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SUSTAINABILITY AND CHEMICAL ELEMENTS

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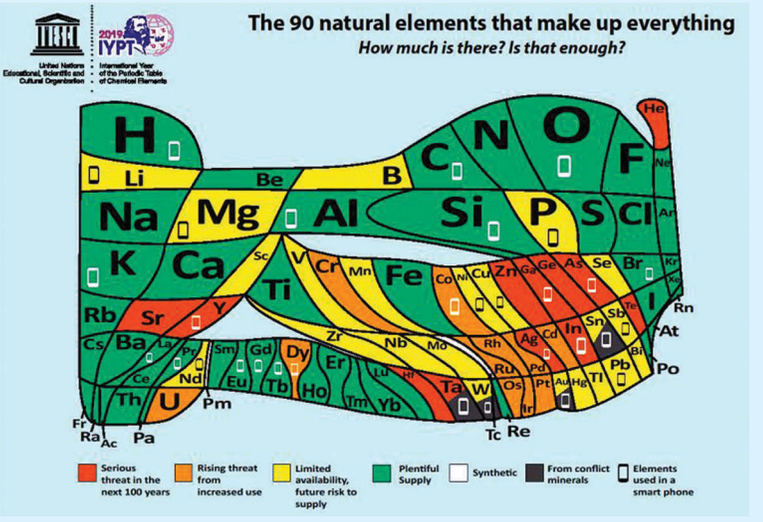
The United Nations declared 2019 as the International Year of the Periodic Table of Chemical Elements in recognition of the 150th year of the arrangement of about 60 chemical elements known at that time in order of the periodic trend in their properties by Russian chemist Dmitry Mendeleev in the year of 1869. It was a reflection of the genius of Mendeleev that he correctly left gaps for the four elements, namely gallium (element 31), germanium (element 32), scandium (element 21) and technetium (element 43) which were discovered later. Subsequently, many other physicists and chemists contributed to the development of the modern Periodic Table which is based on the atomic numbers rather than the atomic weights. Now it has 118 elements of which only 90 occur naturally. It is amazing to think that everything around us is made up from just 90 building blocks – the naturally occurring chemical elements. A large number of these stable elements are of vital importance. The 99% of the human body is made of carbon, oxygen, hydrogen, nitrogen, phosphorus and calcium. Besides, 28 other elements in the form of molecules and complexes play active role in the body in metabolic reactions, such as enzymatic actions. Trace amounts of more than 30 other elements can be detected in the human body.

In fact, declaration of the year 2011 as the International Year of Chemistry and the year 2019 as International Year of the Periodic Table of Chemical Elements is the recognition of the immense contribution made by the discipline of Chemistry in different fields, such as agriculture, healthcare, clothing, housing, transport, living style and many others leading to the betterment of the human life. The advanced technologies of mining and extraction made uninterrupted supply of diverse elements possible, which could be used in different appliances. According to an estimate, more than 30 elements are used in smart phones and the automobile industries use about 70 elements . However, uncontrolled use of the modern technologies started creating problems. For example plastic, which was once considered a wonder discovery, has turned out to be one of the most serious environmental pollutants.



Likewise, uncontrolled mining and use of various elements has put a question mark on the sustainability of such a modern life style. The American Chemical Society has put 44 of the elements on a critical list meaning that these elements may face difficulty in uninterrupted supply in future. This list includes many such elements which are extensively used in many modern technologies, such as high-performance magnets, electronics, catalysts, glasses, etc. Some of these elements, such as phosphorus are vital for life. In order to sustain availability of these elements, we shall have to fix our priorities and change the consumption

pattern. As part of the celebrations, the European Chemical Society has published a completely new version of the periodic table. It is designed to give an eye-catching message about sustainable development; based on an original idea in the 1970s from the American chemist William Sheehan, the table has been completely redrawn so that the area occupied by each element represents its abundance on a log scale.

Each area of the new table has been colour coded to indicate its vulnerability. In most cases, elements are not lost but, as we use them, they become dissipated and much less easy to recover.

Red indicates that dissipation will make the elements much less readily available in 100 years or less – that's helium (He), silver (Ag), tellurium (Te), gallium (Ga), germanium (Ge), strontium (Sr), yttrium (Y), zinc (Zn), indium (In), arsenic (As), hafnium (Hf) and tantalum (Ta).

To give just a couple of examples, helium is used to cool the magnets in MRI scanners and to dilute oxygen for deep sea diving. Vital rods in nuclear reactors use hafnium.

Strontium salts are added to fireworks and flares to produce vivid red colours.

Yttrium is a component of camera lenses to make them shock and heat resistant. It is also used in lasers and alloys.

Gallium, meanwhile, is used to make very high-quality mirrors, light-emitting diodes and solar cells.

The orange and yellow areas on the new periodic table anticipate problems caused by increased use of these elements, too. Green means that plenty is available – including the likes of oxygen (O), hydrogen (H), aluminium (Al) and calcium (Ca).

Four elements – tin (Sn), tantalum (Ta) tungsten (W) and gold (Au) – are coloured in black because they often come from conflict minerals; that is, from mines where wars are fought over their ownership. They can all be more ethically sourced, so it's intended as a reminder that manufacturers must carefully trace their origin to be sure that people did not die in order to provide the minerals in question.

Out of the 90 elements, 31 carry a smartphone symbol – reflecting the fact that they are all contained in these devices. This includes all four of the elements from conflict minerals and another six with projected useful lifetimes of less than 100 years.

Let us consider indium (In), for instance, which is coloured red on the table. Every touch screen contains a transparent conducting layer of indium tin oxide.

There is quite a lot of indium, but it is already highly dispersed. It is a byproduct of zinc manufacture, but there is only enough from that source for about 20 years. Then the price will start to rise quickly – unless we do something to preserve current stocks.

When we look at the Periodic Table and the very precious nature of so many of the elements, can we possibly justify changing our phone every two or so years?

According to an estimate, over 1million phones are traded in every month in the UK alone (10m in Europe, 12m in the US). In India, by 2020, the number of the smartphones users will exceed 400 millions.

When we trade in our smartphones, many of them go to the developing world initially for reuse. Most end up in landfill sites or attempts are made to extract a few of the elements under appalling conditions. The other elements remain in acidic brews. This, and the very many that lie around in drawers, is how the elements in mobile phones become dissipated.

The number of phones we trade in could be greatly reduced and with it the demand on limited resources such as indium.

