Department of Chemistry
Krishnagar Government College

Rasaynika

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From the Principal's Desk

Dr. Sobhan Niyogi
Officer-in-Charge

Chemistry of the nature and our everyday life is an interesting matter which handcuffs us to explore the mystery behind it. I am happy to note that the Department of Chemistry, Krishnagar Government College is bringing out its first edition of magazine 'Rasaynika' for the academic session 2021-2022 and focus on it and makes it interesting and informative as well.

It is a pleasure to see that the department has offered itself as a forum which could aptly be used for resourceful mind of the students and transform them into empowered innovators and young researchers. I am sure; this will depict the aspirations and vision of the faculty, students and common people.

I would like to congratulate all the associated students and teachers for their unstinted efforts in bringing out this publication.

OFFICER-IN-CHARGE

HoD'S MESSAGE

It is a moment of pride to introduce everyone to the first edition of 'Rasaynika' – the annual chemistry magazine of Krishnagar Govt. College. Rasaynika holds a mirror to the ideology of the department and its students. It is a result of the hard labour of our extremely talented students and personalised mentorship of our teaching staff. It stirs the zeal of the learners and gives the students an opportunity to showcase their writing skills, creativity and knowledge.

The theme of the magazine is "Chemistry in everyday life". This edition aims to introduce our readers to the nature from the perspective of chemical reactions. The texts here in are very interesting and innovative as well. I express my sincere thanks to our Officer-in-Charge, Dr. Sobhan Niyogi for his support and encouragement. I express my gratitude to all students and teachers of Chemistry Department who contributed and helped us in bringing out this issue. I would also like to express my appreciation to my editorial team members who worked tirelessly for the completion of this task. I hope this edition of 'Rasaynika' will enable our students in acquiring more knowledge.

Debajyoti Saha

HOD

FROM EDITORIAL BOARD

The COVID-19 pandemic not only shifted our academic coursework towards online mode but also affected our social interaction and cultural life. Our department took an initiative by which we can easily restore our bonds and social interactions between the members and students.

It all started on a busy day, we were attending our classes and labs then our respected professors called us and encourage us to publish a magazine. That's how the journey began for 1st edition of magazine of our chemistry department. With smell of chemicals and surrounded by beakers, test tubes, burette-pipettes & other equipment we planned the whole outline about contents, layouts, Illustrations for our magazine. After finalising all works we initiated collecting articles throughout the chemistry department from students of each semester. After a long whatsapp chat, conference phone calls & many corrections we finally had some quality standard contents for our multistep product, magazine. There are also so many sleepless & tiring nights and correcting arguments behind the illustration and design. The sincerity and hard work of our editorial team members helped organising & publishing committee to bring out this magazine to its full shape.

While shaping this magazine we make our friendships as strong as titanium. As its our first experience we faced many difficulties but our professors guided us. Also during the editing period we gained lot of experiences and knowledge not only academical but also social like team management, interaction, true sense of graphic art & illustrations. We had a great time in forming the magazine.

At the end of this process the final shaped magazine which you are reading now carries the signs of victories of challenges which our team faced during its development and signifies that the time we spent on it is totally worth it. As you delightfully browse through this edition of "Rasaynika" based on the theme 'Chemistry in everyday life', we look forward to your valuable feedback.

Amiyo Kundu
Co-Editor
Bsc(H), Chemistry
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Editor-in-Chief
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Semester-VI

Suman Kundu
Co-Editor
Bsc(H), Chemistry
Semester-VI

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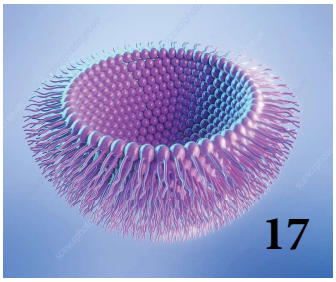

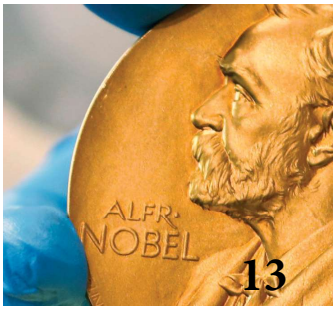

NATURE : THE FIRST CHEMIST

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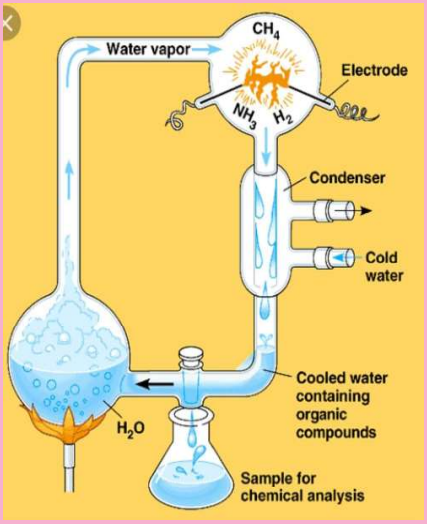
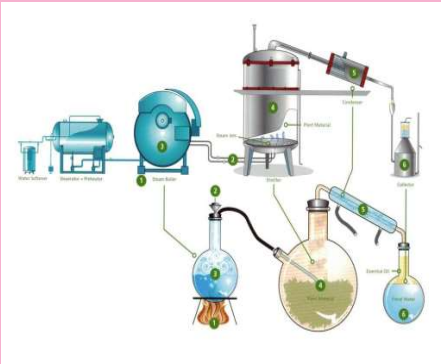
A chemist is a person who does research in the fields related with chemistry or studies chemistry. Tapputi Belatexallim is considered as the world's first recorded chemist, a perfume maker mentioned in cuneiform tablets dated around 1200 BC in Babylonian Mesopotamia. She used flowers, oil and calamus (sweet flag) along with cyperus, myrrh and salsam to make it. She added water or other solvents then distilled and filtered it several times. But here a big question arises that she made only perfume but who made the essential flowers, oil and other solvent, in fact the whole human civilization? The answer coming out is 'NATURE'.

Here nature plays the role of chemist. Now we are trying to get an idea of the origin of life about 3 billion years ago with the help of the organic molecules that are found in the world today. In 1953 Stanley L. Miller and Harold Urey experimentally proved that billions of years ago the simple compounds bounds each other and made a lot of organic compounds. In laboratory they artificially created an atmosphere of 3 billion years ago and in presence of water they taken methane ammonia hydrogen in 2:2:1 ratio at nearly 100 degree Celsius temperature and provide 75000v spark repeatedly over a week.

After they passed the hot product through a condenser and chemically analysed it by chromatographic and colorimetric methods. They found that about 15% of carbon of methane has been converted to amino acids which make up protein molecules. Formation of organic compounds is not possible in oxidising atmosphere because oxygen oxidises most of the intermediate product. Methane and ammonia got oxidised which acted as radiation belt and prevented the entry of most of the high energy UV radiation in the earth's atmosphere. These reactions are the heart of many biological processes in the universe. From photosynthesis of trees to the growth, adaptation, reproduction of human and other animals depends on it





Scientists have readily shown another model how life can evolved from cluster of organic molecule in fact for their development and use of molecules with structure specific interaction of high selectivity, for this contribution Donald J. Cram, Jean Maire Lehn and Charles J Pederson awarded Noble prize in 1987

So, we can conclude that elements are the basic substances that make up matter without any chemical reaction molecules won't interact and change its property, so nature is basically the reason for the existence of living beings. It carries on the circle of life. And without nature the universe will become stagnant .

PETRICHOR : Chemistry Behind Nature's Perfume

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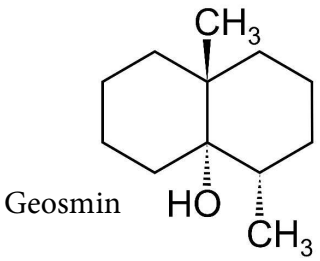
We all have memories of that distinctive odor when the first drop of summer rain hits the ground. As it turns out, it is not just gratification or anticipation that makes the smell of rain so appealing, but there's some chemistry involved too.
Originating from Greek 'petros' meaning 'stone' and 'ichor' meaning 'the fluid that flows in the veins of the Gods', petrichor is the characteristic earthy scent of first rain following a dry spell. It isn't really the water we smell, rather a mixture of fragrant chemical compounds. Oils secreted by plants during dry periods, chemical compounds secreted by bacteria, and splitting of atmospheric chemicals to form ozone contribute in order to produce this distinctive smell.

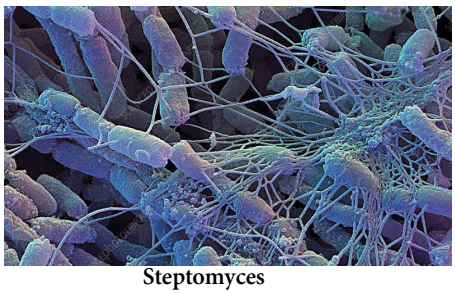
COMPOUND FROM BACTERIA

Coined by Australian scientists Isabel Joy Bear and Richard Thomas in 1964, petrichor is predominantly produced by a chemical compound, named Geosmin (originating from ancient GK word 'geo' meaning 'earth' and 'osme' meaning 'smell'). Geosmin, secreted by Streptomyces, a gram positive type of soil dwelling bacteria, Actinomycetes, is released from porous surfaces such as loose soil or rough concrete when raindrops fall on the ground.



