar with animals in our daily life, from giant elephants and hippos to microscopic worms and insects. They form one of the five kingdoms into which life on Earth is classified. However, the origin of the first animal species from ancient predecessors is still not well documented. As per our current understanding based on fossil studies, the first animals probably came around 550 million years ago, just before the Cambrian explosion (540 million years ago). These animals were most probably ancient sponges.

Sponges belong to the phylum Porifera within the animal kingdom and are one of the simplest multicellular organisms in form and structure. They are essentially a clump of cells with many channels and pores that allow water to circulate through them. Sponges do not have specialised nervous, digestive, and circulatory systems and instead rely on the constant water flow (via the channels mentioned above) to obtain food, water, and excrete wastes. Thus, sponges' basic morphology has made them a prime candidate for being the first animals in the eyes of biologists.

Fossils found earlier this year in Northwestern Canada possess strange wiggly lines that closely resemble ancient sponge fossils. Interestingly, while the oldest sponge fossils come from around 550 million years ago, these new fossils date back to 890 million years! Therefore, if this new fossil is indeed that of a sponge, then the arrival time of the first animals would have to be pushed back a whopping 340 million years, leading to a significant change in our understanding of the evolution of life on Earth.

There are arguments both supporting and opposing the claim that those networks of tubes are indeed fossils of ancient sponges. The main argument supporting the claim is the strong resemblance in structure to sponge fossils from 550 million years and the collagen framework in modern keratose demosponges. However, such fossilised patterns could also arise from ancient bacterial colonies and not necessarily be from sponges. Moreover, the build-up of oxygen in the atmosphere had not yet started 890 million years ago. Then, the percentage of oxygen in the atmosphere is estimated to be lower than 5%. Sponges would not survive at such low oxygen levels. However, these ancient sponges possibly lived close to photosynthetic bacterial colonies and thus may have met their oxygen requirements locally instead of from gases dissolved in bulk water.

As one can see, there are multiple points both in favour as well as opposing the hypothesis. Further investigation into the fossil data and the aquatic conditions prevalent in those times would give further clarity regarding the issue. If these new fossils indeed arise from ancient sponges, this would be a milestone discovery in paleobiology and give more insight into the development and diversification of life on Earth.

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AN INTERESTING WAY TO CALCULATE π

by Asmi Gaikwad

Image by Praveen Raj from Pixabay

Pi which is written as the Greek letter for p or π – is the ratio of the circumference of any circle to the diameter of that circle. Regardless of the circle size, this ratio will always remain constant and its value is 3.142 approximately.

Pi is an irrational number (i.e. it is a non-repeating decimal expansion). The first calculation of π was done by Archimedes of Syracuse, one of the greatest mathematicians of the ancient world. This value has been known for almost 4000 years now.

The ancient Babylonians calculated the area of the circle by taking three times the square of its radius, which gave the value of pi=3. One Babylonian tablet indicates a value of 3.125 for π which is a closer approximation.

Archimedes approximated the area of the circle by using the Pythagorean Theorem to find areas of two regular polygons i.e., the polygon inscribed within a circle and another polygon on which the circle was circumscribed. Since the actual area of the circle lies between the areas of the inscribed and circumscribed polygons, the areas of the polygons give upper and lower bounds for the area of the circle. Archimedes knew that he had not found the value of π but only an approximation within those limits. In this way, Archimedes showed that π lies between (3+1)/7 and (3+10)/71.

Mathematicians began using the Greek letter π in the 1700s. Introduced by William Jones in 1706, use of the symbol was popularized by Leonard Euler, who adopted it in 1737. Euler was also known as the father of π.

An experimental determination of π accurately can be done by throwing matches. To find π by this method, we should have a large piece of paper with parallel lines separated at a distance equal to the length of the matches as shown (Fig. 1):

