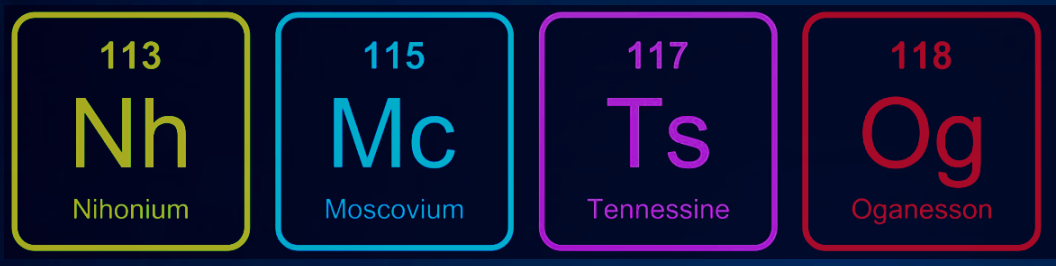
ST. XAVIER'S COLLEGE, MUMBAI
150
Est.1869 | YEARS

XAVIER'S ASSOCIATION OF CHEMISTRY PRESENTS

The Elemental

ALCHEMIA 2019-20



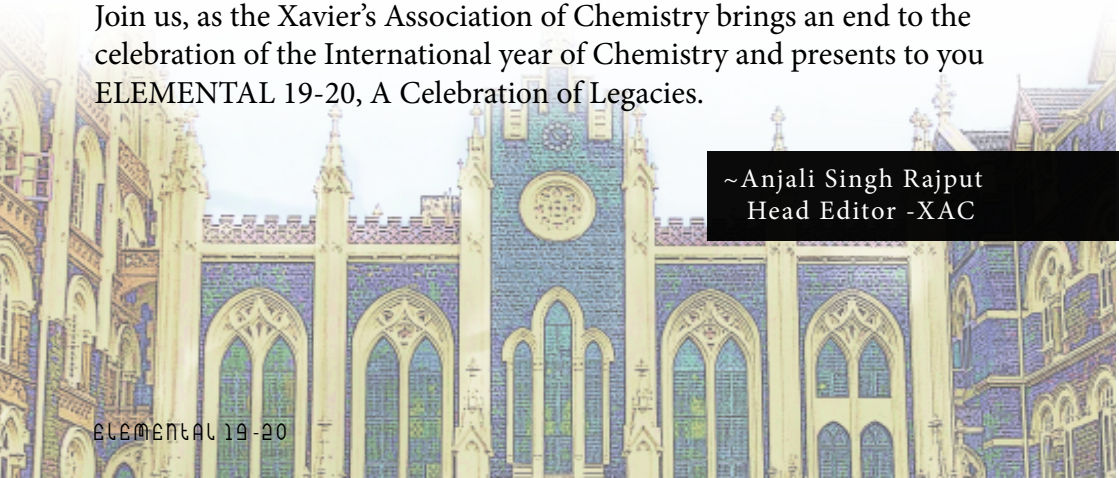
ELEMENTS ADDED TO THE PERIODIC TABLE IN THE LAST 4 YEARS

Celebrating 150 Years of The Periodic Table

FROM THE EDITOR'S DESK

Earth, Water, Air and Fire,
An alchemist in the 16th century would claim that these elements make up the entire universe. Today, a chemist would take out his periodic table and argue.
It's fascinating how far we've come from sorcery and potions, to facts and science. It has been quite a journey for sure. But let's start at what we consider the beginning.
150 years ago, the German Jesuits founded St. Xavier's college, an institute that lives up to its legacy till date. The very same year, Russian chemist Dmitri Mendeleev, embarked on a journey to arrange the universe at its most fundamental level.
The result?
THE PERIODIC TABLE OF ELEMENTS or the holy grail of chemistry as we know it!
Such was his legacy, that when Mendeleev stringed the then known elements into a harmony, he boldly proclaimed that there were still a few notes missing in the tune. These elements when discovered much later, would then happily occupy their pre-defined positions, singing the song of Chemistry.
So join us, as we explore Mendeleev's legacy and decipher the chemical affair of elements that constitute the Earth, Water, Air and Fire, the elements that make up the food you eat as well as the body that eats and digests it, the chemicals that make you fall in love and the ones that make up the tears that you shed after.
Join us, as the Xavier's Association of Chemistry brings an end to the celebration of the International year of Chemistry and presents to you ELEMENTAL 19-20, A Celebration of Legacies.

~Anjali Singh Rajput
Head Editor -XAC



THE CHEMISTRY ALL AROUND US

Man is a curious creature with a mind that can comprehend complex thoughts and ideas. More importantly, it can ask questions and find answers for them. As it is now widely known that the atoms and molecules are what constitute everything perceivable, from natural rocks and plants to all artificial and man-made items. We can say that chemistry is all around us. It is involved not only in all the biological activities in plants and animals, but also in the preparation of all different man-made structures and compounds. The more man studies chemistry around them, the more questions they ask and then try to answer them. This never ending cycle of questioning and answering is what has helped mankind, for better or for worse, create substances and items which were unimaginable just a few hundred years ago.

It can be rightly said that chemistry is one of the most complex sciences known to man and is hence considered daunting and complicated. This is why The Xavier's Association of Chemistry was founded; to excite the students to read and learn more so they can understand chemistry better by research and discussions with their peers.

The students who are pushed to think and ask questions at a young age are the ones who later go on to answer the more complex questions which helps man understand the universe around us better. XAC does exactly this by organizing workshops, exhibitions and lectures by remarkable speakers, with the hope to mold young, curious minds to think outside the box, ask questions and eventually answer them. This is how, we the members of XAC, play our small role in propagating the knowledge of chemistry to the rest of our peers and help them achieve excellence.

~Rushali Bhat
Chairperson-XAC

TEAM ELEMENTAL

THE QUARTET

ACKNOWLEDGEMENTS

This magazine has been made possible by the combined efforts of the Xavier's Association of Chemistry and a very dedicated Editorial Team.
We also owe a debt of gratitude to the Department of Chemistry for their support and encouragement.

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THE CHEMISTRY DEPARTMENT

FROM THE HEAD OF THE DEPARTMENT

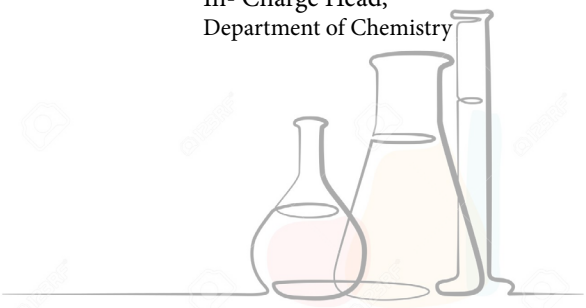
In 2003, XAC was established by the then TY students with enthusiastic support from Dr. Gulshan Shaikh, Dr. Hoshang Master who was the Head of the Chemistry Department then and Dr. Fr. Roy Pereira. From that day there was no looking back as year after year XAC grew and achieved its goal of popularising chemistry and promoting holistic growth of students of the Department.

The first XAC magazine was published in the year 2007, thanks to the efforts of Ms. Fiona Pinto. It was called 'Elemental' on a punny note. Since then, several editions of the 'Elemental' have been released, Some of them purely as e-magazines partly due to lack of funding and partly with the idea of reducing carbon footprint.

This year the XAC organising committee, since its inception in the first week of July, have planned a print version of the magazine as this is a special year celebrating 150 years of establishment of Periodic Table. They have collected an interesting as well as relevant array of articles laden with information and chemistry fun facts .

I must congratulate the entire XAC organising committee and the editorial team of Elemental for putting together an engaging and entertaining magazine for us to read, eschew and ponder.

~Marazban S. Kotwal
In- Charge Head,
Department of Chemistry



150 Years.....in Science

The year 2019 marked a huge milestone:It was the 150th birthday of our college. But as you might know, the year was also designated the 'International Year of the Periodic Table'. Of course, many of you will ask why. Well, what are you waiting for? Step into my TARDIS and come with me on this journey through the last 150 years...in Science!

The journey begins in the year 1869. Russian chemist Dimitri Mendeleev realised that the study of chemical elements was rather disorganised and tedious. So, he came up with a simple solution - organising the discovered elements into a table with rows (periods) and columns (groups). He even formulated his own periodic law based on the relationship between the properties of elements and their atomic masses. Of course, we all know this classification didn't last, but it formed the basis for what we study now.

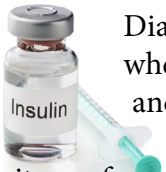
Now, we've always known that the sky is blue, right? Well, it wasn't until 1871 that someone figured out why. That someone was Lord Rayleigh, who discovered the phenomenon known as Rayleigh scattering.

Then, two years later, the world was faced with three major discoveries: Johannes Diderik van der Waals postulated the existence of the van der Waals forces between molecules, Guthrie discovered that heat can cause emission of electrons from metals (also called thermionic emission) and Willoughby Smith discovered what is today known as photoconductivity.
Cathode rays were first studied in 1875 using the Crookes' discharge tube experiment, a pioneering experiment by none other than William Crookes. The very next year, Josiah Willard Gibbs studied chemical thermodynamics, and, in 1877, Boltzmann gave us a statistical definition of disorderness (or "entropy" in chemical terms).
In 1880, Pierre and Jacques Curie discovered the phenomenon of piezoelectricity,where certain substances generated electricity on exposure to mechanical stress. Four years later, Van't Hoff explained chemical dynamics and osmotic pressure in solutions.