Geosmin

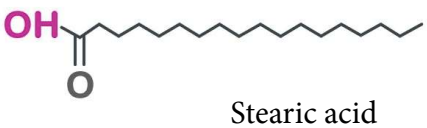
Raindrops, splattering, emit aerosols within which Geosmin dissolve and then it is carried by the wind to nearby areas. During prolonged period of dryness, the decomposition rate activity of the actinobacterias slows down.


Steptomyces

The activity rate speeds up just before the rain, when the air becomes more humid and the ground begins to moisten, producing more Geosmin. The human nose is extremely sensitive to Geosmin and can detect it at concentrations as low as 400 parts per trillion.

VOLATILE PLANT OILS

Geosmin is further accompanied with oils secreted by some plants during dry spell.



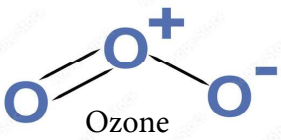
Stearic acid

These chemical compounds, called volatile plant oils, likely created by oxidation of fat, accumulate between rocks and soil and are released into air to add to the smell of petrichor. Stearic acid and Palmitic acid are two such volatile plants oils.

PRODUCTION OF OZONE

Has the smell of thunderstorm ever hit you differently?

It's as if you can smell it coming. That's because of Ozone. Thunderstorms pilot in creating the clean and sharp smell of Ozone. When lightning strikes, diatomic molecules of oxygen and nitrogen split and rearrange to create nitric oxide(NO) and ozone(O3). Stratospheric Ozone is then carried down from high altitudes by thunderstorms, sending off the'pre-rain' smell.



Ozone

Our penchant for the smell of rain is such that perfumers have made it possible to bottle it up for us. Although, better than the bottled-up version is the real McCoy – stepping out and inhaling the argillaceous(as described by Bear and Thomas) scent of freshly fallen rain.

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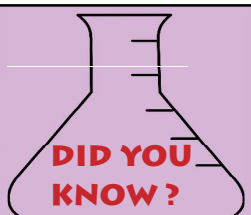

Geosmin has been found to be responsible for an earthy taint in different foods , like- fresh water fishes(Catfish, Carp, Trout), vegetables (Spinach and Beetroot), mushroom and wine.

Future of Mars : Role of Chemistry

"Somewhere, something incredible is waiting to be known."
- Carl Sagan

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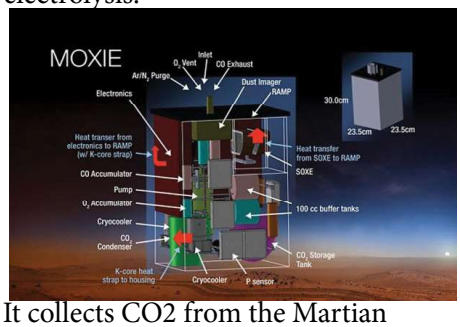
Chemistry and space travel have always been inextricably linked. The first manned mission to the moon (1969, Apollo 11), in fact, was powered by combustion between hydrogen and oxygen .

Humans are continuing their quest to explore outerspace . Recently the U.S. government is funding NASA's Journey to Mars program, which aims to send humans to Mars in the 2030s. SpaceX founder Elon Musk also recently announced plans to develop spacecraft that could transport people to and from the Red Planet .

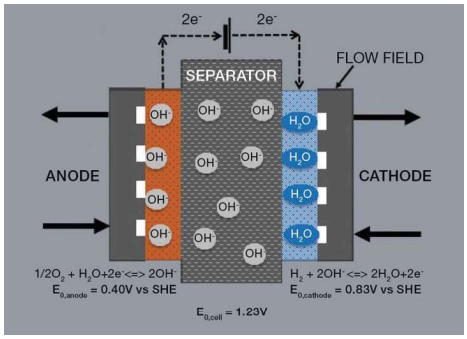
Scientists are confronting some of big challenges of getting a spacecraft to mars, and keeping it's human passenger safe and healthy. Materials and Chemistry are key to addressing these challenges.

MOXIE (Mars oxyzen In-situ resource utilization experiments) an instrument used in perseverance rover (latest 2020 rover of NASA)which is developed by NASA and MIT to produce O_2 on mars via solid oxide electrolysis.



It collects CO2 from the Martian atmosphere, (contains 96% of carbon dioxide) then electrochemically splits the CO2 molecules into O2 and CO. The O2 is then analyzed for purity before being vented back out to the Mars atmosphere along with the CO and other exhaust products.

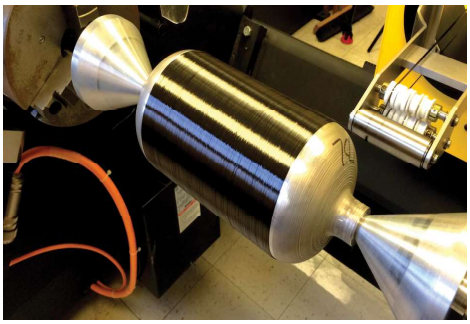
Simulated Martian regolithic brine (SMRB) P. Gayen , S.Sankarasubramanian and V.K. Ramani (Department of Energy, Chemical Engineering, Washington University in St. Louis) demonstrated an approach { Nov 30, 2020 117 (50) 31685-31689}
to produce ultrapure H_2 and O_2 from liquid-phase Martian regolithic brine at ~−36 °C. Utilizing a $Pb_2Ru_2O_7$−δ pyrochlore O2-evolution electrocatalyst and a Pt/C H_2-evolution electrocatalyst .



They demonstrate a brine electrolyzer with >25× the O2 production rate of MOXIE for the same input power under Martian terrestrial conditions with no additional purification requirement for CO removal. The H2 produced in tandem can serve as a clean-burning fuel with a superior calorific value to CO.

Carbon nanotubes (CNTs) A unique cylindrical nanostructures connected with sp2 C–C bonding, have remarkable nanoscale properties- Specific strength 150X that of conventional carbon fibers, 100X aluminum. Elongation 10X that of conventional carbon fibers .

Electrical and thermal conductivities ~10X that of high conductivity carbon fibers.



Cosmic radiation that spacecraft are subjected to throughout their journey. Single-atom-thick CNTs potential can shield field-effect transistors from the cosmic radiation that can damage or even destroy on-board electronics, causing data glitches, break down of vital systems , and ultimately putting the mission and safety of the crew at risk .The improved double-shielded carbon nanotube field-effect transistors could lead to the development of next-generation electronics for space exploration, which are more resistant to radiation and therefore more likely to help keep equipment, electronics . one of the vital significance of CNTs is it could able reduce the mass as much as 30% of launch vehicle and the cost of escaping earth's gravity .

In Space Manufacturing The scope of 3d printing is limited only by the imagination of the designer. From the metals as Titanium, stainless steel to thermoplastic and carbon fibre, the gamut materials can be developed for construction of 3d printing shelter. For colonising mars we need inexpensive automated in-situ construction.

These will be constructed out of a mixture of basalt fibre (found in mars) and renewable bio-plastics (PLA) which would be processed from plants grown on Mars .

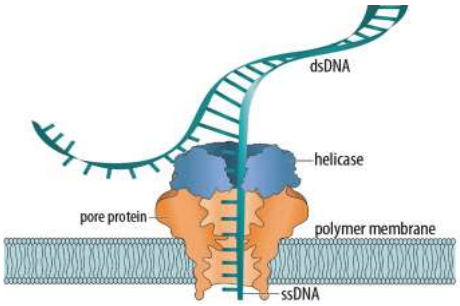
'Unlike the brick and mortar houses on earth, shelter on Mars would need to able resist the Martian temperature of -60°C and atmospheric pressure which is 1% less than Earth . The combination of Basalt fibre and PLA was proven by NASA to be 2-3 times stronger than concrete in compression. PLA acts as effective shield for ionising cosmic radiation due to its low atomic weight and also have lower coefficient of thermal expansion . The emission from PLA formation are benign - unlike petrochemical plastic .

Nanotechnology and ISRU

Nanomaterial catalysts or catalyst substrates increases active area in reactors. It Improves or helps in self-healing coatings and electronics for excavation and construction equipment dealing with abrasive materials.
Nanosensors used for prospecting, hazard detection, and health management of our chemistry plant .
Insulation material for hot (reactors) and cold (cryotanks) components in the not-quite-a-vacuum environment on Mars .
Nanomaterial as a sorption materials used to increase mass adsorbed to mass adsorbent ratio for Mars atmosphere acquisition or during gas separation.