But as the new version of the periodic table underlines, we must do all we can to conserve and recycle the 90 precious building blocks that make up our wonderfully diverse world. Japan has put an example in this regard: in the next olympics to be held. In Tokyo, all the gold, silver and bronze medals will be made with the metals recovered and recycled from smartphones.

If we don't start taking these problems more seriously, many of the objects and technologies that we now take for granted may be relics of a more abundant age a few generations from now – or available only to richer people.

ANCIENT DNA AND ITS CORRELATION WITH CONTEMPORARY DNA

Utsha Ghosh
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What is an ancient DNA?

Ancient DNA (aDNA) is DNA isolated from ancient specimens, due to degradation process ancient DNA is of more degraded in comparison with contemporary genetic material

"The journal cell published a paper given by archaeologist Vasant Shinde and geneticist Vagheesh M. Narasimhan and David et.al that 'An ancient Harappan genome lacks ancestry from steppe pastoralists and Iranian farmers' which claimed that the inhabitants or the Indus valley civilization lacked the steppe pastoralists ancestry which is based on the DNA sequencing of remains of a women found at Rakhigarhi in present day Haryana ancient DNA is studied by extracting from archaeologically recovered bones, teeths and fossil remains. small fragments are processed to sequence the genome of ancient organisms. Ancient DNA degrades on account of its age soil and climatic conditions it was buried in. Palaeogeneticists have been able to establish relation between genetic variations and evolution of species in different continents that were thought to be related or the population which appears distinct today in different geographical areas are related and existed together once in same region.

Ancient DNA from human samples

Modern human DNA databases are built on samples from people alive today .They have been used for several Applications including attempts to understand the genetic functionality towards certain diseases and response towards medicine in different social groups

Initiates the comparison of ancient DNA samples with other ancient DNA and modern DNA databases which can reveal unsuspected genetic histories.

Scientists can trace ancient individuals and assess their genetic makeup on account of alleles, mutations and other markers as well as it's comparison with modern groups.

There is no necessary correlation between the genes of the ancestors who shares common language or identity.

Recent results established

The two recent papers, (in science and cell), have provided detailed account of their findings the first paper,' the formation of human population in South and Central Asia',establishes baseline for the genetic history of populations in these two linked regions based on 523 ancient DNA samples ranging over 8000 years across Eurasia authors demonstrate clearly what was known but now has a detail with clear evidence that over the last 10000 years .the present day distinctive mix of South Asian genetic variability was formed through mixture of population then residents as well as the successive groups that moved into the region the data shows slow long term process of migration, co-mingling and integration.scholars has tried to find the links between sanskrit, Persian and Latin i.e the Indo European language in reference to ancient migrations. Ours is an era when DNA is the evidence .which nothing tells about the language or religion.

Rakhigarhi woman

The second paper presents the result of first successful ancient DNA extraction from South Asia.

Individual 6113 was an elite women who was buried between 2300-2800 BCE in a cemetery on the outskirts of Harappan town of Rakhigarhi.This includes the attempt to extract an ancient DNA which was too degraded or was contaminated. The DNA extracted was a contribution from ancient ancestry shared with Iranian populations. Her genetic mixture are significantly more westerly than the limits of present day India which gives the result that our ancestor from Rakhigarhi was so different from us that no one ,alive today has her particular suite of admixed DNA.

What happened in Indian history

Most of the people today would readily accept information about their susceptibility to daibetes or cancer from their genetic data but we would hesitate to accept that genetic cleavages that happened a 100 generations ago define our action, choices and identity today. The ancient DNA results reflect what we already knew in greater detail from archaeological research conducted over the last 50 years. A host of Chalcolithic (Copper-bronze using) and Iron age cultures prosper between 2000 and 1000 BCE in almost all regions of the subcontinent.

No single story of genetics, or of language families, nor of the movement of people hypothesised from either can explain the manifest geographic, technological and cultural complexities of this millennium.

Source: : https://www.thehindu.com

TARGETING A BLOOD STEM CELL SHOWS THERAPEUTICALL Y RELEVANT GENE EDITING

Utsha Ghosh
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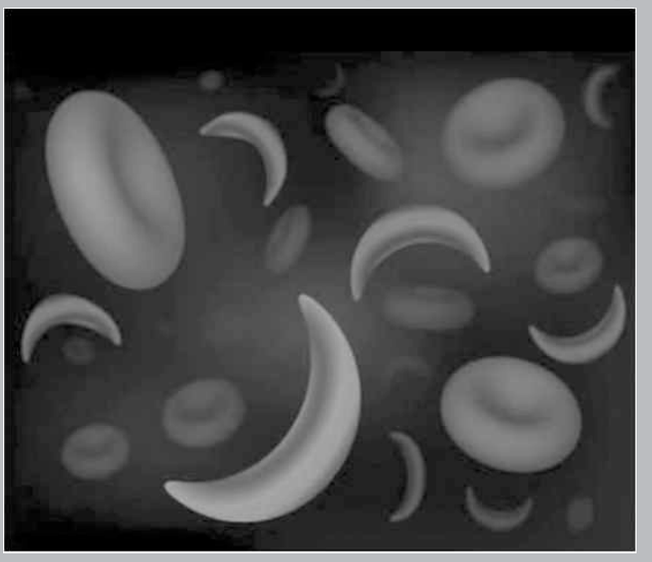
It's the first time scientists have specifically edited the genetic makeup of specialized subset of adult blood stem cells which are the source of all cells in the human blood and immune system.

The proof suggests that efficient modification of targeted stem cells could reduce the expense of gene editing treatment for blood disorders like sickel cell anaemia, thalassemia and other diseases while decreasing the risk of unwanted efforts that occur .Efficient editing of the group of cells is also hope to use for the conditions like HIV and some cancers said by Dr hans- Peter kiem director of stem cell and gene therapy program as well as the member of clinical research division

The research picked a gene related to sickle cell Anemia and beta thalassemia caused by genetic defect in haemoglobin,other studies have shown reversed symptoms by reactivating a version of haemoglobin which works during fetal development but turned off on our first birthday .