For a long time, it was believed that light propagated through a medium called "luminiferous aether". And then, in 1887, Michelson and Morley refuted this theory by experimentally proving the non-existence of such a medium. Liquid crystals (like those in LCD screens) were discovered by Reinitzer in 1888, viruses by Ivanovsky in 1892 and X-rays by Röntgen in 1895.

1896 was another year for a double breakthrough, with Becquerel's discovery of Radioactivity and Arrhenius's explanation of the greenhouse effect. In 1897, the electron was discovered by Sir J.J. Thompson. In 1898, Beijerinck stated that viruses were self-replicating infectious agents, and not just toxins as previously believed. The very same year, Thompson took the first step towards elucidating the atomic structure by proposing what is called the "Plum Pudding model".

Flash forward to 1900, the year in which de Vries, Correns and Tschermack worked independently and rediscovered Mendel's laws of inheritance. In 1905 or what I would call "The Year of Albert Einstein", Einstein dominated science with his theories on relativity, Brownian motion and a lot of other things. The first ever synthetic drug, Arsphenamine, was made in 1907 by Bertheim. 1909 marked the discovery of Haber's process for the synthesis of ammonia and Millikan's oil drop experiment to determine the exact charge on an electron. 1911 marked the first step towards the modern atomic model in the form of Rutherford's gold foil experiment, leading to the discovery of the atomic nucleus. 1912 was the year when X-ray diffraction came into the picture, all thanks to the efforts of Max von Laue. In 1913, Moseley defined the concept of atomic number and Bohr proposed his atomic model.



Diabetes was believed to be uncontrollable until 1922, when Frederick Banting, Charles Best, James Collip and John Macleod isolated the hormone insulin, which is responsible for controlling blood sugar, and suggested its use for control of diabetes. In 1924, Pauli proposed his exclusion principle, pertaining to the arrangement of electrons in shells. In 1925, Erwin Schrödinger formulated the Schrödinger equation, which is now a cornerstone of Quantum Mechanics. This field was furthered in 1927 by Werner Heisenberg, who formulated the Heisenberg Uncertainty Principle.

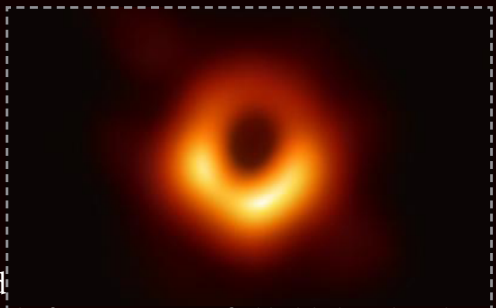
That very year, Georges Lemaître postulated the birth of the universe, otherwise called the Big Bang Theory. In 1929, Alexander Fleming had his lucky accident which led to the discovery of penicillin, the first ever antibiotic. In 1932, atomic structures were elucidated further, with the discovery of neutron by James Chadwick.

Fast forward to 1938, Otto Hahn, Lise Meitner and Fritz Strassmann conducted nuclear fission of heavy nuclei. The very same year, Isidor Rabi discovered Nuclear Magnetic Resonance, a form of spectroscopy which is now used for elucidation of molecular structures.

In 1943, Oswald Avery et al established that DNA is the genetic material and not proteins. 1945 didn't just mark the start of World War 2, but also the start of the mass production of penicillin by Chain and Florey. Transistors were invented by Shockley, Bardeen and Brattain in 1947, the year India became a free country. 1951 was marked by George Otto Gey's propagation of the HeLa cell line (named after Henrietta Lacks, a patient who died due to cervical cancer). In 1952, the polio vaccine was developed and tested by Salk for the very first time. Not only that, Sanger developed a method to sequence proteins and showed that they were made of amino acids. The year after that, Watson, Crick and their co-workers elucidated the structure of DNA. Flash forward to 1977, when Sanger sequenced the DNA of an organism for the very first time, paving the way for the Human Genome Project. In 1983, Kary Mullis revolutionized molecular biology by developing the Polymerase Chain Reaction, a now standard technique for in vitro DNA duplication. In 1995, Cornell, Wieman and Ketterle attained the first Bose-Einstein Condensate, also called the fifth state of matter. The year after, in 1996, Roslin Institute cloned an organism for the first time, creating the sheep named Dolly.

Talking about the last nineteen years, in 2001, the first draft of the human genome sequence was published. In 2004, Geim and Konstantin isolated the carbon monolayer structure called graphene and studied its properties. It was discovered that humans could be the descendants of the Neanderthals, in 2010. The biggest highlight of 2012 was the discovery of the Highs Boson at the CERN, using the Large Hadron Collider. And it was a good thing the world didn't come to an end then, for liquid water was discovered on Mars in 2015.

We have always wondered whether extraterrestrial communication was possible, and finally, gravitational wave signals in outer space were discovered in 2017. In 2018, an extremely controversial (and possibly unethical) experiment led to the birth of a pair of gene edited twin girls, dubbed Lulu and Nana, who were supposedly not susceptible to HIV. This experiment led to a lot of debates in the scientific community as a whole.



The first ever picture of a black hole in the galaxy M87.

And finally, in 2019, we discovered what a black hole actually looks like !! and then in the month of october of the very same year ,John Goodenough, M. Stanley Whittingham and Akira Yoshino were awarded the Nobel Prize in Chemistry "for the development of lithium-ion batteries".

Well, that's the end of the journey. Hope you enjoyed the ride!

~Orchishma Mukherjee (FYBSc)

Journey of the Periodic Table

In 300 B.C, began a versed journey,
Aristotle the great posed the four element theory.
Centuries after, came Lavoisier's first list
33 elements and metals, non-metals, that it consists.

Döbereiner but then insists
traids with a group of three with similar properties.
But it went wrong, until the known
'Law of Octaves', came into form
for his love of music given by Newlands
describing 1st and 9th, 2nd and 10th elements
This could only happen till Calcium.

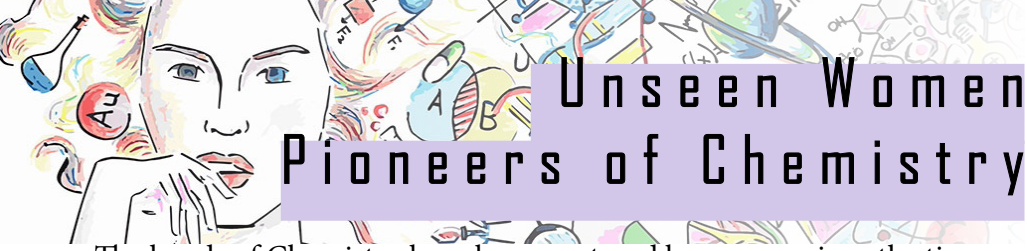
Which followed by Meyer,
who complied 56 elements
relating to volumes and weights.

Mendeleev made a table, based on atomic weights.
gaps where left for unknown and for those 63 elements.
with rows termed periods, columns as groups.
placed elements with their signs, which happened back in 1869.

The long form of periodic table, startlingly designed by a physicist,
trends in size and radius, distance in electrons and nucleus
'atomic number' defining the law, nobles gases being inert
perfect place for Hydrogen, group 17th as Halogens,
It all changed world's vision.

Now these are just a few legendaries,
brains with inventive superiority,
No less than wizardry in development for chemistry
creating a sublime history.

~Kshitija Aherker (FYBSc)



Unseen Women Pioneers of Chemistry

The hands of Chemistry have been nurtured by women since the time of alchemy, but sadly a large number of these women are unseen and unheard. Chemistry through these ages has very fondly looked upon men who have major contributions to this field. Some of these men include Ernest Rutherford, Ilenry Mosley, C. V. Raman and Alexander Fleming to name a few. However, a large number of women who have contributed to this table have gone unnamed.

One such special mention being Russian chemist Julia Lermontova who was the first woman to be awarded a doctorate in Chemistry in Germany, in 1874 for her work in refining the process for the separation of platinum group elements.

In 1902, Rutherford and Soddy announced their theory of radioactive disintegration for which Rutherford was awarded the Nobel Prize in Chemistry in 1908. This work was not possible without the notable contribution of a Canadian physics graduate student Harriet Brooks. Brooks's radon contribution was a first, crucial step, but she is rarely credited.

Urna Chowdry, an Indian by birth, determined to win the Nobel Prize in Chemistry, went to the United States and fell in love with material science. At DuPont her contributions have helped create superconductors. Fields like photovoltaics and batteries have found contributions by her.

Mildred Cohn wanted to study enzymes and she had to build her own high tech instruments in an era when open displays of prejudice against women and Jews were not uncommon. She was pivotal in pioneering the technique of NMR (Nuclear Magnetic Resonance). She had been very active in her field even when she was 90.

Chemist Reatha Clark King was the first African American female scientist to work at the National Bureau of Standards in Washington DC. She was among those women who expanded our knowledge about elements and taught us how to use them. She studied the combustion of gaseous mixtures of fluorine, oxygen and hydrogen, when she found

application to the high reactivity of fluorine. Today this combination is used in rocket propellants.

US chemist Darleane Hoffman, the first woman to lead a scientific division at Los Alamos National Laboratory in New Mexico, made her major discovery in the early 1970's where she showed that the isotope fermium-257 could split spontaneously not only after being bombarded with neutrons. We must not fail to mention Dawn Shaugbnessy at Lawrence Livermore National Laboratory in California. She has helped discover the six new elements (numbers 113—118). She is now the principal investigator of the heavy-element project (and several others) at the same institute in California.

Unlike Marie Curie, who was acknowledged in her own right and took up Pierre's chair at the University of Paris after his death, very few women in the past years for science have been given the just credit for their works. Back tracing the history of key discoveries in chemistry from this point of view unveils a much larger picture to think about the unpaid assistants and technicians at different laboratories around the world. This sesquicentennial year to both the Periodic Table and St. Xavier's College, this is an ode to the unknown and unseen behind Chemistry.