Nanopore Gene Sequencing

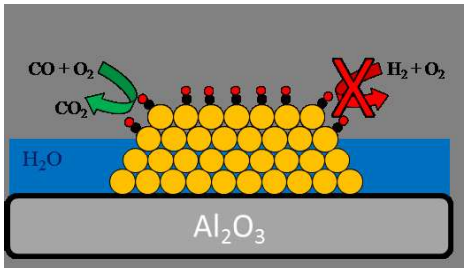
Life as we know it uses nucleic acids as the basis for heredity and evolution. Life beyond Earth might utilize identical or similar informational polymers due to the widespread synthesis of common building blocks, common physicochemical scenarios for life's origin, or common ancestry via meteoritic exchange, most plausible for Earth and Mars. Beyond the search for life.



Sequencing is of high relevance for supporting human health on Earth and in space, from detecting infectious diseases, to monitoring of biologically-based life support systems.

Gold Nanoparticle Catalysts Enhance CO Oxidation

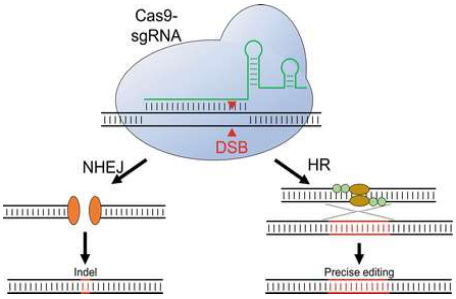
Filtering respirators on ISS(international space station) can remove aerosols, smoke particulates, acid and organic vapors but not CO. Conventional oxidation catalysts are not effective in cold, wet conditions.



Nano-gold catalysts are capable of oxidizing CO at rates >10 that of CO generated in a worst case fire emergency on ISS Certified for use on ISS in 2012

Insitu Biochemical space factory

In nature, strains of Yarrowia lipolytica has tend to grow on cheese, and it has also been found growing on oil spills.The yeast also likes feeding on urea, a compound in urine. Urine from astronauts is already collected in spacecraft like the International Space Station, where it's filtered and turned into drinking water. The unused parts, like urea, could be fed to yeast .



Generally the yeast produces unessential fatty acids to humans. Using gene-editing tools, including CRISPR-Cas 9 - allows scientists to remove and replace genetic materials from DNA — Mark Blenner, assistant professor of chemical and biomolecular engineering at Clemson University, and his team added four genes to the yeast to get it to produce omega-3 fatty acids, which are necessary for heart, eye, and brain health.

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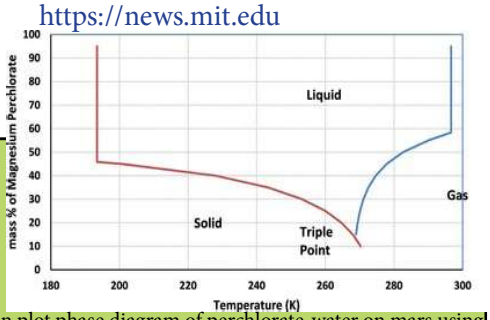
Is there liquid water on mars ?

The normal freezing point and boiling point of liquid water on Mars are 273 and 268 K . Low Martian atmospheric pressure ~600pa depresses the boiling point of pure water but highly concentrated perchlorate brines the boiling point is elevated according the *Van't Hoff equation* $\Delta T_b = i K_b m$. For high concentration (>14%) of salts liquid water can exist in a certain range of temperature . For 57.81% perchlorate water can exist as liquid between 240.9 –275.32 K .



We can plot phase diagram of perchlorate-water on mars using *Clausius–Clapeyron equation*

Scientists Have Found Plastic-Eating Bacteria

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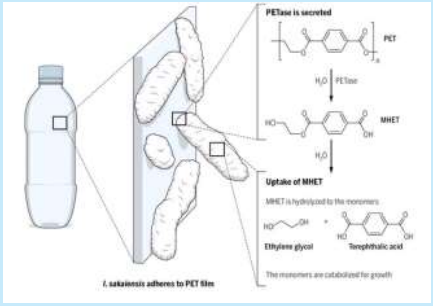
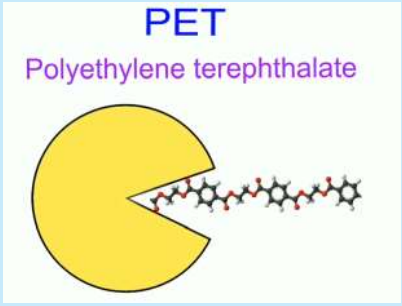
Everything has a beginning and an end. An apple can be thrown into the dirt can be consumed by warm , which then excretes nutrious waste for new plants to grow on while an apple can be recycled into new material within two months but a plastic bottle can take more than 400 years to decompose.Plastic chokes the normal cycles of our ecosystem.

In 2015 ,it was estimated that more than 5 trillion plastic pieces weighing over 268,940 tons were afloa at sea. Most critically the plastic in the ocean endangeres marine life.In order to stop plastic waste accumulating ,there must be a change.





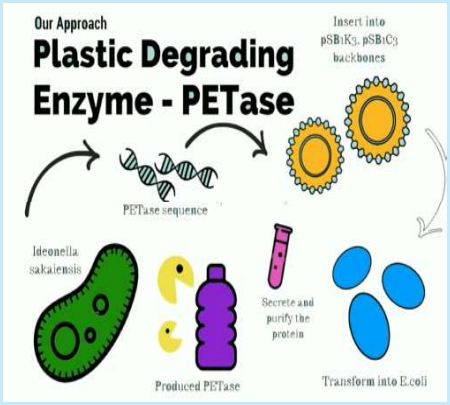
IN MARCH 2016 ,a JAPANESE RESEARCH TEAM FOUND A BACTERIA THAT COULD COMPLETELY DEGRADE POLYETHYLENE TERE-PHTHALATE (PET) WITHIN 6 WEEKS

HOW IT WORKS ACTUALLY ?

Scientists from Japan tested different bacteria from a bottle recycling plant and found that Ideonella sakaiensis 201-F6 could digest the plastic used to make single use drinks bottle.

The PET used in drinks bottles has a semi crystalline structure which means the plastic molecules are tightly packed and difficult for the enzyme to get to. This bacteria damaged PET film extensively and almost completely degraded it after 6 weeks at 30°c .When sequencing the genome of this bacterium to find the main contributes to the PET hydrolytic activity ,they found an enzyme (a type of protein that can speed up chemical reactions) known as PETase. This enzyme generates an intermediate :MHET which is taken back up by the cell and hydrolyzed by a second enzyme .

This second MHET hydrolase converts MHET into two monomers : Ethylene glycol and terephthalic acid .The organisms then uses these monomers to facilitate it's growth. The two hydrolytic enzymes PETase and MHETase catalyze the degradation of the PET fibers to form the starting monomers. The monomers are then used as a food(carbon) source by the bacterium



In a ground breaking paper published in a open source journal of American society for Microbiology Prof.Jay Mellies and students at Reed reported colonies of bacteria that consumes PET and convert it into a source of energy. Bacteria can be self sustaining on plastic and can also be modified to produce less harmful waste .So there has to be more active participation in properly recycling plastic in order for less plastic to be washed to sea .

Ideonella sakaiensis	
Scientific classification	
Domain:	Bacteria
Phylum:	Pseudomonadota
Class:	Betaproteobacteria
Order:	Burkholderiales
Family:	Comamonadaceae
Genus:	*Ideonella*
Species:	*I. sakaiensis*
Binomial name	
Ideonella sakaiensis Yoshida et al. 2016[1]	

Prof. Jay Mellies and students at Reed College are growing colonies of bacteria that break down the notoriously resilient polyethylene terephthalate (PET) plastic. PHOTO BY LAUREN LABARRE

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Chemistry of Dreams

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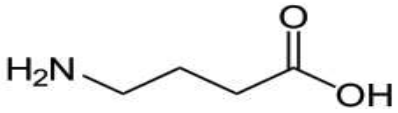
Human body needs sleep under all circumstances, during sleep all mammals dream. Even People who become blind after birth can see dreams.Those who are blind by birth have dreams equally vivid involving their other senses of sound, smell, touch and emotion. There are certain chemicals which are associated with dreams. To study the chemistry of the brain during dreams is a challenging job but still certain theories have been put forth to explain the process of dreams. Dreams are sort of sensations or mysterious mental images that occur involuntarily in the mind during sleep. The study of dreams is called Oneirology. During dreams activity of the brain is very high but the body is in the state of temporary paralysis. About 20 percent of our sleep time can have dreams,in most cases awakenings from Rapid eye movement (REM) sleep resulted in recall of a dream, as compared with awakenings from Nonhrapid eye movement (NREM) sleep.

When we dream, we have the perfect chemical canvas for intense visions' ~Alice Robb (US journalist)

The dreams are considered to be connected to day time thoughts. Most dreams are lost to recall after a few minutes or even within seconds after the end of the REM period. Studies performed in certain animals revealed that REM deprivation may lead to hypersexual and hyper aggressiveness, which has been interpreted as supporting the view that dreaming is linked to basic drives and pleasure-seeking. Studies have shown association of dreams with REM, the brain is switched from sleep to wakefulness and back again by two opposed brain circuits, one produces transmitter chemicals that promote sleep, and the other chemicals that inhibit it.
Dreams involve a low-grade type of mental activity, using brain mechanisms much like those used by the drunk and drugged. It is for this reason we forget dreams in the morning.