The Fred hutch researchers used CRISPR cas9 gene editing and removed a piece of genetic code that turns of fetal hemoglobin protien. Slitting this control DNA with CRISPR enables RBC's to continuously produce increased level of fetal hemoglobin



These edits were taken up by targeted cells 78% took up the edit in laboratory before they were infused .once infused the edited cells settled and multiplied to produce blood cells .this result in upto 20% of RBC with fetal hemoglobin which reverses the disease symptoms in sickle cell Anemia and thalassemia

Not only they were able to edit the cells but also showed engrafts efficient at high levels which is of great hope to translate into an effective therapy for people .The most importantly ,approach was safe ,found no harmful off target mutations in edited cell and studies are still conducted to verify absence of undesired effect

This was the first study to edit a small population of blood cells by kiem's team in 2017 responsible for regrowing entire blood and immune system

The self renewing property of this population of stem cell made them a powerful way to deliver gene therapy as they can provide long term production of genetically modified blood cells and could cure disease for a lifetime

The National heart ,blood ,and lung supported the reasearch under award number RO1HL136135

Source : fred Hutchinson Cancer research centre
www.sciencedaily .com

Replacement of plastic body

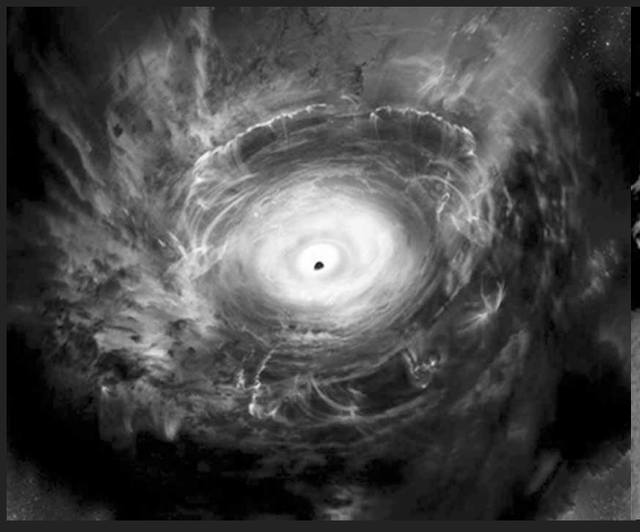
Bhavini Sharma
B.Sc. Sem III

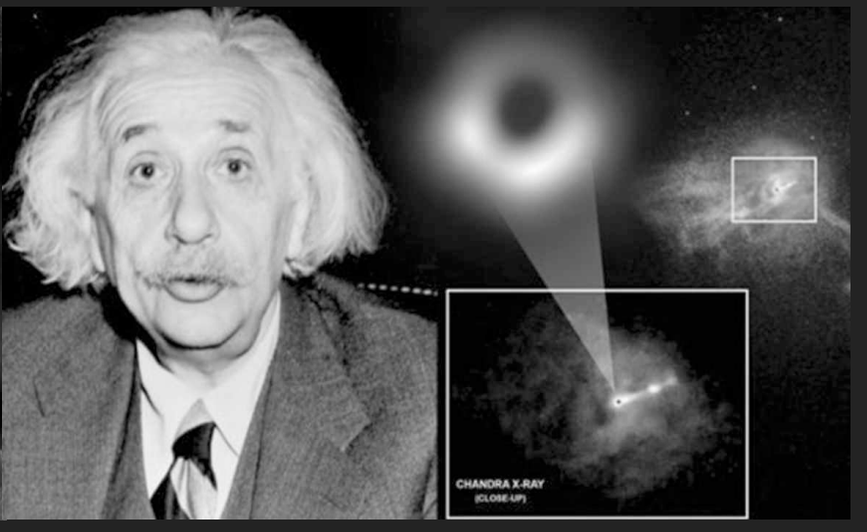
Plastic water bottles come with a higher price tag than most people realize, taking up to 1,000 years to decompose in a landfill. The fact that at least half of all water bottles are used only once makes the waste that much more egregious. Icelandic product designer Ari Jónsson decided he needed to take action by fashioning a biodegradable water bottle from algae. He created a bottle made up of agar powder derived from red algae. Which stay till the water is filled after that it start degrading at much faster rate than plastic bottles and you can even eat it also after you are finished and it water stay cool in hot temperature but the biggest challenge is its paper like durability.

Reference : www.cedarspringswater.ca

The Mystery of the Black Hole

Leena Khurana
Research Scholar, Dept. of Biotechnology





Having shown existence in various Hollywood features, the black hole has always been a dark mystery. The observable universe has always been a source of fascination as the sun is a tiny point of light surrounded by billions of stars swirling around in the Milky Way galaxy which itself has a black hole the size of 4 million solar masses at its core. So vast is the distance, that it would take approximately 27000 years to reach it, travelling at speed of light.

Origin of the Black hole

The idea was originally given by Einstein's general theory of relativity of stars and planets in which he predicted universeas weighted spheres stretching the fabric of space resulting in pulling lighter bodies towards heavier objects gradually at its center with time.The phenomenon was called "gravitational time dilation", concluding that gravity was not a force as Newton contemplated, but it is a result of a distortion in the fabric of space and time.

Einstein's theory also suggested that there is a presence of dimensional entity which scientist in the present day refer to as a "Naked singularity" or a spherical gravitational field called a Black hole enclosed by a boundary known as "Event horizon", which sucked in everything - matter, information and light –that crossed the event horizon.Few weeks ago, scientist released a revolutionary image of a black hole named "Virgo" at the center of Messier 87, a galaxy which is 55 million light years away from our own 'the Milky Way', proving Einstein's theory correct. If we picture it this way: the sun is 330,000 times the mass of earth. The estimated size of this black hole is 6.5 billion times more massive than the sun.

Hindu Cosmology

There are many evident analogues between the mythology and modern astrophysics, specially the visualization of space,time and birth of the universe. For instance, another name for the Hindu god Shiva is Mahakala, the lord of time. Mahakala is typically visualized as black in color which represents total stillness or complete absence of light, much like a block hole. He symbolizes a void and has the power to possess and pull even time and space into himself.Also according to the hindu cosmology, the universe is cyclically created and destroyed which stands very similar to that of what scientist now believe that black holes are not only crucial for existence of the universe but also for our very own existence leading to speculations that the universe we live in came out of a universal black hole that had incorporated all the matter of the previous universe, collapsing into itself and then expelling out everything in an explosion to form the present universe.

"The cosmos is within us. Some part of our being knows this is where we came from. We long to return. And we can, because we're made of star stuff. We are a way for the universe to know itself."

- Carl Sagan

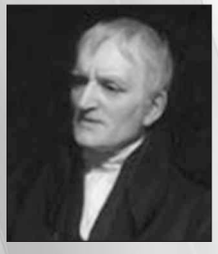
(American astronomer, cosmologist, astrophysicist, astrobiologist)

Source : https://science.nasa.gov/astrophysics/focus-areas/black-holes.
A brief history of black holes. The Hindu Magazine.28 April 2019, Pp 14.