~Kyle J. Meyers
Assistant Professor/
Alumnus
Editorial Director-
ELEMENTAL

WHEN GREEN BLED RED

Let's go a couple hundred thousand years back. There are no skyscrapers, no giant factories puffing out smoke. You come out of your cave after a hard earned sleep.
What's the colour that you predominantly see?
?
?
It's green. And it's everywhere.
It's the colour of forests, the colour of trees.
The colour of shelter, and of security.
It's a shade that symbolizes growth, renewal and the spirit of very life itself.
But when humans tried to capture this spirit artificially, they found it notoriously difficult to do so. The Egyptians created the first artificial green pigment by crushing malachite minerals. Soon, the Greeks followed by synthesizing 'verdigris' from oxidized brass and copper. But since the resultant shades weren't all that awe inspiring, the hunt for the perfect green continued.
And while the human alacrity to seek for perfection is admirable, this would be one of those times when we set out to replicate nature but ended up brewing poison.
In 1775, Swedish chemist Carl Wilhelm Scheele developed a new green pigment - Scheele's Green. It was bright, attractive and most importantly- cheap.The hue was deadly! Quite literally!
The product was chemically- Copper Arsenite, a very toxic substance linked directly with various cancers and diseases. This *minor* shortcoming however, did not stop it from taking the Victorian era by storm. The shade became so popular in the UK that it was used in wallpapers, carpets, paints, and even food and medicines!!
Napoleon Bonaparte's bedroom had one such wallpaper which is believed to have induced the stomach cancer that killed him in 1821.
The green was evidently even more popular in the fashion industry. Women loved how their bright green ball gowns glimmered gracefully as they danced.Factory workers however, were at the greatest risk. Painters would lick their brushes to get a fine tip resulting in immediate poisoning.

Much later it would be known that as less as 1/8th of a teaspoon of arsenic was lethal. In 1861, 19 year old Matilda Scheurer, one such worker, was 'accidentally' poisoned. Her eyes and fingernails turned green, she vomited green, even while dying all she claimed she could see was green!
Many such deaths and cases of poisoning followed, concerns were raised and the pigment finally lost popularity when its recipe was publically released in 1822.
Enter Paris green (copper-acetoarsenite), a bluer but more durable alternative, with yet another *minor* shortcoming that it was just as toxic as its predecessor. The demand for Paris green kept increasing until in 1879, when a visiting notable stayed overnight at Queen Victoria's palace and claimed to have fallen sick from the green wallpaper in his room. In response, all such wallpapers were removed from the Palace. And soon houses across the kingdom followed suit.
Yet, when the National Health Society drew a bill the In the 1880s requesting a permanent ban on arsenic based products, the parliament straightaway rejected it since the industry was still highly profitable.
The demand for the pigment did not see any decrease until the 20th century. And even then it was partly because the detrimental effects of arsenic were now popular knowledge, and mostly because the colour went out of fashion!
Scheele's green and Paris green did make a comeback again in the late 20th century, but this time only as insecticides.
The fear that arsenic green evoked eventually made its way into media. There is a reason why all Disney villains radiate a green aura and why all the potions that their witches brew are green.

It's ironic how a colour that usually symbolizes life came to be associated with death and malice.
It's sad that Scheele was aware of his product's toxicity from the very beginning ,yet decided to have it marketed anyway.
It's irrational how people continued wearing their green dresses even after concerns about the pigment's safety were constantly being raised.

Well, I guess,
What's a little arsenic when you can literally dress to kill!

~Anjali Singh Rajput
Head Editor-XAC

MODAFINIL

My exposure to the drug Modafinil began when I was in my second year of college. I was watching the movie 'Limitless' directed by Neil Burger. The plot of the movie follows a man named Eddie (Bradley Copper), a struggling author who finds the solution to his lack of progress in a nootropic called NZT-48 (a fictional drug). Whenever he would use this drug, it would enable him to recollect everything he had ever read. This helped him in redefining his interpersonal relationships and attaining new skills within a day!

The question of how a drug could change a whole person's personality for a short period of time (not a permanent change) flabbergasted me. So, I thought of searching for a real life alternative to the NZT-48, and in the abyss of the internet. I found the answer- Modafinil.

So what is Modafinil? Is it a drug which is used for recollecting your past and everything you ever did? Or is it used only for recreational purposes? Is it safe? And, what are the repercussions of its everyday use? Or, alternatively, can it be used as a 'study drug'?

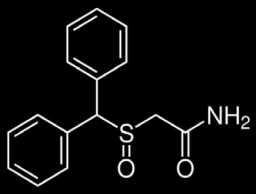
I focused somewhat on the idea of a 'study drug' because I remember reading about several cases that revealed how many students, especially those in medical and engineering fields, abused this 'smart drug' for enhanced memory and greater recollection power. It apparently 'helped' them study better. But whether or not the 'help' was worth it is the question in hand.

So let me begin with a description of this so called 'wonder drug'. Modafinil or 2-[(diphenylmethyl)sulfinyl]acetamide, is an exclusive psycho-stimulant with a waking effect and is a special medicine to be prescribed only to shift workers and patients suffering from Narcolepsy or sleep Apnea. Its normal half- life is 12-15 hours in the human body. Modafinil consist of an R-enantiomer and a 5-enantiomer as a racemic mixture and the waking effect of R-enantiomer has a longer duration. This drug is also known for its mood brightening and memory enhancing effects.

So what can its mechanism of working be? Most of its very simple mechanistic pathway takes place within the brain itself.

Modafinil activates orexin, a neuropeptide regulating wakefulness which is found in the lateral hypothalamus area and is projected towards the entire central nervous system, thus being involved in inducing narcolepsy. One of the currently proposed working mechanisms of this drug suggests that it activates the alpha adrenergic receptor, which in-turn increases the blood pressure and the blood flow, resulting in rapid pumping of the heart. Another states that it targets the dopamine receptors. The drug was screened on a large panel of receptors and transporters to elucidate its pharmacology. The research suggests that it acts as a dopamine transporter (DAT) and acts as a dopamine reuptake inhibitor (DRI). There is also an increase of excitatory glutamatergic signals caused by the decrease in the local gamma amino butyric acid transmission.

Well, then what could the applications of such a potent potion be? As a lot of research indicates, it can be used as an anti- fatigue agent for cancer and depression patients. Studies show that the mood and quality of life of such patients are greatly improved when they are administered Modafinil for 4 weeks. As fatigue is also a common problem across all age groups, this drug can be used to counter that. Moreover, it can be used to equip the defence forces as a performance enhancer making them more alert in combats.

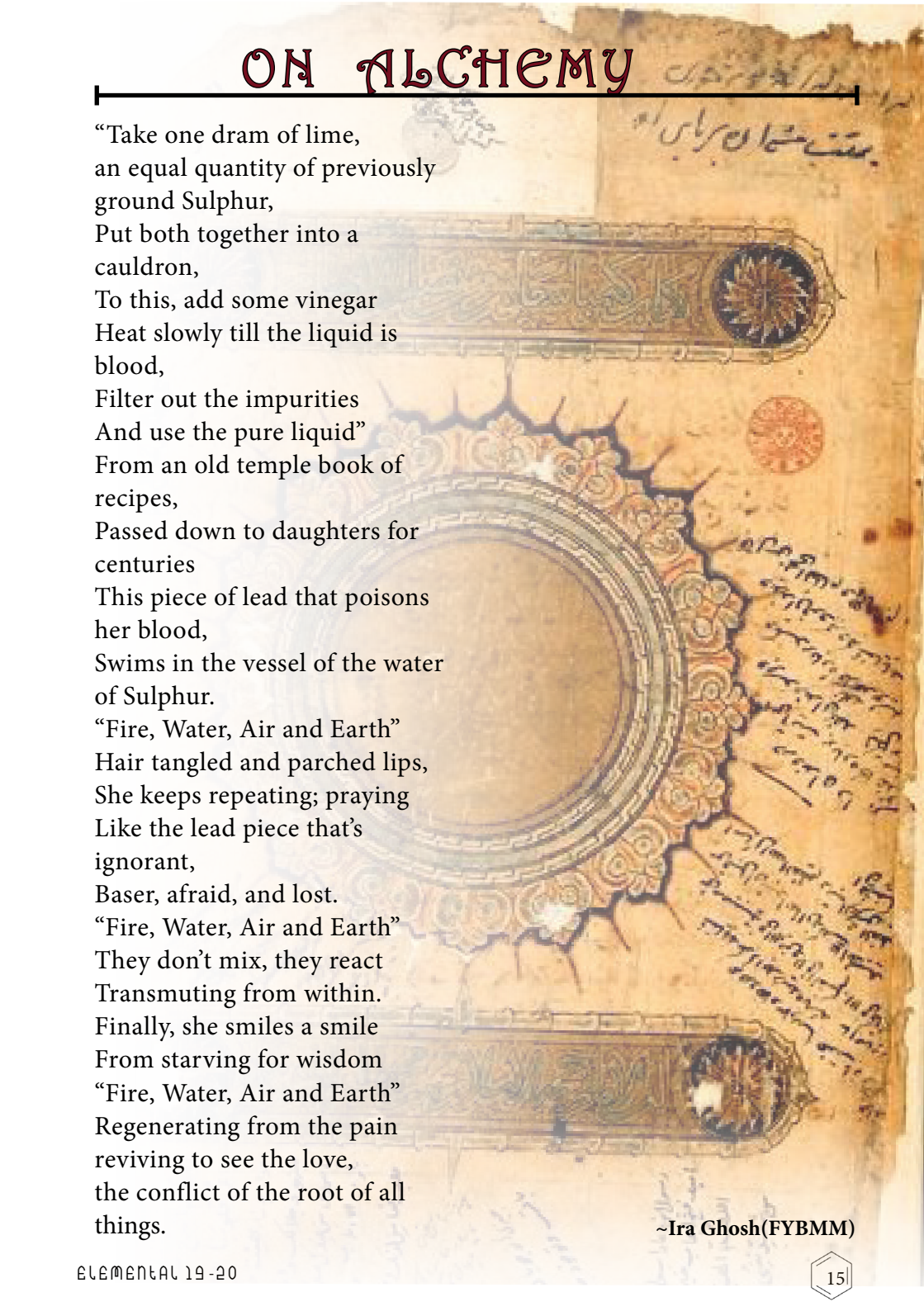


In conclusion, Modafinil is gradually being known for its mood brightening and memory enhancing effects along with its waking effects. Its usage has clearly increased and is now being used in treating memory loss due to dementia, ADHD, jet lag and fatigue caused by the extended work hours and stress of modern lives.