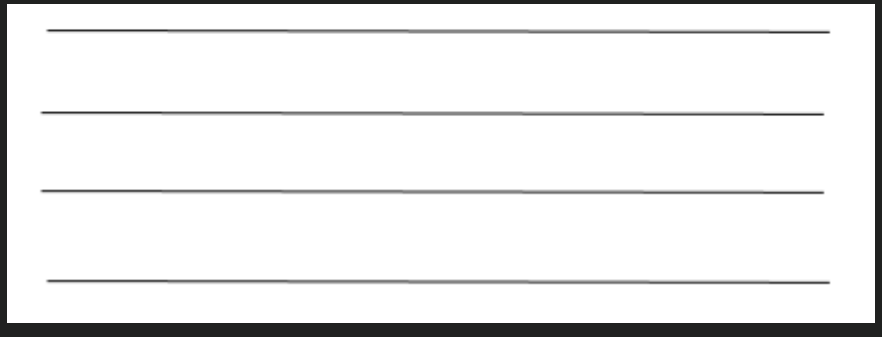

Fig. 1

AN INTERESTING WAY TO CALCULATE π

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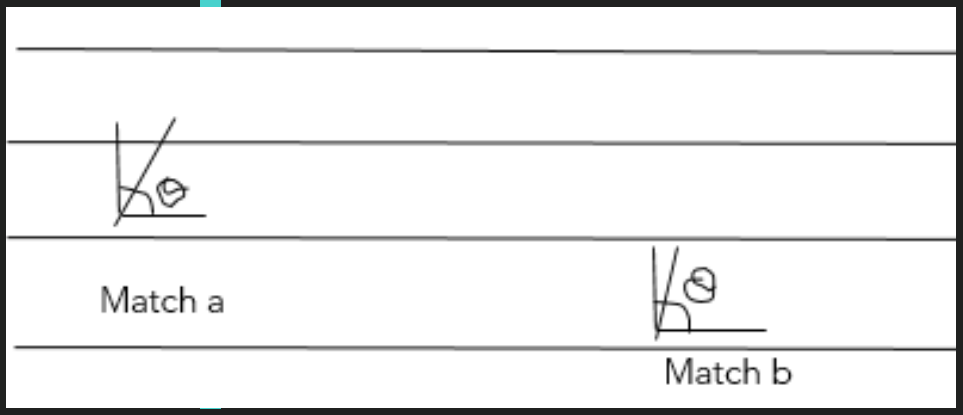

Fig. 2

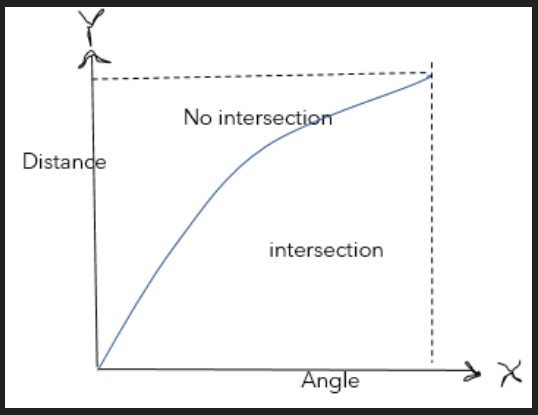

Fig. 3

Now for simplicity, take this length to be 2 units. Then we have to throw the matches onto the paper. Hence, π can be calculated as:
π = 2 x number of matches thrown/ Number of matches intersected with the lines

Reason: The ways in which the matches fall on the parallel lines can be determined by:

- The distance between the lines and the center of matches
- The angle between the lines and the matches as shown in the figure above (Fig. 2)

If a match with a greater angle Θ and is close to the line, intersection occurs (as seen in match a), otherwise, there is no intersection (as in match b). To be more specific, if the vertical projection is greater than the distance between the line and the center of the match, an intersection occurs.

This idea can be generalized by the graph of distance against angle Θ as shown below. It is in fact a sine curve as the vertical projection is 1 X sin Θ (the whole match has a length of 2 units).

Now, from the theory of probability; we know that the probability of intersection is:
= area of the shaded 'intersection' part/ Whole area (Fig. 3)

We take angles from 0 to π/2 and the same is for π/2 to π.
Shaded area= $\int \sin \Theta \, d\Theta = 1$
Whole area= 1X π/2
So, the probability of intersection =2/π

Hence, if I threw 3408 matches out of which 2169 intersected the lines then
Π= (2X 3408)/2169 = 3.1415929, which is correct up to six decimal places.

Nevertheless, the value of Pi can be calculated in this manner.