Famous Chemists

Chemistry is a study of reactions between chemicals and substances that most people experience in their everday life. All of our medicines and household products are the result of a history of chemical studies and discoveries. Below is a list of some of the most important chemists of all time organized by the significance of their contributions to this field.

Marie Curie (1867–1934)
Famous For: *Discovery of Radium and Polonium*
Marie Curie received the Nobel Prize in Chemistry in 1911 for her discovery of radium and polonium. She was able to isolate and study the compounds and nature of radium.



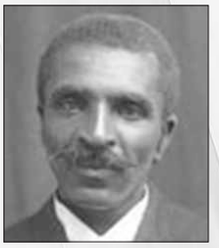
John Dalton (1766–1844)
Famous For: *Identification and presenting the atomic theory*
Recognized for his work on the atomic theory and research on color blindness. He successfully identified chemical compounds and reactions affected by interaction of atoms with one another.

Michael Faraday (1791–1867)
Famous For: *His contributions in electrochemistry and electromagnetism*
Faraday's extensive work in the field of Chemistry includes the study chloring and carbon, both of which he discovered. In addition he made the earliest type of what we know today as the Bunsen burner. He was the first to identify would known as nanoparticles in mettalic form.

Rosalind Franklin (1920–1958)
Famous For: *Discovery of the DNA structure in genetics*
Rosalind Elsie Franklin and her contributions to science involve the study of the structures of coal, graphite, DNA, RNA, and viruses in understing their molecular structures.

Robert Boyle (1627–1691)
Famous For: *Being the first "Modern Chemist"*
Boyle was the one of the earliest men to apply the scientific method in chemistry and physics. His book, The Sceptical Chymyst, is considered a foundational source of literature on the field of chemistry.

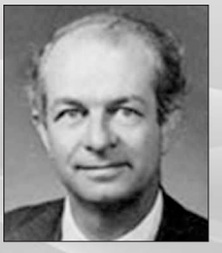
Louis Pasteur (1822–1895)
Famous For: *The process of Pasteurization and creation of Vaccines for Rabies and Anthrax*
In addition to developing the process of Pasteurization, Louis Pasteur discovered the assymetrical molecular structure on certain crytals. He made some of the earliest vaccines for rabies and anthrax, and the reduction of a bacterial infection in what is known as puerperal fever.



George Washington Carver (1864–1943)
Famous For: *Promoting alternative crops to cotton, such as peanuts, soybeans, sweet potatoes*
George Washington Carver found different crops to use instead of cotton. He used peanuts, soybeans, sweet potatoes to keep the land productive. His intention was to keep the poor farmers healthy and productive.

Alfred Nobel (1833–1896)
Famous For: *Inventing the dynamite*
As the inventor of the dynamite, Alfred Nobel is seen as a chemist, innovator, engineer, and arms manufacturer. One of his earliest inventions include the gas meter. At one time, he held nearly 350 patents on various items.

Antoine Lavoisier (1743–1794)
Famous For: *Being the "Father of Modern Chemistry"*
Lavoisier was able to show the relationship between oxygen and metal, resulting in rust. He also was able to show the role of oxygen in plant respiration and in animals. It was he who showed that water was made of hydrogen and oxygen, and that air was composed mainly of oxygen and nitrogen in its gaseous state.



Linus Pauling (1901–1994)
Famous For: *His work in molecular biology and quantum chemistry*
A recipient of the Nobel Prize in the field of chemistry in 1954. His work in the field of chemistry is chronicled in his book The Nature of the Chemical Bond is believed as one of the most foundational books on chemistry.

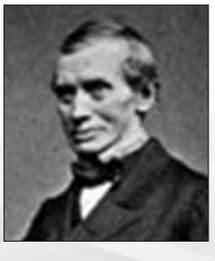
Dmitri Mendeleev (1834–1907)
Famous For: *Creating the table of elements used in chemistry and physics*
In addition to the creation of the periodic table, Mendeleev work on the spectroscope and the capillarity of liquids, both of which continue to be used to this day. Politics got in the way of Dmitri from receiving the Nobel Prize in 1906.

Mario Molina (1943)
Famous For: *Discovered the ozone hole in the Antarctic*
As one of three recipients of the Nobel Prize in Chemistry in 1995, Molina co-discovered the harm that chlorofluorocarbons had on the ozone layer.

Fritz Haber (1868-1934)
Famous For: *Being the "Father of Chemical Warfare" and synthesizing ammonia used in fertilizers and explosives*
Recipient of the Nobel Prize in 1918, Haber was responsible for the development of the synthesizing process of ammonia. He has been referred to at times as the "Father or Chemical Warfare" in which he developed chlorine and poisonous gases during the Great War, WW I.

Svante Arrhenius (1859-1927)
Famous For: *Theory of the Greenhouse Effect and founder on the science of Physical Chemistry*
Arrhenius advanced the theory to help explain the "ice age" which resulted in what is known as the "greenhouse effect." He also provided the Arrhenius equation which is a formula to calculate reaction rates when the temperature is raised on certain chemicals.

Stanislao Cannizzaro (1826-1910)
Famous For: *The Cannizzaro reaction*
Cannizzaro worked extensively on organic chemistry in addition to his explanation which on how certain chemical reactions take place certain elements lact the hydrogen atom. This is named aptly as the Cannizaro reaction.



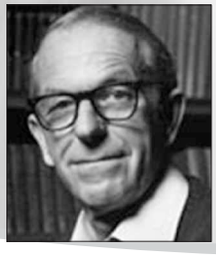
Thomas Graham (1805-1869)
Famous For: *His work on the diffusion of gases and the application of dialysis.*
The discovery of Graham on the use of dialysis has its roots on his study of colloids. He was able to separate crystalloids from colloids using a dialyzer. His work on the diffusion of gases has become to be known as Graham's law.

Joseph Priestley (1733–1804)
Famous For: *Inventing soda water*
As a chemist, Joesph Priestly has been credited with the discovery of oxygen. He shares that distinction with Lavoisier and Scheele. More importantly, we have Priestly to thank for "soda water", which he invented.

Humphry Davy (1778–1829)
Famous For: *The discovery for earth based alkaline metals and alkali*
Humphrey Davy's contribution can be summarized in his discoveries on the nature of chlorine and iodine in its natural state. In addition, people remember for his identifying earth based alkaline metals and alkali itself.