We are neither endorsing nor promoting this drug and its consumption is illegal for a regular citizen without government approval or a medical prescription. However, we can surely be less stereotypical in our minds about the idea of drugs and their possible effects on human lives, as rationality and open-mindedness towards every potent tool of development is indispensable to a scientific temperament and a progressing society. The use of nuclear power to the effect of human welfare clearly proves this point.

~Navin Saji
(TYBSc)

ON ALCHEMY



"Take one dram of lime,
an equal quantity of previously
ground Sulphur,
Put both together into a
cauldron,
To this, add some vinegar
Heat slowly till the liquid is
blood,
Filter out the impurities
And use the pure liquid"
From an old temple book of
recipes,
Passed down to daughters for
centuries
This piece of lead that poisons
her blood,
Swims in the vessel of the water
of Sulphur.
"Fire, Water, Air and Earth"
Hair tangled and parched lips,
She keeps repeating; praying
Like the lead piece that's
ignorant,
Baser, afraid, and lost.
"Fire, Water, Air and Earth"
They don't mix, they react
Transmuting from within.
Finally, she smiles a smile
From starving for wisdom
"Fire, Water, Air and Earth"
Regenerating from the pain
reviving to see the love,
the conflict of the root of all
things.

~Ira Ghosh(FYBMM)

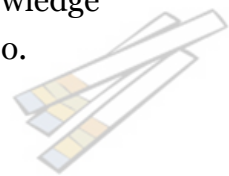
CHEMISTRY LAB

It's a happy place,
With learning,experiences,
and pipette mishap days.

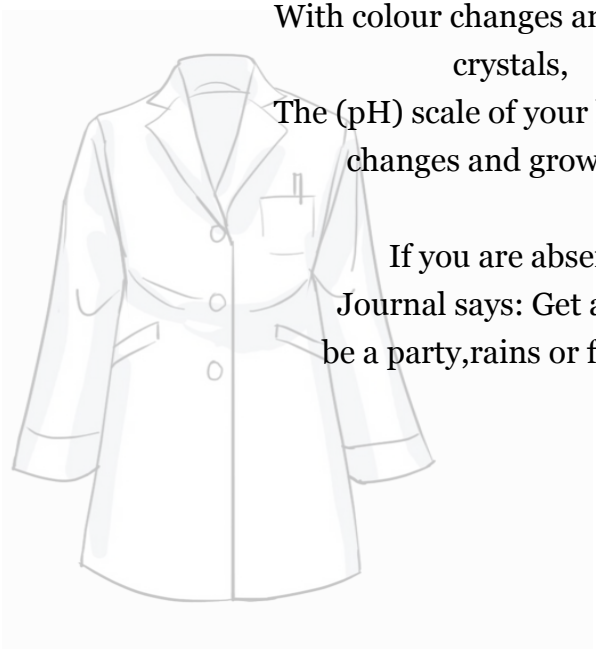
Bottles,burners and vials,
For Kinetics keep an eye on clock dials.

Goggles and Coats are a must,
They protect you from burns and dust.

With colour changes and growing crystals,
The (pH) scale of your knowledge changes and grows too.



If you are absent,
Journal says: Get a note.
be a party,rains or fake flu.



~Mahek Khan
(FYBSc)

THE UNIVERSE OF COLOR ADDITIVES

INTRODUCTION:

Colour additives, more commonly known as 'food colouring' or 'dye' ,are an integral part of modern day food, medicinal and drug industries. It is an ingredient with no nutritional value which imparts colour and thereby makes the food more appealing. This article examines food colour additives and further explains their toxic effects on humans. An alternative to harmful synthetic colour additives are organic colour additives which are mainly plant extracts and are safe to consume are also discussed in the article.

THE COLOR GAME:

Tasting with our eyes is the most crucial factor in enjoying food and has eventually given birth to the use of harmful colour additives in the food industry , for increased sales and profit without taking into consideration the adverse effects it has on the entire human race. This arena of colour additives that have been causing significant harm to humans ,are generally not taken seriously enough since their effects are'nt immediate . This article further gives evidence of how adversely the use of a synthetic colour additive,harms the consumer in the long run.

HIDDEN HEALTH RISKS:

- The most widely used colouring culprits- Yellow 5,Yellow 6 and Red 40 contain compounds including benzidine and 4-aminobiphenyl that research has linked with cancer.
- Moreover, these additives have proved to be a leading cause of increasing rates of infertility in the modern population .
- Research has also associated food dyes with allergic reactions in children, learning impairment, irritability and aggressiveness.

EXPERIMENTAL EVIDENCES:

- Abe and Sasaki showed that azo dyes induced chromosomal aberrations in Chinese hamster ovary cells.
- Patterson and Butler aimed to study the genotoxic effect of tartrazine in mammalian cells. The results clearly inferred the fact that tartrazine induced chromosomal aberrations in Lymphocytes of Muntiacus muntjac.
- Roychaudary and Giri investigated the effect of Indigo Carmine, Orange G and tartrazine on human peripheral blood Lymphocytes. These studies also came up with conclusions that clearly showed that high concentrations of the above mentioned additives induced chromosomal breaks and micronucleus formation in blood lymphocytes.
- Researchers also studied the genotoxic effect of 4-methylimidazole on bone marrow cells of albino mice. Results showed that it did not induce any chromosomal aberrations however, studies have also reported that sunflower yellow and kokum red weakly increased chromosomal aberrations in bone marrow of swiss albino male mouse.
- A 2007 British study found that children who consumed a mixture of common synthetic dyes displayed hyperactive behaviour within an hour of consumption.

LET'S SWITCH:

An alternative to harmful synthetic food dyes are the naturally derived food colouring products derived from plant extracts . These alternatives are feasible and safe for consumption.They are cost -effective due to availability and easy production ,and are potent enough to colour the food like any other synthetic colour dye.

Some of the natural organic food colourings that can be used in our everyday preparations are listed below:

- Mangoes
- Raw carrots
- Turmeric
- Red cabbage
- Blueberries
- Cocoa powder
- Spinach extracts
- Raspberries,etc.

~Sneha Bince (TYBSc)

The Dough of Love

Tides! We have all heard of them. Briefly, they are caused by the gravitational pull of the moon. Tides are a product of the gravitational attraction between the Sun and the Moon. Here we see the word 'attraction' in play. The phenomenon of attraction occurs between two entities (or more). Attraction, when stretched on the scale of time, turns into love. I do not mean to say that the entire solar system is a result of love between the planets and the sun. *laughs* It is definitely the gravitational force between two heavy masses.
And while this gravitational attraction is easily measurable,
Quantifying and measuring attraction as a feeling is a pretty tedious task. Let me tell you a fact, everybody fails at it! Hence, we must not do that, right? But also, it is fun to try and dimensionalize emotions, isn't it?

The chemical formula of love is $[C_8H_{11}NO_2] + [C_{10}H_{12}N_2O] + [C_{43}H_{66}N_{12}O_{12}S_2]$. Yes, right here is all that we need to know about the 'Chemistry of Love'. These three hormones- Dopamine, Serotonin and Oxytocin are the cause of what we feel. The entire roller-coaster that we go through is caused by them. Together they constitute the chemical formula of love. Yes, now you can blame it all on them! Sigh!

As we know, human beings are social animals. With evolution, we started living in groups. While living that way, we had to focus our energies on one person to win the best mate and guard him/her against others. This made love, less of a feeling, and more of a striving. This is how the study of these neurochemicals became important. The feeling of longing when seeing a suitable mate, possessiveness when the mate is with us, mental-fixation when the mate is not with us, jealousy or rage when the mate is with someone else and despondency when we lose the mate!

In fact, when we are in love, we can't think straight. It is because the feeling emerges in primitive parts of our brain (in the brainstem) which are beneath the logical centers and thus beyond their (and our) control.

Dopamine and serotonin are the chemicals involved here. They get sprinkled from the brainstem, are attributed to the reward-seeking feelings ,and as per their varying levels, bring out the feelings attached to all related behaviors right from longing to despondency.
Dopamine is the hormone that controls the reward-seeking center of the brain. It is associated with a feeling of euphoria, excitement, and (yes) addiction. Cocaine and love both manifest similarly in the dopamine receptors of the brain. Have you ever felt a literal addiction to someone? In those early stages of love, it feels that way because the brain chemistry is that of addiction. Crazy, right?
Serotonin is the one that gets you a little crazy! Do you remember having felt a little obsessive, at the beginning stages of love? When you can't stop thinking about that special someone? You feel anxious, jittery, and your stomach is always full of butterflies?
Well, there you go. Now, you know!
Oxytocin is the bonding hormone. Nursing a newborn child causes it to surge in new mothers. The hormone actually makes us want to stick with that one person. That intense feeling of closeness, trust, and bonding that comes from oxytocin during the early stages of love (and later stages too as we shall see) is hard to resist. Oxytocin can result in adverse behavior too, depending on the person. It can result in envy, jealousy, or suspicion, and in highly emotional and imaginative people, can lead to stalking.