DID ANYBODY THINK ABOUT THE CHEMISTRY OF DREAMS?

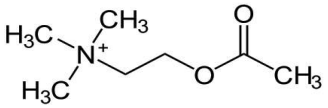
How different kinds of chemicals / hormones affect dreams?
All dreams, nightmares and night terrors are all caused by different chemicals being released while you are sleeping. The way you fall asleep is through the activation of the neurotransmitter gamma-aminobutyric acid (GABA).



Sleeping is considered as a default state in us but you can't sleep whenever you require. There are two reasons behind this :
(I) your body will not support when your brain is active;
(II) secretion of Acetylcholine and other dream chemicals in our body which will make us awake throughout the day.

ACETYLCHOLINE :

Acetylcholine is released in high levels as a result of wakefulness and alertness. But it is also found in high levels during REM sleep. Its lowest levels have been found during delta sleep.



Other dream chemicals which make us awake during day time are :

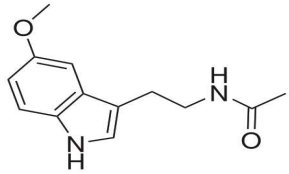
- Dopamine
- Glutamate
- Aspartate
- Histamine

Serotonin

At the end of the day Acetylcholine and other chemicals make us tired and from this time to until before you are going to sleep there is rise in levels of chemical called Melatonin.

MELATONIN :

Melatonin is a natural hormone made by your body's pineal gland. Pineal gland is located just above the middle of the brain. Melatonin levels in the blood stay elevated for about 12 hours - all through the night - before the light of a new day when they fall back to low daytime levels by about 9 am. Daytime levels of melatonin are barely detectable.

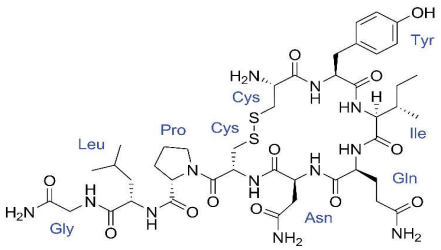


Melatonin is sometimes called "the hormone of the night."
Melatonin might help shift workers on irregular shifts who need to adjust their schedules. When taken in low doses at the appropriate time, melatonin can help advance or delay the sleep-wake cycle. The effect can last for six hours. Some researchers have suggested that at certain doses, melatonin increases the number of dreams a person remembers by artificially prolonging the amount of time spent in REM sleep. Taking melatonin may also increase a person's chances of experiencing a lucid dream for a similar reason, by elevating them to a more self-aware state while they are still in REM sleep.

OXYTOCIN

Oxytocin is a mammalian neurohypophysial hormone that acts primarily as a neuromodulator in the brain. It is once released in the body, affecting sleep processes. Levels of oxytocin peak after 5 hours of sleOxytocin).

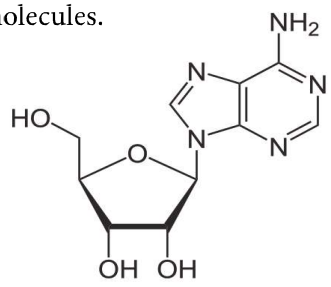
levels are also correlated with stages of light sleep (State II of sleeping)



Dreams from State II are just as filled with social interactions as dreams from REM sleep.
According to scientists oxytocin affects our social emotions in real life, and the same thing will continue in sleep.

ADENOSINE

Adenosine is a purine nucleoside comprising a molecule of adenine attached to a ribose sugar molecule (ribofuranose) moiety via a β-N9-glycosidic bond.
Adenosine appears to accumulate in your bloodstream when you're awake and eventually makes you drowsy. Inside your brain, your adenosine levels exert a major influence on the regulation of non-REM sleep. This regulating effect occurs when an enzyme called adenosine deaminase breaks down, or metabolizes, adenosine molecules.



The rate of this metabolism has an effect on the intensity and duration of sleep when slow brain waves are present. Metabolism also reduces your brain's adenosine supplies, and your adenosine levels drop as sleep continues.

Brain during sleep:

Sleep-inducing waves activate the visual-processing parts of the brain, and make dreams visible. The first stream of brainstem waves usually begins about 90 minutes after the onset of sleep, and the fourth or last about 30 minutes before waking up. During REM periods the brain is even more active than it is while awake, but because the muscles are paralyzed, the body lies quietly in bed. Our brain experiences four types of electrical brain waves: "delta," "theta," "alpha," and "beta". Together they form the electroencephalography (EEG).
There are certain studies which show that dreams are generated in, or transmitted through a particular area of the brain, which is associated with visual processing, emotion and visual memories. The portion of the brain that is related to Long-term memory is not active while sleeping. For the same reason, dreams quickly fade out when we wake up. Normally only the fragments of a dream left in Short-term memory have a possibility to be converted after we wake up.

Study using MRI techniques revealed that vivid, bizarre and emotionally intense dreams (the dreams that people usually remember) are linked to parts of the amygdala and hippocampus. While the amygdala plays a primary role in the processing and memory of emotional reactions, the hippocampus has been implicated in important memory functions, such as the consolidation of information from short-term to long-term memory.

Theories of dreaming

Different theories have been proposed by scientists.
According to Hartmann the purpose of dreaming is to provide the dreamer with an opportunity to deal with their dominant emotional concern. Kramer and Cartwright et al, Rather closely related functions for dreaming that incorporate problem-solving and affect regulation. Different theories have been proposed by scientists.
According to Hartmann the purpose of dreaming is to provide the dreamer with an opportunity to deal with their dominant emotional concern. Kramer and Cartwright et al, Rather closely related functions for dreaming that incorporate problem-solving and affect regulation.

Conclusion:

Dreams mainly occur only during REM sleep, but some dreams occur during non-REM sleep phases also. It's possible there may not be a single moment of our sleep when we are actually dreamless.REM dreams are characterized by bizarre plots, but non-REM dreams are repetitive and thought-like, with little imagery. During dreams only part of the brain wakes up and it seems to be even more active than it is during waking. Particularly the emotional region of the brain is highly active during dreaming.While dreaming Part of brain responsible for descions or violations becomes deactivated, however there are other areas of the brain that deal with rationality and remain active, so we don't lose all rational thinking when we dream.

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The "Accidental" Cure - Platinum based Treatment for Cancer : CISPLATIN

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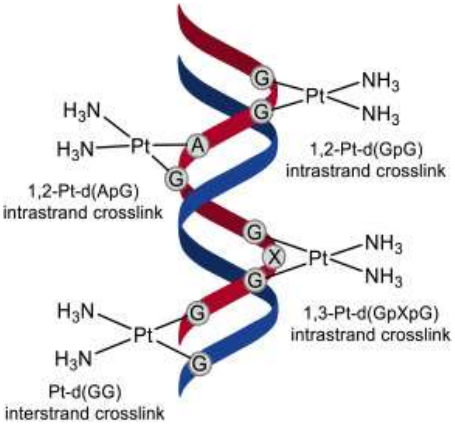
Pathway to discovery

In 1965, Barnett Rosenberg, Ph.D., was following a hunch. Dr. Rosenberg, a biophysics researcher at Michigan State University (MSU), had noticed that microscopic images of dividing cells resembled the pattern of iron shavings subjected to a magnetic field. He wondered whether this meant that an electrical field could also affect cell division, so he devised an experiment to find out. platinum was thought to have no biological activity, Dr. Rosenberg and his colleagues put platinum electrodes into a solution containing the common laboratory bacteria E. coli and turned on the power. As soon as the current started, the bacterial cells stopped dividing, although they kept growing to up to 300 times their normal length. When the power was cut off, the bacterial cells began dividing again. It appeared that the electrical field was controlling cell division. Dr. Rosenberg later called this experiment the "accidental discovery that led eventually to cisplatin."

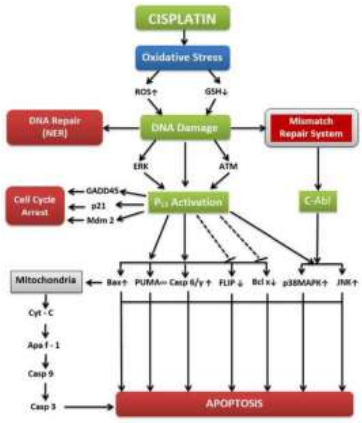


How does Cisplatin works :

Cancers form when some cells within the body multiply uncontrollably and abnormally. These cells spread, destroying nearby tissues. Cisplatin works by stopping the cancer cells from multiplying. It does this by binding together the strands of the cells' genetic material, DNA. DNA is needed for growth and multiplication of cells. Cisplatin damages the DNA inside the cancer cells and so prevents them from multiplying.