Otto Hahn (1879–1968)
Famous For: *Being the "Father of Nuclear Chemistry"*
Hahn was one of the earliest men to work in the field of radiochemistry and radioactivity. During one of his experiments, he founded what is known as "Applied Radiochemistry" which eventually led to nuclear chemistry.

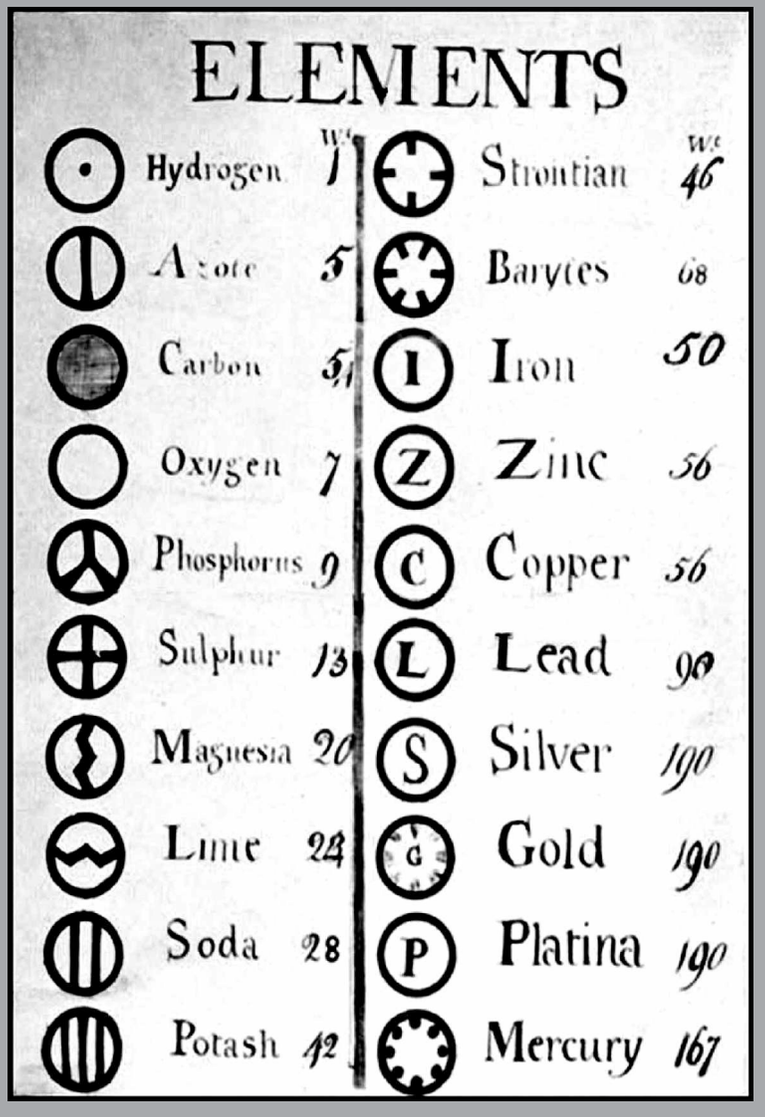
Ahmed Zewail (1946-2016)
Famous For: *Being the "Father of Femtochemistry"*
Zewali was the first to delve into the field of "femtochemistry", which is studying chemical reactions measured in femtoseconds (10 to -15 of a second). He received a Nobel Prize in 1995 for his advancement of the field of femtochemistry.



Frederick Sanger (1918-2013)
Famous For: *Successful determination of base sequences in nucleic acids*
The research work undertaken by Frederick Sanger involved his successful sequencing of DNA, insulin, and RNA. He was awarded the Nobel Prize two times, both for his work in chemistry, in 1958 and in 1980. He was able to establish a baseline in "the determination of base sequences in nuclein acids."

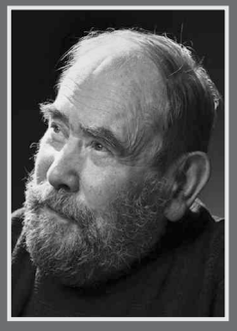
Albert Ghiorso (1915-2010)
Famous For: *Co-Discoverer of 12 Periodic Elements*
Albert Ghiorso, lifelong nuclear researcher at the Lawrence Berkeley Laboratory, the co-discoverer of twelve chemical elements (more than anyone else in history) and a prolific inventor of nuclear technology, died December 26, 2010, at the age of 95. Ghiorso was born in Vallejo, California July 15, 1915.

John Dalton's Element List

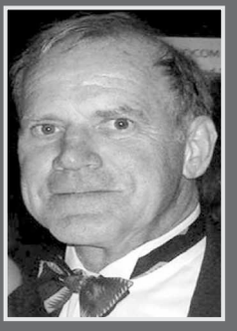


Source: *https://images.theconversation.com*

LOSS IN THE SCIENTIFIC COMMUNITY



Kary Banks Mullis (1944 - 2019) Invention of PCR



Sydney Brenner (1927- 2019) Discovery of non-overlapping triplet genetic codon

The Genius Family

This photo shows three Nobel Prize winners: Marie Curie (physics, chemistry), Pierre Curie (Physics) and their daughter Irène Joliot-Curie (chemistry) making Curies, the family with the most Nobel laureates till date.

Hard as a diamond?

Scientists predict new forms of superhard carbon

Summary: Superhard materials can slice, drill and polish other objects. Now, science is opening the door to the development of new materials with these seductive qualities. Researchers have used computational techniques to identify 43 previously unknown forms of

carbon that are thought to be stable and superhard -- including several predicted to be slightly harder than or nearly as hard as diamonds.