This is roughly how chemicals are involved in helping us experience the excitement and adventure of one of the best feelings in human existence - Love.

~Prateek K. (TYBSc)

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A CHEMICAL TRAGEDY

Not many of us are aware about the Lake Nyos Tragedy- and that is why I'm highlighting this. It was a calm evening of 21st August, 1986 in North Western Cameroon (Africa). The quaint villages near Lake Nyos were settling in for their evening supper, probably gossiping about the day. The silhouettes of children playing happily are seen in the dim, fading light of the setting sun as their mother called them in to go to bed. The owl hooting, the cow mooing and the dogs barking as though they too wanted to gossip and debate about whether or not their masters are loving towards them.
Soon the lights go off and villagers are asleep in the hope to start another exciting day, the following morning. But little did they know that this sleep would last for eternity!

That was the night when there was a sudden eruption of a large cloud of CO_2 from the lake surface, which rapidly spread over the 25km radius around it at a speed of 100 km/hr. The CO_2 emission was estimated to be 100,000-300,000 tons ,which settled in over the countryside sweeping east to west from Cha to Subum and down the valley displacing the gas even more.
Almost 1,746 people and 3,500 livestock and large number of birds, insects, and animals in the neighbouring forests were killed of asphyxia (suffocation) within minutes.

The Lake Nyos stretches uncomfortably over the edge of an inactive volcano in the Oku Volcanic field. An 80km deep pit of magma lies below the lake from where the carbon dioxide slowly percolates from the earth's crust through groundwater and accumulates in the lake at the bottom. That is where the lake received its CO_2 from,and over the course of time became super saturated. Nyos is a meromictic lake i.e. it's layers do not mix with each other. Also it has no animals and plants that can cause water circulation. The upper layers of water provide high pressure and allowed unusually high concentration of CO_2 to dissolve in the lower layers. On the night of catastrophe, probably a landslide or volcanic eruption or light tremors of an earthquake resulted in lake water rising over 300 feet in the air and releasing the CO_2 it had been storing over the period of time. CO_2 being heavy displaced all the other gases and settled down choking everything on its way to death. To understand what exactly happened, we can consider this simple experiment:

When we drop a mentos in a bottle of coke there is an explosion and all the CO_2 compressed in the coke gets evolved. Well, somewhat like this happened that night. Here, the microscopic revices on the mentos surface allowed the CO_2 bonded to the water molecules to evolve. Though mentos seems fairly smooth the surface is rough on a microscopic level and provides tremendous surface area for CO_2 to be released.
Now, in the case of Lake Nyos, the mentos is the volcanic eruption / landslide/ earthquake and coke, the lake itself. Considering all the dire consequences of the lake, scientists from all over the world tried to come up with a solution. In 2001, French scientists installed a degassing instrument consisting of a pipe that went all the way to the bottom of the lake and a fountain that allows the gas to escape at a consistent rate. Two more such pipes were installed in 2011.

~Bipasha Kulkarni
FYBSc

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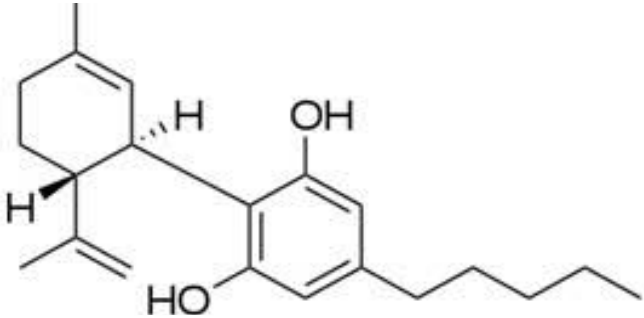
STONED AGE:

The Science Behind Cannabis and Why It Won't Kill You

Cannabis, Weed, Marijuana, Ganja or Pot, whatever one might call it ,refers to a psychoactive drug obtained from the dried flowers of the plant Cannabis sativa, believed to be a native plant of India. Historically, it has been used religiously (pun intended) in medicines and for recreational purposes. It is oneof the five sacred plants mentioned in the vedas. It was also used in ancient Egypt and Greece.

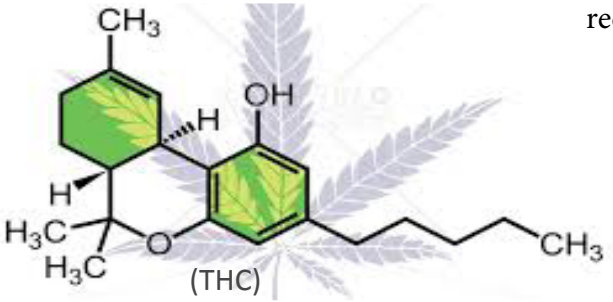
The plant contains various chemical compounds of which around 100 are called cannabinoids (though the number is debated), which constitute the psychoactive part of cannabis. Two of the most important of these are Tetrahydrocannabinol (THC) and Cannabidiol (CBD), the latter makes up about 40% of the plant resin. THC produces cannabis' mind-altering effects giving a sense of 'high'. Another chemical compound abundant in cannabis are Terpenes which are aromatic unsaturated hydrocarbons that are mostly found in plant oils imparting to them their characteristic fragrances. There are over 100 terpenes present in the cannabis plant but few are found in high concentrations. Myrcene terpenes and limonene terpenes found in the plant have anti-inflammatory and anti-bacterial properties and are a mood enhancer. They have cardamom-clove like and citrus smells respectively.



Cannabidiol

Marijuana works on the brain's cannabinoid system which is a biological system composed of endocannabinoids which are neurotransmitters that bind to cannabinoid receptors. Most neurotransmitters travel from one neuron to the next in the synapse passing on information, but endocannabinoids travel in the opposite direction from the receiving neuron to the sending neuron, essentially giving feedback. They slow down neural signalling but not the sense of perception and by doing so they can increase the intensity of the signal.

Tetrahydrocannabinol (THC) is similar in structure to a natural chemical produced in the body called Anandamide which is an endocannabinoid. It slows down signalling by binding to cannabinoid receptors, but this binding is not regulated and it binds to all the receptors at once opposed to Anandamide which is released at a specific area and binds to the receptors in that area only.
When THC binds to these receptors, the person is left in a chain of thought.



(THC)

THC binds to the CB1 receptor while CBD weakly binds the CB_2 receptor. CB1 and CB2 are receptors present in the synapse between two neurons which are otherwise activated by Anandamide. Since the cannabinoid system is also present in the central and peripheral nervous system, it indirectly affects numerous other systems of the body. These cannabinoids also affect the levels of dopamine and norepinephrine in the brain thus leading to a sense of euphoria. It can also induce sleepiness, impair perception and increase appetite.
Cannabis is smoked, consumed orally or is used in teas. But consumtion of this drug comes at its own peril. Cannabinoid receptors are more concentrated in the white matter of the brain, in people below the age of 25, which is associated with memory and emotion. Frequent marijuana use may hinder with white matter development causing long term learning disabilities. Immediate effects of cannabis on first time users can lead to paranoia, psychosis and shortness of breath but these effects subside on their own.

This said, an overdose of weed will not kill anyone.

As seen with other drugs, the brain and body become less sensitive to the drug with repeated use leading the person to consume more each time to reach the same level of euphoria. The risk of marijuana overdose would require around 680 kg of weed to be inhaled within 15 minutes to be fatal. It is impossible to die from marijuana overdose because the cannabinoid receptors are mostly absent in the brain stem which is the part of the brain that controls fundamental body functions such as breathing, heart rate and blood pressure. Other drugs directly affect these functions. There aren't any scientific evidences of life-threatening withdrawal symptoms associated with marijuana.
Medicinal Marijuana is known to reduce chronic pain, treat muscle spasms and reduce chemotherapy induced nausea. It is consumed in the form of brownies, lollipops, granola bars and chewing gums. Many countries are reviewing their laws for the use of not just medicinal but also recreational marijuana. In India, cannabis consumption for any use was criminalised in 1985.
It's a Cannabis Controversy.

~Hriday Saxena
FYBSc

FUN FACTS

150 YEARS OF CHEMISTRY

THERE IS ABOUT 13 BILLIONTH OF A GRAM OF GOLD IN EACH LITRE OF SEAWATER.

CHALK IS MADE OF TRILLIONS OF MICROSCOPIC SKELETON FOSSILS OF PLANKTON.

DYNAMITE CONTAINS PEANUTS AS A PART OF IT'S INGREDIENTS.

MOSQUITOES LIKE THE SCENT OF ESTROGEN,HENCE WOMEN GET BITTEN MORE OFTEN BY MOSQUITOES THAN MEN.

EVERY HYDROGEN ATOM IN YOUR BODY IS 13.5 BILLION YEARS OLD BECAUSE THESE ATOMS WERE CREATED AT THE BIRTH OF THE UNIVERSE.

COPPER IS THE ONLY METAL THAT IS NATURALLY ANTIBACTERIAL.

COCA-COLA INITIALLY CONTAINED COCAINE AND HENCE, THE NAME.

LEMONS HAVE MORE SUGAR THAN STRAWBERRIES.