Molecular mechanism

Cisplatin binds to the N7 reactive centre on purine residues and as such can cause deoxyribonucleic acid (DNA) damage in cancer cells, blocking cell division and resulting in apoptotic cell death. The 1,2-intrastrand cross-links of purine bases with cisplatin are the most notable among the changes in DNA. These include the 1,2-intrastrand d(GpG) adducts 1,2-intrastrand d(ApG) adducts representing about 90% and 10% of adducts, respectively. 1,3-intrastrand d(GpXpG) adducts and other adducts such as inter-strand crosslinks and non-functional adducts have been reported to contribute to cisplatin's toxicity.



Hence, published research from many laboratories has implicated DNA as a critical target for cisplatin cytotoxicity, the most revealing evidence being the hypersensitivity to cisplatin by both prokaryotic and eukaryotic cells deficient in DNA repair. As illustrated in the right sided diagram, several molecular mechanisms leading to apoptosis have been implicated in cisplatin treatment of human cancers.

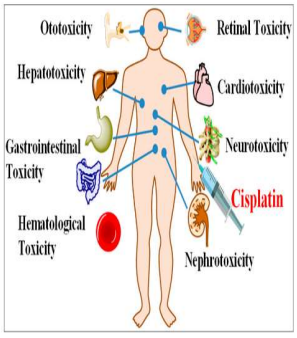
Combination Chemotherapy with Nanoparticles

Combination of cisplatin and a protein phosphatase 2A inhibitor (4-(3-carboxy-7-oxa-bicyclo[2.2.1] heptane-2-carbonyl)piperazine-1-carboxylic acid tert-butyl ester) using PEG-b-PLGA micelles has facilitated to overcome tumor resistance to cisplatin. This combination has shown to prolong drug residence in the blood while minimizing the side effects. In vitro studies with mesoporous silica nanoparticles loaded with cisplatin and phthalocyanine has been evaluated for its potential treatment efficacy in HeLa cells as Nano carriers. The confocal microscopy experiments presented that the silica nanomaterials can be effectively internalized in HeLa cells. The in vitro and in vivo studies with oligonucleotides assembled Au nanorod for combination remote-controlled drug delivery of doxorubicin and cisplatin have reported significant cell toxicity and controlled solid tumor growth, respectively. The design included a complementary DNA (cDNA) with the 5' amine functional group assisted to chain cisplatin-Dox with amide bond.

Toxicological effects :

Cisplatin treatment has been linked to various toxic side effects:

- Nausea
- Nephrotoxicity
- Cardiotoxicity
- Hepatotoxicity
- Neurotoxicity



Combination Therapy of Cisplatin with Other Cancer Drugs :

Drug resistance has been observed in many patients who have relapsed from cisplatin treatment due to its cellular uptake and efflux of cisplatin, increased biotransformation and detoxification in the liver, and increase in DNA repair and anti-apoptotic mechanisms. To overcome drug resistance, cisplatin has been commonly used in combination with some other drugs in treating a wide variety of cancers.

- Cisplatin and Paclitaxel
- Cisplatin and Tegafur-Uracil (UFT)
- Cisplatin and Doxorubicin
- Cisplatin and Gemcitabine

Conclusion :

In conclusion researchers have often stressed the importance of Cisplatin therapy as the basis for the treatment of different cancers. While most cancer cells are highly responsive to platinum chemotherapy, evidence has shown that many patients often relapse due to cisplatin resistance. The efficacy of cisplatin in overcoming resistance and efficient treatment of broader types of cancers is therefore achieved through combination of cisplatin with certain agents in the treatment of ovarian, lung, carcinoma, gastric, biliary, melanoma, breast, prostate, pancreatic, colon, cervical as well as urothelial bladder cancer.

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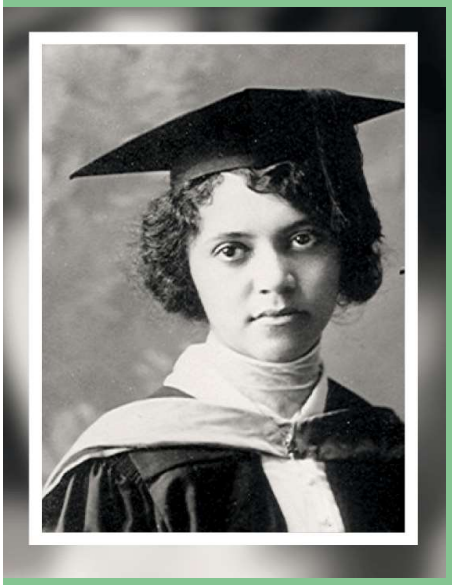
WOMEN IN CHEMISTRY

- Anushka Basak
BSc Hons. Semester-II

Alice Augusta Ball (1892-1916) :

"She developed The Ball Method which was first truly effective treatment for Leprosy"



Alice Ball was an African American chemist born on July 24, 1892 in Seattle, Washington. Ball was the centre child with two older brothers and a younger sister. She belongs to upper middle-class family. She excelled at Seattle high school, graduated in 1910, and went onto the University of Washington, earning a bachelor's degree in pharmaceutical chemistry in 1912. Alongside her pharmacy instructor, Williams Dehn, she published a 10-page article, "Benzoylations in Ether Solution", in the Journal of the American Chemical Society. She completed her master's degree in chemistry from College of Hawaii (now the University of Hawaii). Her master's thesis involved studying the chemical properties of the Kava plant species, latter she studied chaulmoogra oil and its chemical properties. Ball created the first injectable leprosy treatment using oil from the chaulmoogra, which was only a moderately successful topical agent employed in Chinese and Indian medicine. She isolated the oil into carboxylic acid components of various molecular weights allowing her to manipulate the oil into a water-soluble injectable type. She was also the first African American "research chemist and instructor" in the College of Hawaii's chemistry department. Her scientific rigor resulted into a highly successful method to alleviate leprosy symptoms, later called the "Ball Method," that was used on thousands of infected people for over thirty years until sulfone drugs were introduced.

Death and Discovery Credit Stolen: Tragically, Ball died on New Year's Eve,1916, at the young age of 24 because of inhaling chlorine gas during a lab teaching accident. Dr. Arthur Dean, continued her without giving ball all the credit and even called her own discovery, the "Dean Method." In 1922, six years after her death, Dr. Harry T. Hollmann tried to correct this injustice. He published a paper in 1922 giving credit to Ball, calling the injectable variety of the oil the "Ball method". In 2000, the University of Hawaii-Manoa placed a bronze plate before a chaulmoogra on campus to honour Ball's life and her important discovery. Former functionary (Lieutenant Governor of Hawaii), Mazie Hirono, also declared Feb 29 as "Alice Ball Day."

COVAXIN AS A BOON

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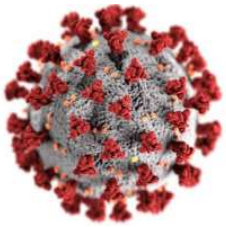
WHAT IS COVID-19?

COVID-19 is a diasesase caused by Corona virus called SARS-CoV-2. You can be affected by COVID-19 through contact with another person who has the virus. It is Predominantly a respiratory illness that can affect other organs. People may experience wide range of symptoms from mild to severe category. Symptoms may appear 2 to 14 days after exposure to the virus. Symptoms like fever or chills; cough; shortness of breath; fatigue; muscle or body aches; headache; loss of taste or smell of recent onset; sore throat; congestion or runny nose; nausea or Vomiting; diarrhea are also reported.



WHAT IS COVAXIN?

Covaxin (it's codename is BBV152) is an whole inactivated virus-based COVID-19 .It is developed by Bharat Biotech in collaboration with the Indian Council of Medical Research – National Institute of Virology.one should not get Covaxin if that person had a severe allergic reaction to any ingredients of the vaccine or a previous dose of this vaccine or you are currently having an acute infection or fever.Side effects that have been reported are Injectionsite pain/ Swelling / Redness/ Itching ; Headache;Fever; Malaise / bodyache; Nausea;Vomiting;Rashes.

WHAT ARE THE INGREDIENTS IN THE COVAXIN?

Covaxin includes following ingredients: Covaxin contains 6µg of whole-virion inactivated SARSCoV-2 Antigen.Other inactive ingredients such as aluminum hydroxide gel (250 µg), TLR 7 /8 agonist (imidazoquinolinone) 15 µg, 2-phenoxyethanol 2.5 mg, and phosphate buffer saline up to 0.5 ml are also present.Thus Covaxin has been developed by using inactivated/ killed virus along with the above mentioned chemicals.

EFFECTIVENESS:

Vaccines are generally considered effective if the estimate is ≥50% with a >30% lower limit of the 95% confidence interval. Effectiveness of vaccine is generally expected to slowly decrease over time.

•EFFICACY:

The permission for the sale or distribution of Covaxin is owned by The Central Licensing Authority emergency use in public interest. In Phase 1 and Phase 2 clinical trials, about 680 (300 in Phase 1, and 380 in Phase 2) were administered with 2-doses of COVAXIN. A Phase 3 clinical trial with 25,798 participants found that the vaccine is 64% (95% CI, 29–82%) effective against asymptomatic cases, 78% (65–86%) effective against symptomatic disease, 93% (57–100%) effective against severe disease, and 65% (33–83%) effective against the Delta variant.