Source: *University at Buffalo/ September 9, 2019*

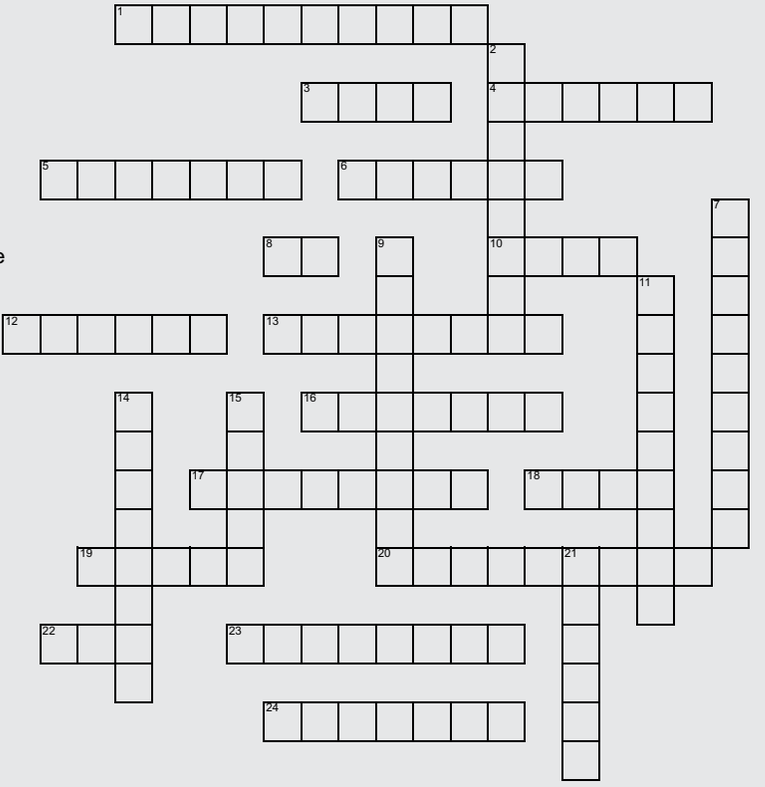
Crossword on Periodic Table

Across

1. This element was discovered in 1669
3. This element is in pencils
4. This element has the lowest boiling point on the periodic table
5. This element was discovered by johan august arfwedson
6. This element is a girls best friend
8. This element is the sixth most abundant metal in the earths crust
10. This elements heat of vaporization is 340 kj
12. We need this to survive
13. this element is the most abundant element in earths atmosphere making up about 78% of the atmosphere by volume
16. this element is good for your bones
17. this is the bottom element in the alkali column
18. νέον is how you say this element in greek
19. this elements speed of sound is 323 m/s
20. This element has a boiling point of 1,996 degrees Fahrenheit
22. this element has a density of 7.1
23. This element is the lightest element on the periodic table
24. This elements symbol is Si

Down

2. This element is the second lightest halogen following fluorine
7. this element has a melting point of 336.7 K
9. This element costs $230 per pound
11. The chief ore of this element is bauxite
14. This element has a atomic number of 9
15. this element is produced entirely by cosmic ray spallation and supernovae
21. This element has an atomic mass of 32.06



QUIZ

EASY LIKE SUNDAY MORNING

The world of chemical reactions is a stage. The actors are the elements : Clemens Winkler

Snehal Gupta
M.Sc., Department of Microbiology

1. A gaseous undiscovered element that has a bright yellow lines in the spectrum of the chromosphere were noticed at a wavelength of 587.49nm. Chemist Frankland naed it after the greek word for the sun . Name the first element you learn about.

2. This was probably the first metal mined and crafted by humans. Discovered 9000B.C.back in middle east.This metal used by humans in various ways, from carrying water to carrying electricity. Name this metal.

3. This element discovered by Indian metallurgists in Rasaratna Samuccaya and had been a component of brass and pure form that was isolated in 1749. Name the element which plays a major role in making iron corrosion resistant.

4. Henning Brand discovered this element while trying to create the mythical philosopher's stone through the distillation of salts by evaporating urine. He named it mirabilis which is a white material that glows in the dark and burned brilliantly. Never found as a free element on earth. What is this that is so reactive?

5. In 1751 Axel Fredrick Cronstedt produced a white metal while trying to extract copper and named it after mischievous spirit from German mythology. Metal widely used in coins and at some places refers to an amount of currency. Name it.

6. An element Azote which means "no life" founded by Antonie Lavoisier after Daniel Rutherford. The name which in greek means "To choke" and is what it does to organisms exposed to it. Most abundant uncombined element in the atmosphere. Name it.

7. Carl Wilhelm Scheele discovered oxygen, molybdenum, tungsten, barium and hydrogen. He discovered the element that bleached litmus and had a yellow green color. Humphry Davy classified this as an element that smell in aquatic centres. Name it.

8. Named after a planet, this element which precipitates as yellow compound is formed by dissolving pitchblende in nitric acid and neutralizing the solution wit sodium hydroxide. Name the element whose isotopes play a major role in providing energy to fast growing cities.

9. Element discovered by Bernard Curtois and named by Joseph Louis Gay Lussac which is greek for violet color. Element formed by burning seaweed with ash and washed with water and purple vapour rose on addition of sulphuric acid to remaining water that crystallizes as dark crystals. Name a common addition in nutrients.

10. Three inner elements discovered by W.Ramsay and W.Travers and remain in dry air after removal of nitrogen, oxygen, argon and carbon dioxide. Each had a characteristic emission spectrum of Orange red, white and light blue. Out of the three, first is used in advertising signs, second in high powdered lasers and third in flash lamps. Name these elements that are a part of six noble gases.

Answers:

1. Helium
2. Copper
3. Zinc
4. Phosphorus
5. Nickel
6. Nitrogen
7. Chlorine
8. Uranium
9. Iodine
10. Neon, krypton and Xenon

Source : www.thehindu.com

Chemistry : It's everywhere!

Chandani Mathur
Department of Chemistry

Okay, picture this with me. Imagine standing at the tip of the space station orbiting our planet. We take a deep breath and jump, hurtling down towards the earth at a breakneck speed. Physics, the lack of oxygen, the intense cold, all don't matter because this is our imagination. The wind whips past our face, the clouds spiral around us as we squint against the bright Sun. We keep rushing down until we have a view of the greens and the browns. Going on, we now have an aerial view of our city where, with the approaching ground, we recognize the streets and suddenly crash through our ceiling and land in our seat. To put things in perspective, what we just pictured is a view zoomed in by a factor of 1 million. Imagine doing the same here, on Earth, sitting in the close comfort of our room. If our hand was the Earth, zooming in a million times, we could see the cells, bacteria, proteins all working together to keep us alive and yet completely invisible to the naked eye. What if we could magnify this view by a billion times and see the DNA, the individual molecules, atoms and their inner structures? Imagine what we could learn!