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INSPIRON

SIR MICHAEL FARADAY

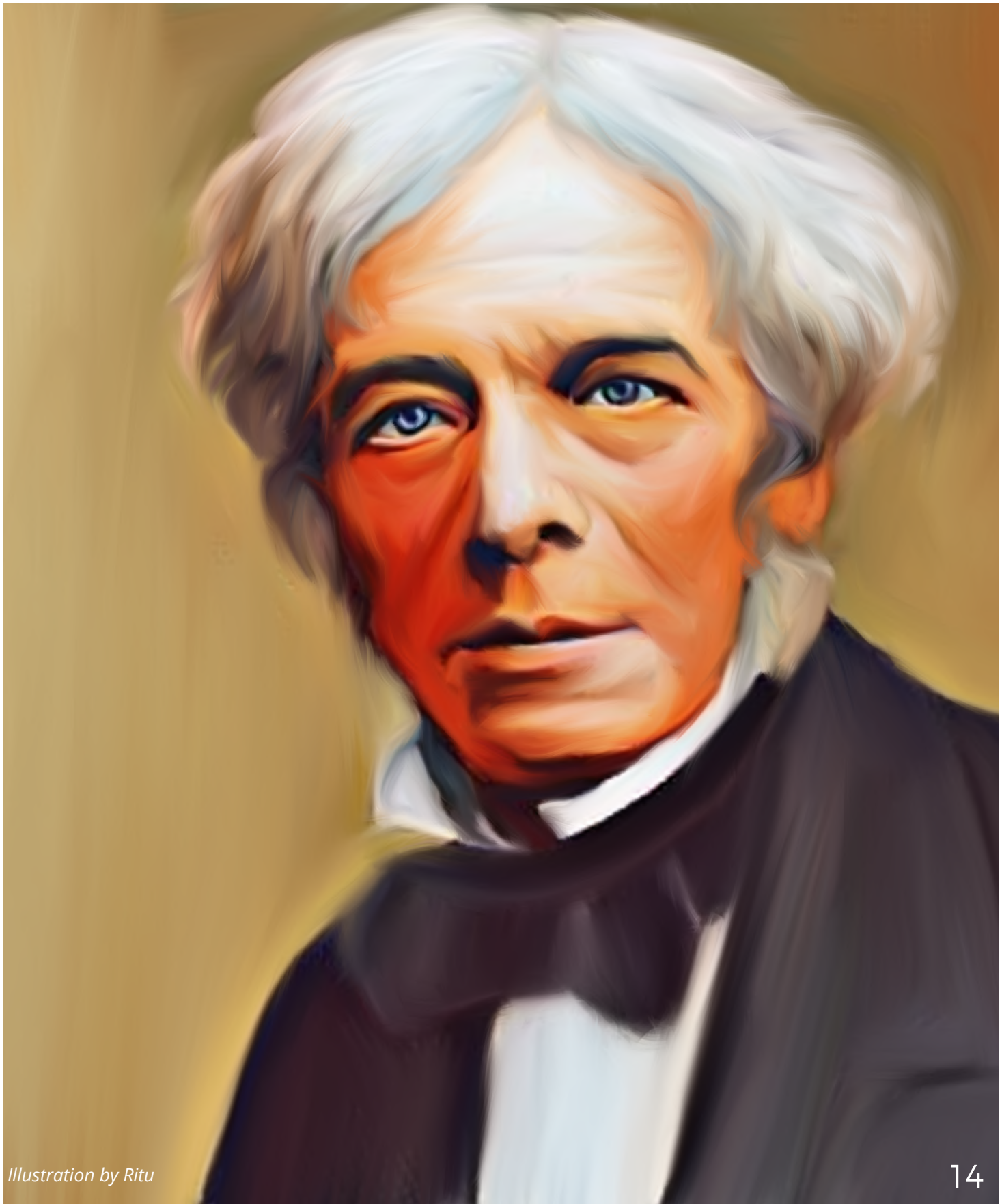

Illustration by Ritu

Illustration by Ritu

Sir Michael Faraday was an English scientist known for his contributions to the fields of Physics and Chemistry. He was a brilliant experimentalist and is considered one of the most influential scientists of the 19th century.

Sir Michael Faraday was born on 22nd September 1791 in Newington Butts, a town in Surrey county, England. His father, James Faraday, was a blacksmith. His mother, Margaret Hastwell, was a country (rural) woman born in a family of farmers. Faraday's childhood was consumed by destitution and hardships. His father was often ailing and hence was unable to provide the family with a stable income. Faraday even once recollected that he was once given a loaf of bread as food for the whole week!

Faraday's mother was a wise and peaceful woman who supported him throughout his tough childhood. His family belonged to a small sect of Christians called the Sandemanians, which provided Faraday with the much-needed spiritual guidance in his life. This religion of his has had an immense influence on his life and work.

Faraday could never obtain a formal education and only learned bits and pieces of it in a church's Sunday School. His financial condition compelled him to start earning early on in his life. He started making some money by delivering newspapers under a bookbinder, later becoming an apprentice at 14 years of age. Faraday grasped the opportunity to read a few of the books brought for rebinding. During his apprenticeship that lasted seven years, Faraday read several books related to diverse topics and had started developing an interest in Science. Among all, he became especially fascinated by the concept of 'Electricity'.