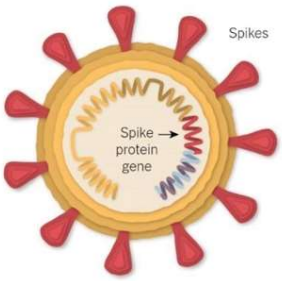
HOW THE VACCINE WORKS?

Covaxin teaches the immune system to make antibodies against the SARS-CoV-2 coronavirus. Now the antibodies attach to viral proteins, such as the so-called spike proteins that stud its surface. After production of virus they doused them with a chemical called beta-propiolactone. The compound is used to disable the coronaviruses by bonding to their genes. The inactivated coronaviruses could no longer replicate. But their proteins, including spike, remained intact.The researchers then drew off the inactivated viruses and mixed them with a tiny amount of an aluminum-based compound called an adjuvant. Adjuvants stimulate the immune system to boost its response to a vaccine.Inactivated viruses have been used for over a century. Jonas Salk used them to create his polio vaccine in the 1950s, and they're the bases for vaccines against other diseases including rabies and hepatitis A.

When viruses are inside the body, some of the inactivated viruses are swallowed up by a type of immune cell called an antigen-presenting cell. The antigen-presenting cell tears the coronavirus apart and displays some of its fragments on its surface. A so-called helper T cell may detect the fragment. If the fragment fits into one of its surface proteins, the T cell becomes activated and can help recruit other immune cells to respond to the vaccine.

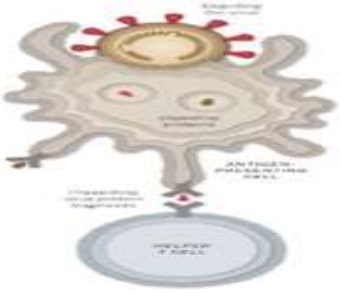
B cell is also detected.It may encounter the inactivated coronavirus. When a B cell locks on, it can pull part or all of the virus inside and present coronavirus fragments on its surface.A helper T cell activated against the coronavirus can latch onto the same fragments .In this time the B cell gets activated . It prolifer-

ates and pours out antibodies that have the same shape as their surface proteins.
After vaccination the immune system can respond to an infection of live coronaviruses.Now B cells produce antibodies that stick to the invaders. Antibodies which targets the spike protein can prevent the virus from entering cells.
Covaxin is being tested in two doses, given four weeks apart.If Bharat Biotech's Phase 3 clinical trial demonstrates that Covaxin can protect people against Covid-19, researchers will have to observe it for months to see how long that protection lasts. There is a possibility that the level of antibodies will drop, but at a same time immune system also have special cells called memory B cells that might retain information about the coronavirus Vaccine Made From Coronavirus

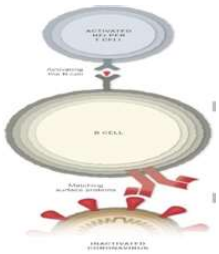


VACCINE MADE FROM CORONA VIRUS

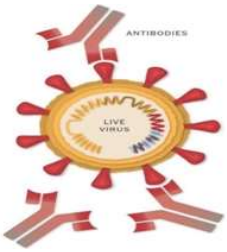
KILLING THE VIRUS



PROMPTING AN IMMUNE RESPONSE



MAKING ANTIBODIES



STOPPING THE VIRUS

REMEMBERING THE VIRUS

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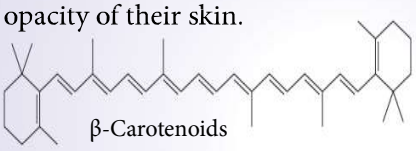
3) https://www.nytimes.com/interactive/2021/health/bharat-biotech-covid-19-vaccine.html#:~:text=Covaxin%20works%20by%20teaching%20the,proteins%20that%20stud%20its%20s urface.&text=To%20create%20Covaxin%2C%20Bharat%20Biotech,India's%20National%20Institute%20o f%20Virology

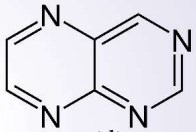
COLOURFUL CHEMISTRY

Chemistry play a huge role in defence mechanism or tactic that organisms use to disguise their appearance, usually to blend in with their surroundings called **Camouflage,** also called **cryptic coloration** .These is due to presence of biochromes and microscopic physical structures .

Biochromes : Contain true pigment,Conjugated Molecules such as carotenoids, pteridines . They Absorb certain wavelengths of light and reflect others to change colour.Many species of octopus have a variety of biochromes that allow them to change the color, pattern, and opacity of their skin.



β-Carotenoids



pteridines

Microscopic physical structures : they act like prisms, reflecting and scattering light to produce a color that is different from their skin. The polar bear, for instance, has black skin. Its translucent fur reflects the sunlight and snow of its habitat, making the bear appear white.

Camouflage can change with the environment. Many animals, such as the arctic fox, change their camouflage with the seasons. Octopuses camouflage themselves in response to a threat. Other species, such as nudibranchs—brightly colored, soft-bodied ocean "slugs"—can change their skin coloration by changing their diet.

Honey : A sweet Chemistry

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Honey bees are chemists. Using enzymes and dehydration, these scientists of the natural world are able to change the sugar in nectar into a supersaturated power food.

ORIGIN OF HONEY

Honey, sweet, viscous liquid food, dark golden in colour, produced in the honey sacs of various bees from the nectar of flowers. Flavour and colour are determined by the flowers from which the nectar is gathered.

Honey is as old as written history, dating back to 2100 B.C. where it was mentioned in Sumerian and Babylonian cuneiform writings, the Hittite code, and the sacred writings of India and Egypt

COMPOSITION OF HONEY

It's no small feat-honey is composed of at least 181 components. Its unique taste is a result of complex chemical processes, which is why sugary syrup substitutes just can't compare.

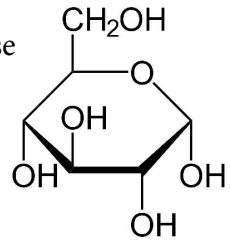
Honey is composed of sugar (about 76%), water (18%) and other ingredients that make up about 6%. Sugar gives the sweetness of honey, water follows the liquid, and components that are found in small quantities determine the differences between various types of honey. These differences are the colour, aroma and taste.

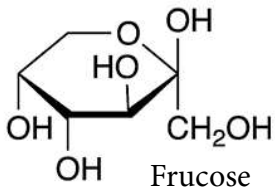
Sugar in honey is not a single species, but consists of three kinds of sugar.

These are the fruit sugar (fructose) which has among the highest (41%), grape sugar (glucose) which has about 34% and ordinary sugar (sucrose) which is between 1 and 2%.

Honey contains trace amounts of the B vitamins riboflavin, niacin, folic acid, pantothenic acid and vitamin B6. It also contains ascorbic acid (vitamin C), and the minerals calcium, iron, zinc, potassium, phosphorous, magnesium, selenium, chromium and manganese. Honey also contains organic acids such as acetic, butanoic, formic, citric, succinic, lactic, malic, pyroglutamic and gluconic acids, and a number of aromatic acids. The main acid present is gluconic acid, formed in the breakdown of glucose by glucose oxidase. The honey is acidic and average pH is 3.9

Glucose





Frucose

Minerals	Amount (mg/100 g)	Vitamins	Amount (mg/100 g)
Sodium (Na)	1.6 – 17	Thiamine (B_1)	0.00 – 0.01
Calcium (Ca)	3 – 31	Riboflavin (B_2)	0.01 – 0.02
Potassium (K)	40 – 3500	Niacin (B_3)	0.10 – 0.20
Magnesium (Mg)	0.7 – 13	Pantothenic acid (B_5)	0.02 – 0.11
Phosphorus (P)	2 – 15	Pyridoxine (B_6)	0.01 – 0.32
Selenium (Se)	0.002 – 0.01	Folic acid (B_9)	0.002 – 0.01
Copper (Cu)[a]	0.02 – 0.6	Ascorbic acid (C)	2.2 – 2.5
Iron (Fe)[a]	0.03 – 4	Phyllochinon (K)	0.025
Manganese (Mn)[a]	0.02 – 2		
Chromium (Cr)[a]	0.01 – 0.3		
Zinc (Zn)[a]	0.05 – 2		

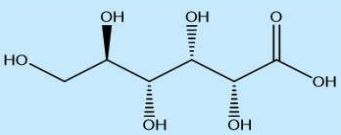
*Adapted from [2,3] [a]Heavy metals.

DID YOU KNOW ?

Why doesn't honey spoil?

Modern archeologists, excavating ancient Egyptian tombs, have often found something unexpected amongst the tombs' artifacts: pots of honey, thousands of years old, and yet still preserved. Since honey has been dehydrated by the bees, it pulls in water through osmosis.