ONE BUCKET FULL OF WATER CONTAINS MORE ATOMS THAN THERE ARE BUCKETS OF WATER IN THE ATLANTIC OCEAN.

EYES OF A GOLDFISH PERCEIVE THE VISIBLE SPECTRUM, INFRARED, AS WELL AS THE ULTRAVIOLET LIGHT.

THE AVERAGE SHOT OF ESPRESSO CONTAINS LESS CAFFEINE THAN A TYPICAL CUP OF COFFEE.

A RUBBER TIRE IS TECHNICALLY ONE SINGLE, GIANT, POLYMERIZED MOLECULE.

DNA IS A FLAME RETARDANT.

SUPERFLUID HELIUM DEFIES GRAVITY AND CLIMBS ON WALLS.

IF YOU POUR A HANDFUL OF SALT INTO A GLASS OF WATER, THE WATER LEVEL WILL GO DOWN.

THE RAREST NATURALLY-OCCURRING ELEMENT IN THE EARTH'S CRUST IS ASTATINE.

THE AMAZON RAINFOREST PRODUCES APPROXIMATELY 20 PERCENT OF THE OXYGEN IN THE ATMOSPHERE.

GALLIUM HAS A MELTING POINT OF 29.76 DEGREES CENTIGRADE AND CAN MELT ON THE PALM OF YOUR HAND.

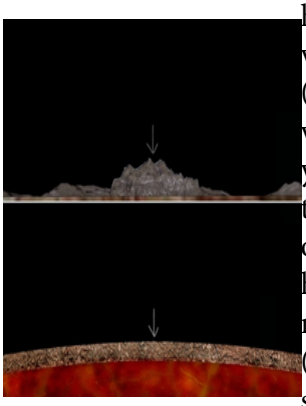
"Is it possible to know the exact composition of the Earth's interior?"

DECODING THE MANTLE COMPOSITION USING TRACE ELEMENT GEOCHEMISTRY

As Neil Degrasse Tyson rightly said," After knowing the vastness of the universe, if you end up feeling small, it is because you started off with an ego unjustifiably high to even begin with." The spirit of Science dies the moment we let go of healthy skepticism and assume that we have got it all figured out. For those who think that we already know everything about our planet's interior, let me put the facts into perspective so that we can reach a consensus about the intricacies involved in comprehending the deep earth before moving into the different methodologies of analyzing the chemical aspects of it.

Visualizing the scale

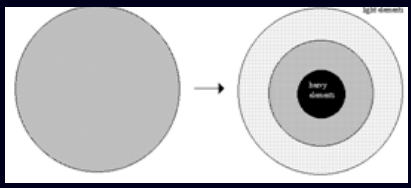
Firstly, we need to understand the scale that we are dealing with; the planet is too huge for a human to dig and reach even the crust-mantle boundary using the current technology. To help you visualize the size, here is an example; If we look at the cross sectional view of the planet along tallest peak -Mount Everest (8,848m),it is not even visible at the scale of the voluminous mantle and core as shown. Well, now you know how puny we are that manually digging the earth to understand the mantle composition is out of question. So your next query would be-"then how in the world were we able to conclude that the mantle composition might be broadly peridotitic (a silicate rock rich in Fe and Mg) and the core- a solid Fe/Ni alloy?" To understand that, you need to know what chemical differentiation is.



Global Chemical Differentiation

The concept is similar to what you might have observed in a smelt, if you leave it for some time, the denser metallic contents sinks and settles at the bottom and the lighter components, say the sulphides, rise to the top and

float. Planets also undergo the same process, post its accretionary phase and the thickness of the layers of heavier components (core and mantle) and lighter components (crust) depend on the time it takes to complete the differentiation process. Usually, a planet that underwent a slow differentiation process has a thick mantle layer and a thin crust, Earth is such a planet.



We could thus use this concept to get an idea about the generic composition of the mantle by comparing them with chondritic meteorites and asteroids as they directly represent the composition of the solar nebula from which the terrestrial planets evolved. These chondrites also contain the volatiles intact within them which is not the case for terrestrial samples as all the volatiles are lost by degassing. Thus, all the relevant inferences of the differentiation process can be obtained by analyzing such chondrites. So, the mantle would thus be homogenous and now the only thing remaining to be explained was the heterogeneity in rocks formed on the earth's surface. Well, NOT EXACTLY, the real challenge was yet to come…where all our assumptions and understanding of the composition of mantle started crumbling down….

What was wrong with our assumptions????

For decades, the scientific community has been on a quest to find the source to the various types of rocks that we see on the surface of our planet. One school of thought was that the mantle is chemically homogenous but the mineralogical composition varies with depth. This framework was able to explain all of the encountered varieties of rocks with the concept of primary magma (source) and derived magmas which result due to variations in pressure and temperature conditions. This concept was able to account for the heterogeneity in mineralogy using a homogenous source, thus concluding that any derived magma(s) will ultimately have a single parent magma, which accounts for all magma types. But alas, this conception crumbled when trace element data suggested that the difference in signatures between Ocean Island Basalts (OIBs) and Mid Oceanic Ridge Basalts (MORBs) can only be explained if there are multiple sources in the mantle thus eliminating the homogenous model. YES, WE WERE WRONG about a homogenous mantle.

This marked the beginning of using trace element data as a staggeringly useful tool to track down the independent sources in the mantle.

Rare Earth Elements: The Game Changer

The Lanthanides or Rare Earth Elements (REE) consist of the elements from Lanthanum (Z=57) to Lutetium (Z=71). The three valence electrons causes the REE^{3+} to be the most stable ions found in nature except for Europium, which is mostly as Eu^{2+}, and Cerium which may be partially oxidized to Ce^{4+} and this behavior is key for geochemical signatures. The concept of compatible and incompatible elements play a significant role in explaining why the REE is useful to detect magma sources. As a general rule, the compatible elements tend to incorporate within the crystal (solid) and the incompatible elements tend to remain in the melt (liquid). REE are generally incompatible, and can be used to create geochemical signatures.

Since Eu and Ce can vary their oxidation states, they can replace certain compatible elements thus deviating from the general behavior of residing in the melt, for example, Eu^{2+} can replace Ca^{2+} in Plagioclase ($CaAl_2Si_2O_8$) and this will be reflected in the REE diagram as a negative Europium anomaly and thus it tells us that the sample that showed the anomaly is now devoid of plagioclase that once existed which is great information. All of that looks cool….and it's definitely not as easy as it looks…..but understanding them is the essence of science, right??

The heart breaking revelation is that, not only is the mantle heterogeneous with multiple reservoirs, but we forgot that the mantle itself is depleted now because the crust was created from it!!!!!

So all that is fine, you might say, but deep down, you really want to ask what is the point in figuring out all these right? Well, I wish to answer that question using a philosophical cosmic perspective.

The Grand Picture and accepting that we are nowhere near it

Comprehending the geochemical processes can open new gateways for analyzing our neighbors in the solar system and even planets beyond the solar system, if technology allows for it. Therefore, If you wish to find your place in the universe, this is a good way to do it. Science has always been a conduit in reaching the truths about reality,

but as I have mentioned in the beginning, this conduit will not function if healthy skepticism is absent. The fact that our brains were able to comprehend the variability in composition due to sources extending hundreds of kilometres beneath our feet is astounding. But can we be entirely sure of our findings??Well no, and there is a beauty in that. All these inferences that we have made regarding the mantle sources has been from rock data that is, at maximim, from the upper mantle…..i.e, we have no idea what is out there in the lower mantle and also, it is very difficult to tell if our samples have been contaminated as it finds it's way and reaches the top and thus, these implications are inevitable and beyond our reach for now. Who knows, perhaps we might be wrong about all these, but we the scientists are always ready to make changes if we are proved wrong and that quality exists in no other profession and therefore, we should be proud of it…., you might be thinking, why is this guy getting all philosophical now, Well, the point I'm trying to make is that we have just barely scratched the surface of the geochemical attributes of the mantle.

There are still much more obscured facts about the nature and origin of the elements and it will surely reveal itself to those who are willing to follow wherever the facts lead them….

~Joel George
TY-Geology

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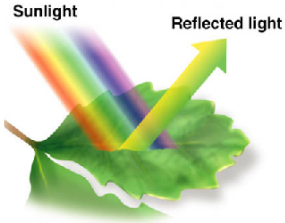
THE COLOUR CHEMISTRY CONUNDRUM

Anyone who has stepped into a chemistry lab knows that chemicals are all about colours. But a new question- are colours all about chemicals?

Technically speaking, no. Colours, as we know them, are an illusionary construct, a conspiracy between visible electromagnetic radiation (aka commonly "light") and our cone cells (colour cells in the human eye), to make our lives more interesting. But often colloquially, we call paints, pigments and dyes as "colours", and in that sense, yes, "colours" are certainly all about chemicals.

The instinct and love of colour is universal. Vincent van Gogh once said that "Colour in a picture is like enthusiasm in life." Indeed, who hasn't ever messed about with paint tubes and brushes? Who has never admired a rainbow? Yet ironically, these two phenomena, as far as the colours are concerned, are almost complementary. The VIBGYOR of light gives white, the VIBGYOR of paint gives black! It's totally topsy-turvy, but amazing and beautiful! Much of what we call "beauty" is visual, yet most of us know so little of the grand machinery behind it all. And hence, a glimpse into the world of "colours", pigments and dyes- their compositions, discoveries and development, chemical histories, diplomatic controversies, the present scenario, and of course, the backstage beauty! Indeed, a race that can have fought wars for colour is a strange one, but worth belonging to.