Faraday's golden chance came when he was offered the ticket to attend the Chemistry lectures of Sir Humphry Davy at the Royal Institution of Great Britain, London, in 1812. Without letting it go, he swallowed everything that Davy spoke about in his talks. With hopes of becoming a scientist, Faraday returned and created a 300-page book by binding his lecture notes. He sent a letter to Davy, along with his book, and asked for the opportunity to work under him. Davy decided to take him as a lab assistant and wrote back to him.

Illustration by Ritu

In 1813, Faraday began his second apprenticeship under Sir Humphry Davy. Davy then was a leading chemist who went on to revolutionise modern chemistry. Thus, Faraday got the opportunity of his lifetime - to learn from one of the most excellent practitioners of his time. Despite this, Faraday is popularly referred to as the most distinguished discovery of Davy!

Faraday was involved in discovering Chlorine gas extracted from muriatic acid, now known as hydrochloric acid. During his tenure under Davy, he invented a primitive form of a Bunsen burner. In addition to that, he synthesised the first known compounds of Carbon and Chlorine in 1820.

In 1821, Faraday married Sarah Barnard and settled down at the Royal Institution of Great Britain, where he pursued scientific research for the rest of his career. Come 1825, and Faraday stumbled upon the discovery of 'Benzene', which he called the 'Bicarburet of hydrogen' while researching the properties of illuminating gases. This finding caused a significant breakthrough in the discipline of Organic Chemistry. In the 1820s, Faraday also investigated steel alloys, which gave rise to the Science of Metallurgy.

In the 1820s-1830s, scientists made several advances in the field of Electricity and Magnetism. It was observed that electric charges exert a force on each other, either attractive or repulsive. Something very similar was observed in the case of magnetic poles - like repel and unlike attract. Faraday conceived an idea to visualise the phenomenon. He imagined invisible lines arising or terminating at an electric charge/magnetic pole, which, when interacting with another charge/magnet, exerts a force on it. He called them 'lines of force', which are today known as electric or magnetic field lines, respectively.

Two prominent physicists, Hans Christian Oersted and Andre-Marie Ampere, seemingly discovered a link between electricity and magnetism. They had found that flowing electric current gives rise to a circular magnetic field around it. Using the concept of magnetic lines of force, Faraday pondered if he could use the magnetic force to create motion in an object.

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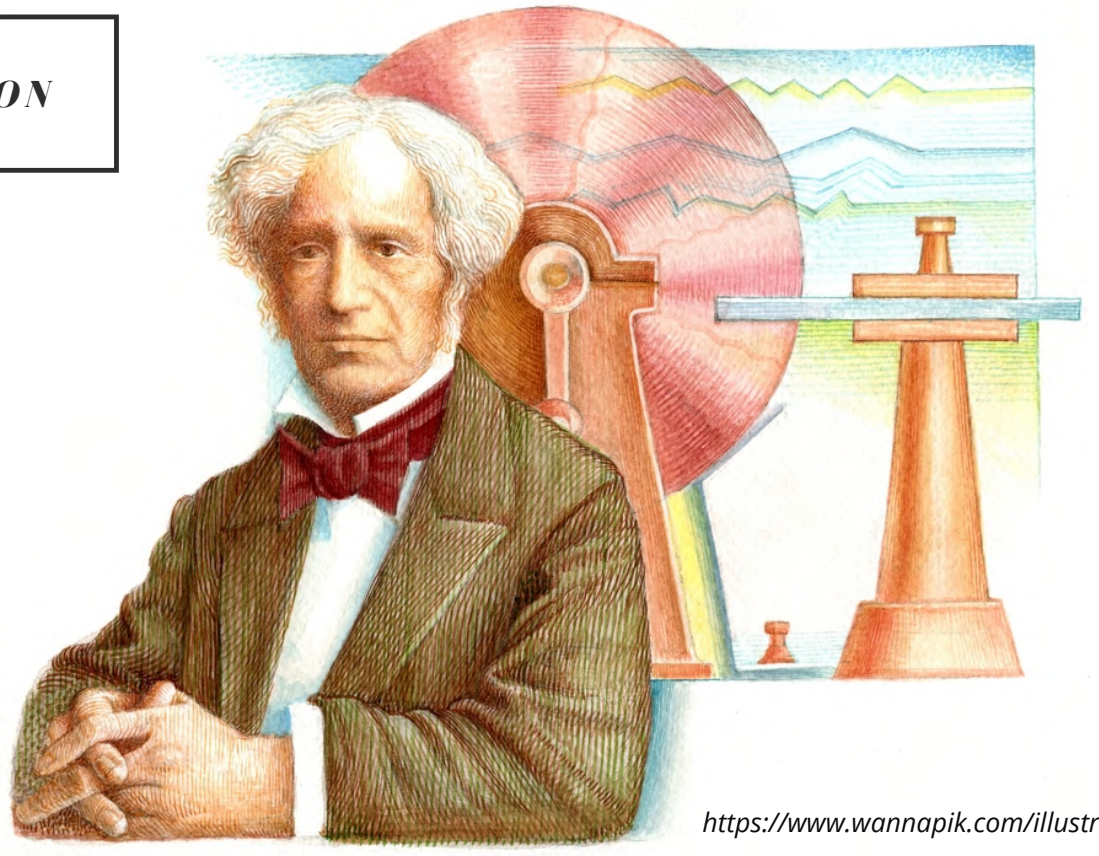
He conceptualised a device that would experience a force due to the magnetic field and display motion when carrying an electric current. Thus, the device was successfully used to convert electrical energy into mechanical energy and was called the 'Electric Motor'.