This means it can also dehydrate bacteria, and keeps from spoiling. The central acid in honey is gluconic acid. This and additional acids give it a low pH (between 3-4). With small traces of hydrogen peroxide as well, honey is too hostile an environment for bacteria to grow.



gluconic acid

Upside and Downside

Honey is primarily composed of sugar, provides small amounts of several vitamins and minerals, and is rich in health-promoting plant compounds. Honey contains a number of antioxidants, including phenolic acids and flavonoids. Honey may offer some protective effects related to blood sugar management, but it should still be consumed in moderation, especially by people with type 2 diabetes. Honey has been linked to beneficial effects on heart health, including reduced blood pressure and blood fat levels. When applied to the skin, honey can be part of an effective treatment plan for burns, wounds, and many other skin conditions. It's particularly effective for diabetes-related foot ulcers. For children over 1 year of age, honey can act as a natural and safe cough suppressant. Some studies show that it's even more effective than certain cough medicines. One tablespoon of honey contains 64 calories, which is higher than that of sugar at 49 calories per tablespoon which is cause of weight gain. It is not safe to give honey to infants younger than 12 months. Honey's bacterial spores can cause infant botulism, a rare but potentially life-threatening disease. Honey has similar effects as sugar on blood glucose levels. This is especially problematic for people with diabetes and insulin resistance

Conclusion

As you can see honey has various disadvantages and side effects along with its several health benefits. But these side effects can be easily tackled if you consume honey in moderate amounts. Overdosing on anything will lead to several side effects. We, at Health and Healthier always recommend consuming anything on a moderate amount and following your doctor's advice. Also, be sure to look out for good quality honey.

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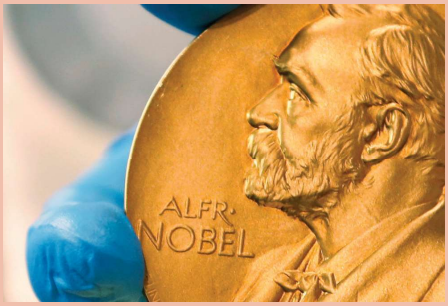
THE NOBEL PRIZE IN CHEMISTRY 2021

For developing 3rd type of catalysis

Swagata Modak
4th Sem ,BSc Hons

Benzamin List and David W.C.MacMillan won the Nobel prize for the development of a new type of catalysis , asymmetric organocatalysis, a precise new tool for molecular construction.



A BREAKTHROUGH

Benjamin List and David Macmillan have built what the ROYAL SWEDISH ACADEMY of SCIENCES (which hands out the prize) said was "a new and ingenious tool for molecule building " Till 2000,rea- searchers believed that there were just two types of catalysts : metals and enzymes.They independent of each other developed a third type of catalyst.The process has been widely applied including in the development of pharmaceuticals and the construction of solar panel

Benjamin List wonderd if the single amino acids which build up enzyme could catalyse a ratio on their own knowing of prev.reasearch on the amino acid proline acting as a catalyst ,he used it to ctalyse an aldol reaction and found it was efficient and also formed one mirror image of the product.

David Macmillan tried to develop alternative to metal catalysts using organic molecule.He identified an imidazolidinone molecule which could catalyse a carbon- carbon bond forming reaction and produced one mirror image of the product .He coined the term organocatalysis for the concept of catalysing reaction using small organic molecules.

WHY DOES THIS RESEARCH MATTER

✓Cheaper to use. ✓Environmentally friendly. ✓Can make specific mirror image of molecules They can be used one after another for different reaction steps, improving the efficiency of molecule- making. In this way organocatalysis are bringing greatest benefit to humankind.

Chopping Onions : A Tearful Chemistry

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Happily cutting onion for your dinner when BAM! Your eyes are stinging and tears are running down your face. Scientists have been investigating why this happens for a long time. Finally they have figured out how one of the veggie can make us emotional to cry out!!

For a common vegetable , the chemistry of onions is surprisingly perplexing , says Eric Block, a senior chemist from University at Albany in New York.

Slice into it and you unleash a chain of chemical reactions, he notes. Stable molecules in the onion's tissues transform into a volatile, sulfur-containing gas. This gas reacts with the eyes to form small amounts of sulfuric acid. Sulfuric acid can lead to itching, burning and tears.

About the Chain Reaction

Block has been working on the problem since the 1970s. He determined the structure of one of the onion's eye-irritating molecules in 1979. This sulfur- containing chemical is called lachrymatory factor, or LF. (This name comes from the Latin word lacrima, which means 'tear'.)

He knew that LF must start off as a different molecule. That's because it only caused a tearing of the eyes once the onion's skin was broken. He hypothesized that a chemical reaction must take place as an onion is cut. Block thought this chemical reaction must convert a stable molecule into one that could quickly vaporize and burn the eyes.

Sometimes chemical reactions need a little help to get started.

That's where enzymes come in. They are nature's fire starter.

Enzymes help to speed up chemical reactions.

Block focused on an enzyme known as alliinase. He showed that it helped to speed up the chemical reaction that converts stable sulfoxides molecules in onion into eye-irritating ones.

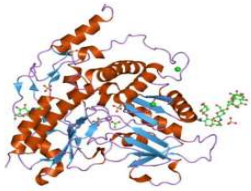
What is alliinase ?

In enzymology, an allin lyase is an enzyme that catalyzes the chemical reaction-

S-alkyl-L-cysteine-s-oxide ⇄ alliinase

Alkyl sulfenate + 2-aminoacrylate

Alliinase is generally found in plants of the genus allium such as garlic and onions. Alliinase is responsible for their flavours, odors and tear-inducing properties



What is lachrymatory agent ?

Syn-propanethial-s-oxide, a member of a class of organosulfur compounds known as thiocarbonyl-s-oxide, is a volatile liquid that acts as a lachrymatory agent. The chemical is released from onions, Allium cepa, as they are sliced.

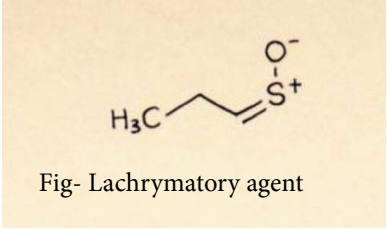


Fig- Lachrymatory agent

Later in the early 2000s, scientists at a Japanese food company discovered a second important enzyme in onions. They had been looking for a way to make a tearless onion. After certain experiments, they discovered a new enzyme LF synthase in onion. They reasoned that alliinase helped to change the shape of the starter molecule so that the second enzyme could go to work on it.

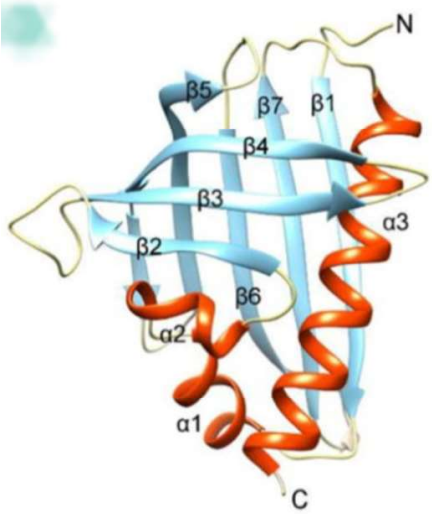
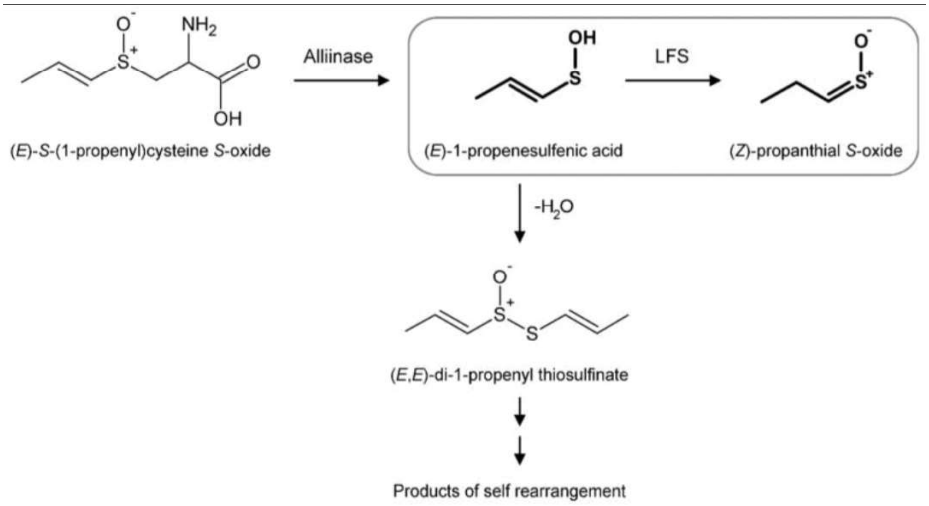


Fig- Ribbon diagram of LF synthase

Tips to prevent eye-irritation :-

- Use a sharp knife to cut the onion to reduce the amount of damage to the onion cells.
- Cool the onion in a refrigerator to suppress the scattering of the LF.
- Soak the onion in water to dissolve the amino acids.
- Use a ventilator or fan to blow the allyl sulfide away .