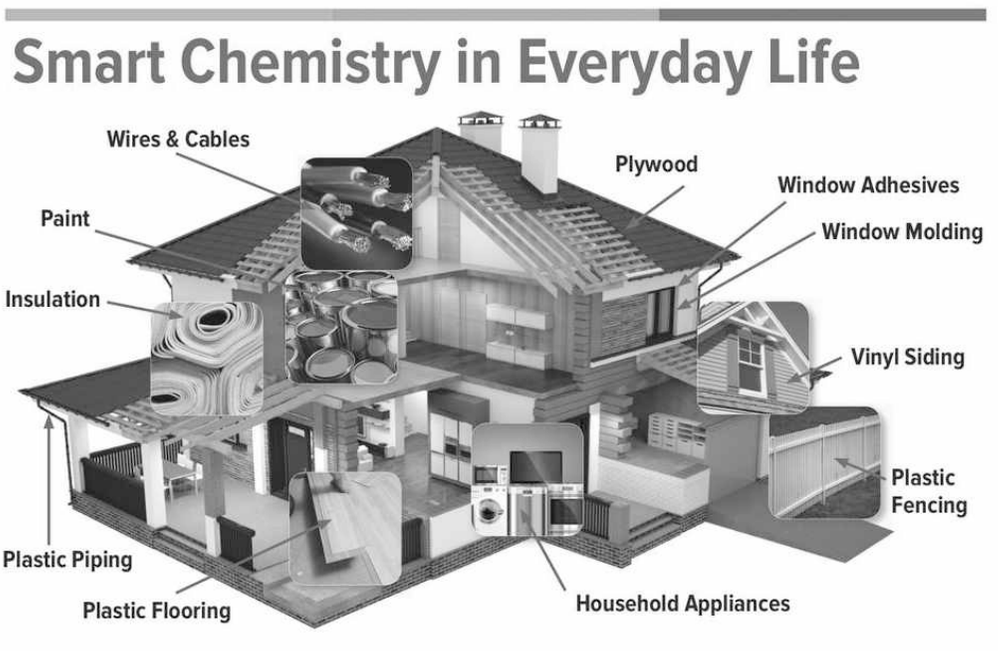
The truth is, scientists are already doing this. They have aids like powerful microscopes and imaging techniques to see and visualize the smallest bits of matter known to man as well as to look at the galaxies thousands of light years away. When we think about the enormity of the universe or the incredible number of particles positioned perfectly to build our body, we ought to feel lost and that's completely normal. It's this feeling of insignificance that drives us to inquire about the most trivial details of our existence. Chemistry, as the name suggests, is a science that deals with the mysteries of various chemicals and their related reactions. It's imperative to treat it as an integral part of life rather than a discrete subject if its importance is to be understood. If we look closely, there's chemistry all around us. From the gases that make up the interstellar space to the electrons that vibrate within an atom, theyreall a product of some chemical reaction. Be it the denaturing protein that causes a frying egg to go from clear to white, or the biochemistry of how alcohol reacts with our brain and liver, or the simple process of combustion and greenhouse gas emissions, or the history and synthesis of nylon that revolutionized the textile industry post World War II, all these examples from our everyday lives involve the fundamentals of chemical science.

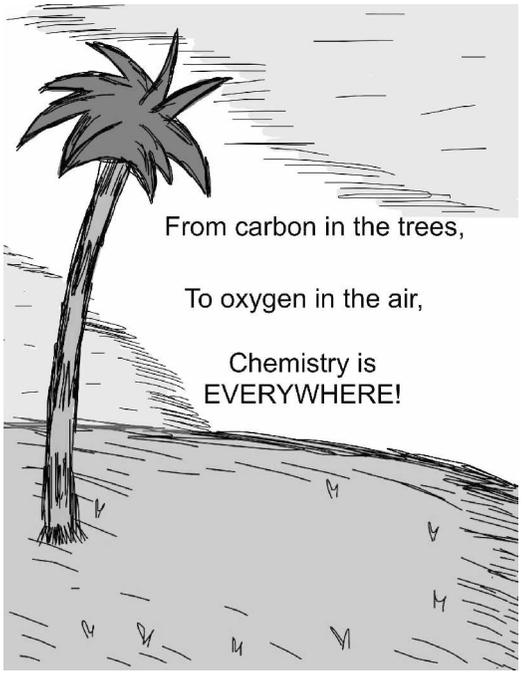
The answers to questions, like why cookies rise in the oven, why the detergent works better than a soap, how does a stain remover get rid of the dirtiest stains, or how does a medicine know what area in the body to target, can be explored using key chemistry concepts through the lens of the everyday!

The whole point of studying a subject is to develop a skill through which we can apply the knowledge and focus the blurry picture into a clear one, to know 'why' in addition to 'how'. It is interesting to note that we're an insignificant part of a dynamic system where significant changes keep taking place. If we dwell into the know-how of these processes, we could tremendously improve our lifestyle and find answers to the questions that we have but never ask.

And this is why, Chemistry is not just an insurmountable subject as it seems, it's a way of life! All it requires is a little food for thought, attention to detail and an inquisitive mind.

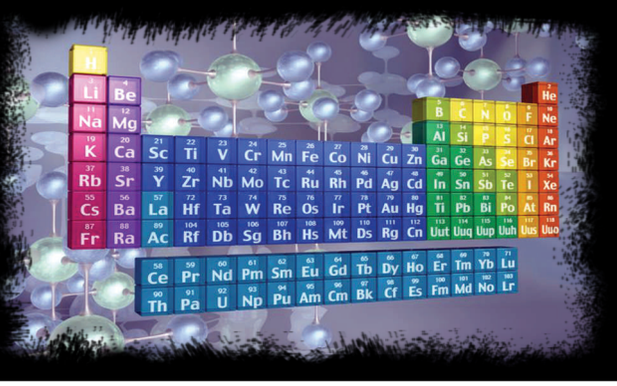
Happy learning!



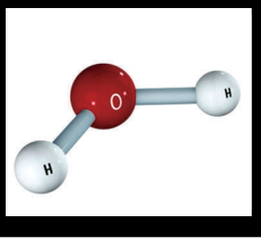


Lightweight Of Periodic Table Plays Big Role In Life On Earth

Manisha Patni
Department of Chemistry

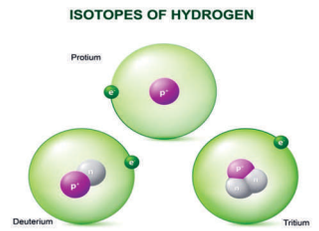


Although hydrogen is the lightweight of the chemical elements, it packs a real punch when it comes to its role in life and its potential as a solution to some of the world's challenges. As we celebrate the 150th anniversary of the periodic table, it seems reasonable to tip our hat to this, the first element on the table.