So, chemically speaking, what causes some things to exude colours and others not? The culprit goes by the name of "chromophore". It is a region in the molecule with molecular orbital energy difference within the range of the visible spectrum. Visible light hitting the chromophore can thus get absorbed and excite electrons. The unabsorbed (or reflected) part of the visible light reaches our eyes causing us to see the colours. Chromophores are commonly transition metal systems or, conjugated or delocalized electron systems.



The "colours", or more appropriately, the colouring agents we use are dyes and pigments in various forms. Dyes are water soluble compounds whereas pigments are water insoluble. Pigments can be organic (natural or synthetic) or inorganic (mineral or synthetic). Organic natural ones are of plant or animal origin. Carmine from cochineal insects, Tyrian Purple from predatory sea snails, Bone Black from charred bones of animals and the gruesome Mummy Brown are some examples of animal pigments. Common plant-origin pigments include those from madder, woad, indigo, sumac, beets, blueberries, etc. Pigments like ochre, sienna, cobalt, azurite, ultramarine, vermillion, etc. fall under the inorganic mineral category.

"Colours" have a very colourful history.

It might sound a bit unbelievable, but they've been major players in so much of world dynamics- trade, conflict, diplomacy, power balances, and even the death of one of the world's most discussed emperors! Ever noticed purple on a national flag? In fact, only two nations in the world have it, and that too, not till late nineteenth century. What makes purple the colour of royalty and until recently, more expensive than gold, is the rareness and labour- intensive time- consuming manufacture of the Tyrian purple. Ultramarine was another colour that competed gold in expense, and

a colour of intense conflict. Very popular among Renaissance painters, this pigment was made from the semiprecious gemstone lapis lazuli, whose only source were the mountains of Afghanistan. The search for a synthetic substitute led to big money exchanges, disputes on credit between the French and German and finally the French Ultramarine, the synthetic kin of the colour of divinity. Indigo trade and the great Indigo Revolt of 1858 in India are a history we are all familiar with. And as a last on anecdotes, the copper arsenite from the Scheele's green adorning the wallpapers of Napoleon Bonaparte's exile home is said to be the major cause behind his death of acute arsenic poisoning.

Notice the purple chest of the Sisserou parrot on the Flag of Dominica

The herald of synthetic colouring agents in late nineteenth century eased the markets to an extent that obviously, today we don't face wars and revolts for colours.
Mauveine or aniline purple was one of the first synthetic dyes to be produced. Ever since, the colourant industries haven't looked back.

Personally, I can identify three major eras in this story of "colours".
The first era- from organic plant and animal pigments used by prehistoric cave dwellers, to the discovery of grinding minerals to produce colouring agents, to multifarious trades and geopolitical relations between countries.
The first bridge- the need for synthetic dyes and pigments and the accelerated competitive research it fuelled
The second era- industrial mass production and trade of synthetic and natural colouring material
The third era-the use of sustainable, ecologically-benign materials to this end.
Today, we are standing at the bridge between the second and third era. With the entire planet at the brink of perishing under the flames of climate change, it is of utmost significance that organic synthetic research and industry contribute their bit to fight the crisis. Time and change are of the essence, and we need a careful gamble to the turn the tables of the planet's future in favour of survival.

~Bonobithi Biswas
(SYBSc)

HISTORY OF CHEMICAL WALFARE

What is Chemical warfare

It could be the use of the toxic properties of different chemical substances as a weapon against the opposition in a war which causes casualties at a large scale, which is why they are often called as Weapons of Mass Destruction (WMD). These are different from nuclear or conventional weapons as their primary effect is not because of any explosive but due to the increased toxicity of the chemical substance.

There is another category in which chemical warfare is classified- herbicidal warfare,where the toxicity of the chemical substance is used to restrict and destroy the growth of food crops which can in turn affect the enemy.

History and incidents

On 22nd April 1915 , Chlorine gas was used as the first chemical weapon in Belgium, causing 90,000 deaths and over one million casualties. After this a series of these chemical weapons were used in the coming decades. In 1962, United States of America used Agent Orange and tear gas during the Vietnam War, around 475,500 gallons were dropped in parts of Cambodia and Laos .This affected around three million Vietnamese leaving them with health problems and physical disabilities that would also affect the coming generations .

In the year 1988, Iraq launched a poison-gas attack on its own city of Halabja, as a result around 5,000 Kurds were killed and most of them were civilians.

Another massacre happened in Syria where the Syrian government launched a chemical attack on the rebel held areas during the Syrian civil war. Around 1,238 people were killed.

On further investigation by the Organisation for the Prohibition of Chemical Weapons (OPCW) it was found that the chemical weapons were used around 34 times in Syria, Nerve Agent Sarin was used on several occasions.

Chemical warfares are especially dangerous, since they don't only affect the people alive today, but also the future generations . Such wars also damage plants, animals and disrupt the entire ecosystem .Hence, Many steps are being taken these days by OPCW for eliminating any future possibility of a chemical warfare .

Regulations and International Norms

The Organisation for the Prohibition of Chemical Weapons (OPCW) is an intergovernmental organization and the implementing body for the Chemical Weapons convention which entered into force on 29th April 1997. OPCW has total 193 members and is having its headquarters in Hague, Netherlands. FFM (Fact Finding Mission) was set up in 2014 after the allegations on the Syrian government on using the chemical weapons on its people.
India entered into Chemical Weapon Convention (CWC) in 1993 and after few years it declared the stockpile of 1044 tons of sulphur mustard in its possession, by 2005 six more countries declared their chemical weapons stockpiles and entered into this treaty. Together,many countries and organisations are coming forward to maintain peace, and are joining hands for using science for the upliftment and not the destruction of mankind.

~Siddhant Pathak
FYBsc(IT)

THE NEXT BIG THING IS SMALL

Nanomaterials are part and parcel of today's modern world. Miniaturized particles of the nanometer scale have new and devised properties. One Nanometer is a unit of length equal to one billionth of a metre (10^{-9}).

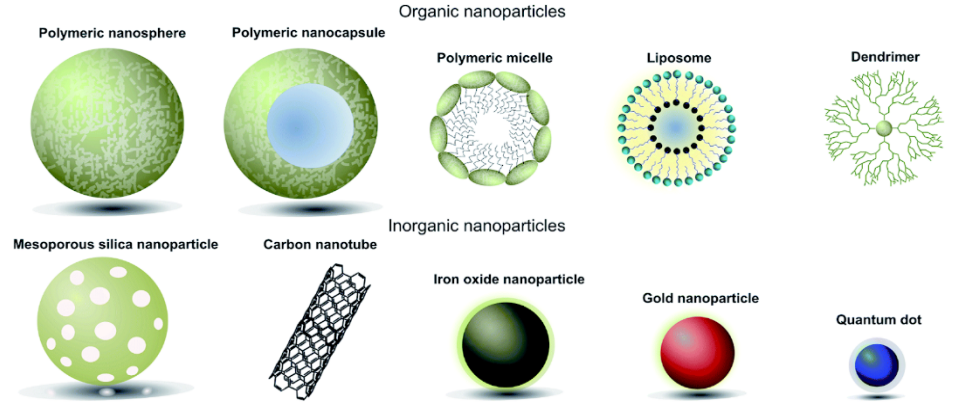
The concept of Nano technology was given by the physicist Richard Feynman in 1959. Since such particles were found to have unique chemical and physical properties in comparison to the bigger sized particles,they were termed to be the materials of the future.

In today's world, nanoscale assays are introduced for screening cancer, infection and genes. Gold nanoparticles doped with DNA help in detection of bacteria in a person's bloodstream.

So, what is the reason that nanoparticles act this way?

The answer lies in their scale which is responsible for the unique interactions among atoms and their constituent subatomic particles . This is the size scale where so-called quantum effects rule the behavior and properties of particles. Properties of materials are size-dependent in this range and thus, properties such as melting point, fluorescence, electrical conductivity, magnetic permeability, and chemical reactivity change as a function of the size of the particle.

These materials provide smaller surface area for smooth movement of electrons. The interactions are useful in production of graphene and quantum dots for mini computers and communication device.



Carbon nanotubes are wonders used in fabrics, solar cells and electric cables. Nanoparticle-Filled Ink conducts electricity to light the bulb or an LED display. Gold nanoparticles are the new "sniffers" for cancer and other diseases. Also, there is a development of particles that can cure and diagnose cancer in early stages. Sepsis can be identified using gold nanoparticles.

Different shapes and chemical framework can target specific cells. Nanobots help in drug delivery.

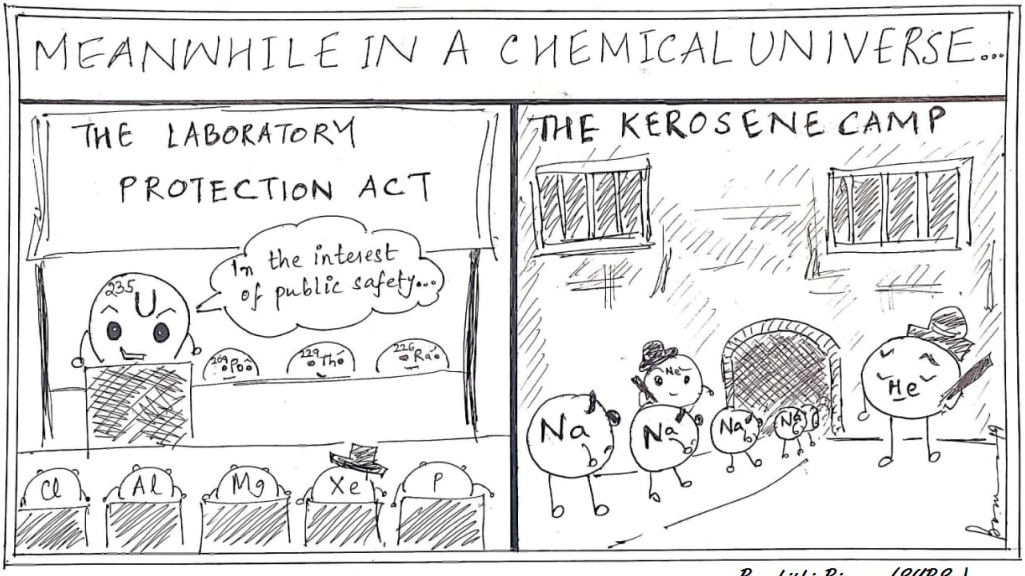
Sunscreen containing nanoparticles of titanium dioxide and zinc oxide prevents harmful solar radiation from penetrating your skin. Recent studies show that titanium dioxide does not penetrate into the skin. Nano-coatings are protective, waterproof and repels dirt from surfaces.