Later experiments by Faraday tried to probe further into the matter to understand if the opposite could be achieved, i.e. magnetism giving rise to electricity. Legend has it that once Faraday experimented with a magnet and closed-loop of wire connected to a galvanometer. A Galvanometer is a device used to measure the presence and direction of electric current in an electric circuit. He tried to induce a current in the circuit with the help of the magnet. However, after several unsuccessful attempts, he became frustrated and threw the magnet towards the circuit in anger. It was at that moment that the galvanometer showed a deflection, which indicated the presence of current.

It was a Eureka moment for Faraday! He had found that magnetic fields that change with time are capable of inducing an electric current. The discovery demonstrated that Electricity and Magnetism are nothing but two sides of the same coin and gave rise to a field called 'Electromagnetism'. He started working on another device, similar to the electric motor, which would serve an opposite purpose. In 1831, Faraday invented the 'Dynamo' or the first 'Electric Generator', which converted mechanical energy into electrical energy.

Faraday also investigated the effect of electricity in chemical reactions giving rise to 'Electrochemistry'. He studied Electrolysis, the process by which compounds in solution are broken into their constituent components (for example, decomposition of water into hydrogen and oxygen gases) and came up with 'Faraday's laws of Electrolysis.'

However, his relentless scientific work caused a lot of strain on his physical health. Consequently, Faraday's health broke down in 1839, which detrimentally affected his ability to do scientific research. It was in 1845 that he picked up the pace once again. In 1846, while delivering a lecture on "Thoughts on Ray Vibrations", Faraday hypothesised that light was made up of electric and magnetic fields.



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Although the hypothesis was later proved correct by James Clark Maxwell, Faraday couldn't convince his contemporaries of the same. This was because Faraday lacked the mathematical tools required to confirm the idea.

As a tribute to Faraday's contributions to electromagnetism, the SI unit of capacitance is Farad (a quantity used to measure the amount of electric charge stored in a capacitor). Around 1855, Faraday's scientific career was almost at its end, as he started experiencing the effects of ageing. Queen Victoria granted him a house at Hampton Court as a reward for his unconditional devotion to Science. He would spend the rest of his life there until his demise on 25th August 1867 at the age of 75.

Despite being at the pinnacle of success, Faraday always tried to remain modest in his living. He humbly rejected the knighthood that Queen Victoria had offered him and denied the opportunity of the Presidentship of the Royal Society twice. These decisions were primarily guided by his religion, which believed that pursuing worldly riches and pleasures was against the word of the Bible.

Needless to say, Faraday received several awards and honours for his work throughout his career. From the prestigious Queen's medal to being awarded an honorary doctorate by many institutions, the list is too long to be mentioned. In addition to this, he was also elected as a member of numerous scientific and academic societies, some of which include the Royal Society of Britain, the Royal Swedish Academy of Sciences, the French Academy of Sciences, the American Academy of Arts and Sciences, etc.

Ernest Rutherford, also known as the father of Nuclear Physics, once said a beautiful statement regarding Faraday's life and work - "When we consider the magnitude and extent of his discoveries and their influence on the progress of science and of industry, there is no honour too great to pay to the memory of Faraday, one of the greatest scientific discoverers of all time."

~click by Vaibhav Ingale

"Keep every stones they throw at you. You've got castles to build"

~Leanne Kirkham

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