Hydrogen is the most abundant element in the universe, but not on Earth due to its light weight, which allows the gas to just float off into space. Hydrogen is essential to our life – it fuels the sun, which converts hundreds of million tons of hydrogen into helium every second. And two hydrogen atoms are attached to one oxygen atom to make water. Both these things make our planet habitable.

Not only does hydrogen enable the sun to warm the Earth and help create the water that sustains life, but this simplest of all the elements may also provide the key to finding a clean fuel source to power the planet.



Hydrogen's yin and yang as an energy source

Like many other chemical elements, although hydrogen is of immense value to us, it also has a darker side. Being lighter than air, it makes things float, which is why is was used in early airships. But hydrogen is highly explosive, and in 1937 the German airship the Hindenburg exploded on its attempt to dock with its mooring mast after a transatlantic journey, killing 36 people.

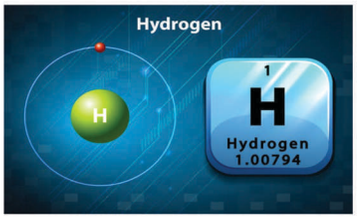
Hydrogen's cousins, deuterium and tritium, called heavy hydrogen, have been used to make hydrogen bombs. Here, the heavy hydrogen atoms merge together in a process called nuclear fusion to make helium, a bit like the reaction that takes place in the sun. The amount of energy produced by this process is greater than any other known process – the area at the center of the explosion is essentially vaporized, generating shock waves that destroy anything in their way. The bright white light produced can blind people many miles away. It also produces radioactive products that are carried in the air and cause widespread contamination of the environment.

Isotopes of hydrogen: protium, deuterium and tritium

Taming the beast, however, could be the solution to the energy problems of the future. When burned in a controlled way, hydrogen offers the cleanest fuel, producing only water as the waste product. That's refreshing when compared with a gasoline engine that produces climate change-inducing carbon dioxide and a range of other nasty gases. When stored under high pressure and very low temperature of -400 degrees Fahrenheit, hydrogen exists as a liquid, and its combustion with oxygen is used for propelling rockets into space.

However, a car with a tank of highly explosive hydrogen rocket fuel doesn't sound like a safe bet. There's currently lots of research focused on solving the storage problem. Large numbers of scientists are trying to develop chemical compounds that safely hold and release hydrogen. This is actually a hard nut to crack and is something that will take time and many great minds to solve.

The power of hydrogen

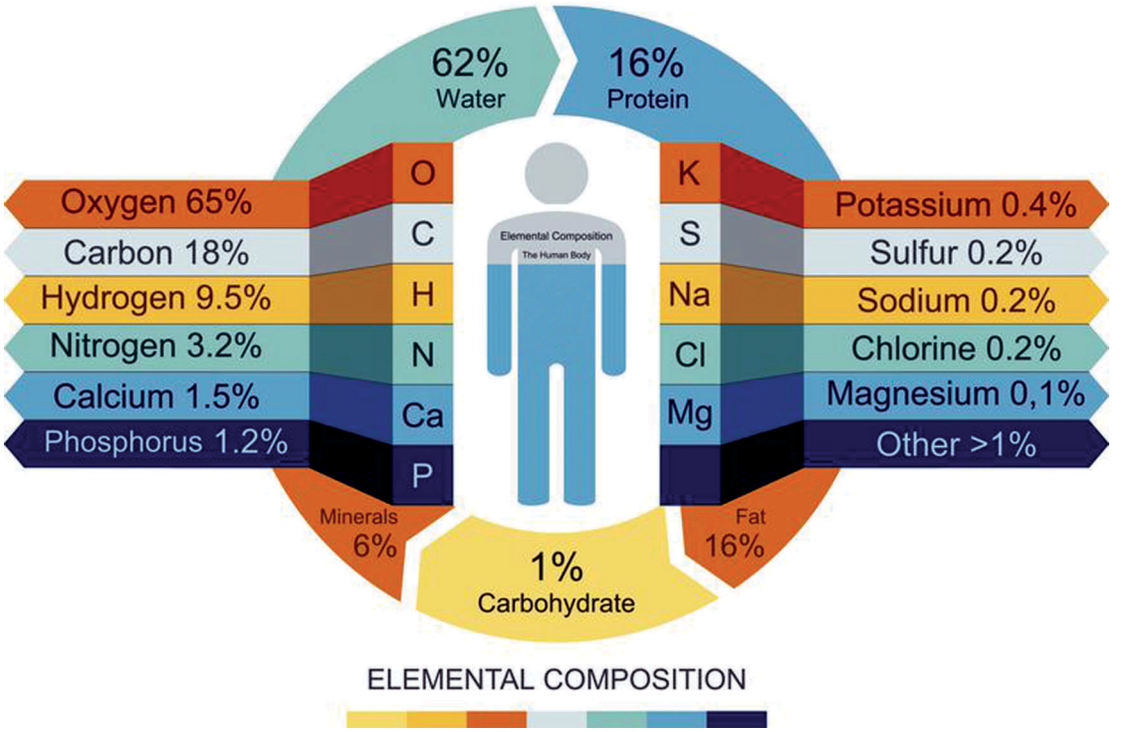


Hydrogen atoms also give things like lemon juice and vinegar their distinctive tart taste. Positively charged hydrogen atoms, called protons, having been stripped of their only electron, float around in these solutions and are the key component of acids. The chemistry of these protons is also responsible for driving photosynthesis, the process whereby plants turn light energy into chemical energy, and powering many processes in the human body.

Protons also are the key component of fuel cells. Rather than burn the hydrogen, fuel cells convert it to electricity and are seen as the way of the future. They do this by splitting the hydrogen gas into protons and electrons on one side of the fuel cell. The positively charged protons move over to the other side of the cell, leaving behind the negatively charged electrons. This creates a flow of electricity between the sides of the cell when connected with an external circuit. This current can power an electric motor placed in this circuit. Hydrogen-powered trains are already in operation in Germany, and several international car manufacturers are developing fuel-cell powered cars. Again, the only byproduct of the process is water.

In future, we will see increasing use of hydrogen as a fuel. For it to be useful, there are two major challenges. A big one is the storage issue. Engineers need to figure out how to store hydrogen safely and start to build places where people can fill up. With rapid advances in chemistry and engineering, hydrogen stations could start to appear soon, becoming as common place as gasoline filling stations are today.

MOST COMMON ELEMENTS IN THE HUMAN BODY



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