Nanoparticles are used as a pesticide or as fertilizers, but some research shows they could damage crops and can even be fatal.

Thus, nanotechnology is the present and future of the coming

~Donna Jacob

TYBSC



Bonobithi Biswas (SYBSc)

Tom Riddle's Diary

Are you a Potterhead?
Do you want to write with your own magical ink?
Well, look no further for here's the che-mystery of wizardry!

Developing Invisible Inks

Ink Source	Development Methods	Effects
Lemon or orange juice	Heat gently over light bulb	Written message turns brown
Baking soda solution	Heat gently over light bulb	Written message turns brown
Baking soda solution	Spray or brush with purple cabbage juice	Green letters appear on pink paper
Corn starch solution	Spray or brush with dilute iodine solution	Dark blue text appears on light blue paper
Lemon juice	Spray or brush with dilute iodine solution	White text appears on light blue paper
White wax candle or crayon	Spray or brush with any colored aqueous solution	White text appears on colored background

How to write the message?

1.Dab a Q-tip or brush into solution of the 'ink source' and write the message on a paper. Just make sure you don't use too much.
2.To see the message, simply follow the development technique.
3.MAGIC!

~Sonal Joshi(TYBSc)

A BITTERSWEET FAREWELL

Fr.Roy has contributed immensely to this Institute's legacy , as a responsible Head, an innovative and respectable teacher (and an excellent singer!). After years of committed service, he's finally retiring . And while we are sad to see him go, we wish him luck with his future endeavors.

Here's what he had to say when we reached out to him for a few words of encouragement:

"XAC has completed 16 years and it is a joyous occasion. I feel very privileged to be part of the founding team. XAC continues to achieve its mission year after year with different batches of students providing leadership. Its mission of making Chemistry alive and fun for the students continues to be achieved through the annual intercollegiate XAC Fest – ALCHEMIA for colleges around Mumbai. The hike at the beginning of the year provides an opportunity for the members to enjoy nature at its best as well as to help the group bond together. And of course, the magazine - Elemental gives all budding writers a platform to showcase their writing skills.

I wish all the current batch of students all the very best for the festival. Most of all I want to put down my gratitude for my colleagues who worked to make XAC great during all these years. You my dear teachers continue to bring out the best in our students. God bless all of you!"

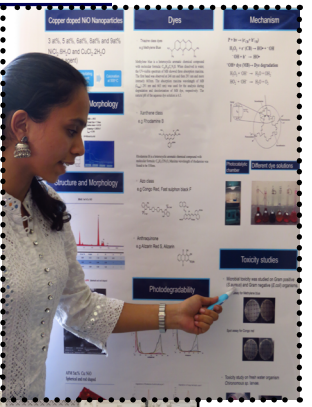
Dr. Fr. Roy Pereira, S. J.
Ex- Head, Department of Chemistry,
Director, Xavier's Development Programme,
Vice-Principal (Academics)

ALL THROUGH THE YEAR.....


XAC CORE TEAM

HIGHLIGHTS

INTERNATIONAL SCIENCE CONFERENCE - 2019



ICE BREAKING SESSION

30th July 2019

The Ice breaking session was conducted on 30th of July 2019 and was a great kick start to the academic events of XAC for the year 2019-20. It began with a brief introduction about XAC where Professor Marazban emphasized on how sagacity is not only gathered through bookish knowledge, but also through life experiences. Soon, the ice-breaker session witnessed the official launch of the XAC logo and was followed by fun-filled games and interactions .

LAB SAFETY WORKSHOP

JAIPUR INDUSTRIAL VISIT

6th - 10th OCTOBER, 2019

As Francis Bacon once said, "Travelling in the younger sort is part of education, while in the elder sort it is part of experience", thus, corroborating the quote aforementioned, the chemistry department of St. Xavier's College felt the need to organize an educational industrial visit for their students. And so, On the bright afternoon of 6th November 2019, a batch of TY students accompanied by Dr. Pralhad Rege, Professor Himanshu Gupta, and Dr. Nikhila Bhat ,boarded a train from Bandra and left to explore the industrial majesty of the pink city of India-Jaipur.

SARAS DAIRY – 7th Nov 19

Saras Dairy is an ISO 9001:2008 & IS 15000 (HACCP) certified organization that supplies milk to the whole of Rajasthan. It is affiliated to Rajasthan Co-operative Dairy Federation Ltd., Jaipur, and has a Dairy plant handling capacity of 2.5 lakh liters per day .Its main products are Ghee, Milk ,Srikhand, Paneer and Chhach.

An official from the dairy took the students for a tour across the various facilities and briefly explained the steps involved in the production process.

PAPER INDUSTRY – KAGZI INDUSTRY – 8th NOVEMBER

Established in Jaipur, 'Kagzi Industries' is an ISO 9001:2000 certified firm engaged in offering a quality range of Handmade Paper & Paper Products. They produce over 2000 types of paper, 80% of which is exported to international markets and about 20% is put on for domestic sales. Their uniqueness lies in the fact that they produce paper by using leftover cloth

Pieces that are obtained from garment industries across the country. This makes their products bio degradable and eco- friendly. Also, since paper made from shredded fabrics has longer interlinked fibers, these papers are comparatively stronger than the ones available in the market.

TEXTILE INDUSTRY -KAGZI INDUSTRY – 8th NOVEMBER

'Kagzi Industries' also had a textile industry set up under them. The manufacturing process mainly involved the coloring and dyeing of fabrics and then printing designs on them.This was done using both machines as well as manual labor. Large sheets of cloth were rolled and passed through a conveyor belt where workers manually printed designs on them. The use of ionic dyes also ensured that the colour didn't come off easily when the clothed were washed later on.

The stay came to an end on 9th November but it is important to note that this industrial visit was a great learning experience that was generously packed with knowledge and fun. We feel grateful to our professors and the chemistry department as a whole, for providing us with the opportunity to indulge in a quest that imparted into us, a plethora of practical knowledge,all while creating beautiful memories.

MATHERAN HILLS TREK
- FAR FROM THE MADDING CROWD

September 10, 2019

The Xavier's Association of Chemistry of St. Xavier's College, Mumbai, organised a trek for the BSc students of the college to Chanderi Caves in Badlapur. A group of twenty- five, under the cheerful supervision of Fr. Roy Pereira caught an early train from the CST railway station to Badlapur, followed by autorickshaw rides till the village at the base of the trail- a long, nevertheless, enjoyable journey.

The weather turned out perfect for the venture, cool if a trifle misty. While some stayed back midway through at a charming waterfall, the rest managed the four- hour climb, whose end revealed a stunning view, a wide eagle's eye reach of the tiny village and miles beyond, through a veil of mist and vibrant silence.

Back at the base, the whole team clicked the all- happy- faces group photograph that goes with every perfect experience. Indeed, the trek, a much-awaited event, proved to be a day's escape to an earthly paradise, a tranquil realm where the din of city life seemed not so many miles as worlds away…

A VISIT TO TARAPUR ATOMIC POWER STATION

Boisar. 8th August, 2019

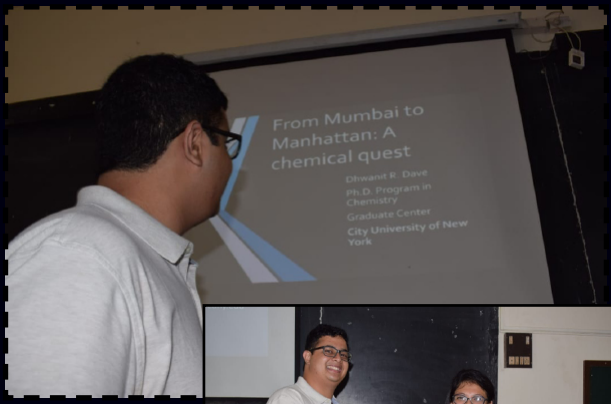
On 8th of August, 2019, the students of TYBSc went on a fun and informative trip to the Tarapur nuclear power plant and were accompanied by faculty members.
After a brief introduction, they visited the four Atomic Power Stations and were aided in understanding the machinery and the working principle involved in the complete process of power generation by fission, right from the preparations to the shutdown process. This visit was not only informative but helped in further corroborating students' interest in Chemistry.

TOM RIDDLE'S DIARY - WORKSHOP

STUDENT LECTURE SERIES

XAC successfully organised various fun and interactive talks throughout the year. These talks were conducted by the students , for the students.

Interaction session with Alumni



Spectroscopy Workshop

15th and 16th of November 2019

The spectroscopy workshop was a two-day workshop with informative sessions by Padmashree Dr. J.P. Mittal, Dr. S. Nigam, Dr. R.K. Vatsa .

XAVIER'S ASSOCIATION OF CHEMISTRY PRESENTS

ALCHEMIA 2019-2020

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evolving perceptions

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