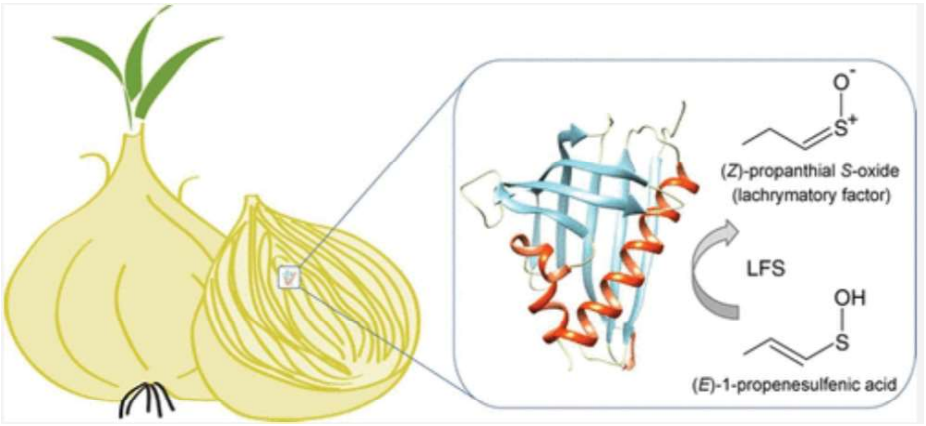


This is the complete chain reaction.

Making Crystals

Marcin Golczak, a biochemist at Case Western University in Cleveland, Ohio and his team was researching on the topic how LF forms. To do that, they used X-ray crystallography over LFS crystal to map its structure. First, the researchers mixed the enzyme with an acid .

Then after freezing the crystals in liquid nitrogen, they used X-ray beams over them and measured the angles of scattered beams with a special camera. Thus they constructed a 3-D picture of the enzyme. Golczak's team combined this 3-D picture with the previous research findings of what the enzyme did. From this, they made a model of what the enzyme looks like.



Conclusion

As to why onions produce the eye-irritating chemical in the first place, Block says it probably helps the plant to defend itself from predetors. This chemical hurts human eyes and other organisms also. This would make the plant less appealing to wildlife,insects and even some bacteria or fungi.

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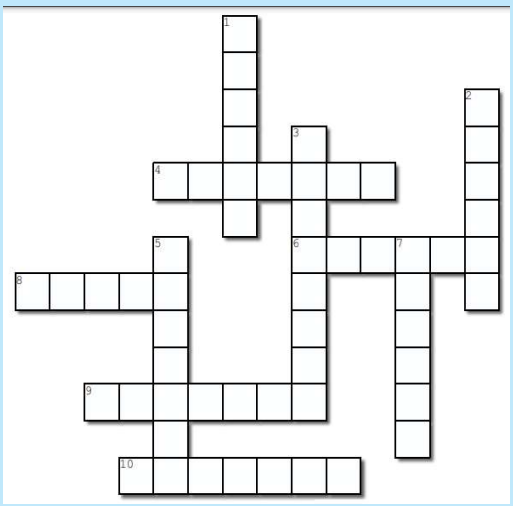
Josie A. Silvaroli, Matthew J. Pleshingen, Surajit Banerjee, Philip D. Kiser, Marcin Golczak, (2017), Enzyme That Makes You Cry- Crystal Structure of Lachrymatory factor Synthase from Allium Cepa.

CAN YOU SOLVE IT?

Chemistry Crossword Puzzle



Across
4. Simplest ketone
6. German word means 'built up'
8. Radioactive noble gas
9. atoms having same no of protons
10. Scattering of beam in colloidal solution

Down
1. two diastereomer having difference in only one chiral centre
2. Element having highest density
3. Inorganic Benzene
5. Degree of randomness
7. Father of atomic bomb in India

Are You Eating Pure & Healthy Food?-Know with Chemistry

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Did you ever noticed that the packaged or canned ready to eat foods are often more attractive than our regular homemade foods, also their life time is over the months where homemade foods normally are edible hardly for few days; can you say why commercially produced foods have these qualities?

This is due to incorporation of additives and preservatives in food during preparation. These additives are used to perform various functions, example to enhance the flavour where it is not sharp enough to meet consumer's demand, to give foodstuffs a delicious appearance or to increase the shelf life of the food also some of the additives perform as essential elements or nutritious supplements to fulfil the diet deficiencies of specific groups of people.

So actually what are the food addtives? In broad sense, food additives are any substances that added to food. Legally, the term indicates to any substance the intended use which results or may reasonably be expected to result directly or indirectly in its becoming a component or otherwise affecting the characteristics of any food. This definition includes any substance used in the production , processing treatment, packaging transportation or storage of food.

Then can we consider any substance as food additives? Simply the answer is NO. Food additives have several definite properties and based on their activity additives can be grouped, although there is some overlap with each other. These groups are as follows-

- **Acids:** Food acids are substances which are added to make flavours sharper and also act as preservatives and antioxidants. Vinegar, citric acid, tartaric acid, lactic acid is some example of this group.
- **Acidity regulators:** Acidity regulators are used to change or otherwise control the acidity and alkalinity of foods.
- **Anticaking agents:** Anticaking agents prevent powdered foods such as milk powder from caking or sticking.
- **Antifoaming agents:** Antifoaming agents reduce or prevent foaming in food.
- **Food colouring:** Colouring agents are added to food to compensate colours lost during preparation or to give the food more attractive appearance.
- **Emulsifiers:** Emulsifiers allow water and oil to remain mixed together in an emulsion, as in mayonnaise, ice cream and homogenized milk.
- **Flavours:** Flavours are additives which give food a particular taste or smell that make the food more attractive.
- **Humectants:** Humectants prevent foods from drying out.
- **Stabilizers:** Stabilizers, thickeners and gelling agents like agar or pectin (used in jam for example) give foods a firmer texture.

Does after addition of any of this food additives shelf life of foods increase? Nowadays more than 3000 additives are available in market but each of these does not have preserving properties. Preservatives may be added to food to prevent the growth of fungi, bacteria and other microorganisms. Preservatives can be used alone or in conjunction with other methods of food preservation. Hence all additives cannot be considered as preservatives. We can know about the preserving properties of any additives from the classification of preservatives where they are classified based on their source. The classes are as follows-

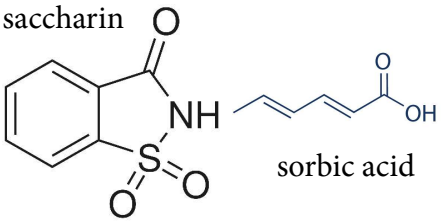
Natural preservatives: It includes food preservatives which are obtained from nature for example salt, sugar, vinegar, spices, honey, edible oil etc.

Chemical preservatives: It includes chemically semi synthetic or artificial preservatives for example asbenzoates, sorbates, nitrates of potassium sulphites, glycerides etc.

Now one can naturally ask that this much additives & preservatives are good for human health? Although additives & preservatives are essential for food storage, they can give rise to certain health problems; mostly artificial additives can cause several health damages. Some of known health damages due to food additives and preservatives are as follows:

- Butylates are responsible for high blood cholesterol and malfunction of liver.
- Caffeine cause nervousness, heart palpitation and occasionally heart defects.
- Saccharin causes allergic response, affecting skin, gastrointestinal tract and heart. It also causes tumors and bladder cancer.

saccharin



sorbic acid

- Benzoates can give rise to allergies such as skin rashes and asthma.
- Bromates cause nausea and diarrhea also destroys food nutrients.
- Red dye 40 causes certain birth defects and possibly cancer.

Mono and di-glycerides can give rise birth defects, genetic changes and cancer.

- Caramel can cause vitamin B6 deficiencies and certain genetic defects and even cancer.
- Sodium chloride can lead to high blood pressure, kidney failure, stroke and even heart attack.

Then why are we consuming such products in spite of such health problems? Well, the presence or absence of additives & preservatives in a specific food can only be controlled by its manufacturer. But from our side we can be concerned about the possible toxicity of some food additives. This helps us to avoid such hazardous products.

To control the use of the additives and preservatives at international level many standard methods for controlling, monitoring and quality assurance certification for food additives have been set in place by various regulatory bodies such as the European Union (EU) and American Food and Drug Administration (FDA). These organisations also either totally banned some additives or set maximum limits and strict rules to ensure the health security of consumers.

Hence from now before purchasing the packaged or canned simply stored food, you must check its ingredients. You should buy organic foods, which are free from artificial additives and try to eat the freshly prepared food as much as possible rather than previously processed food.

Reference:

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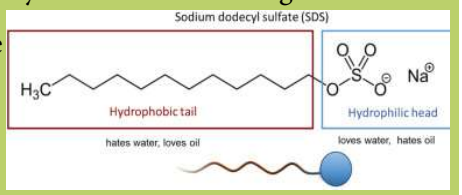
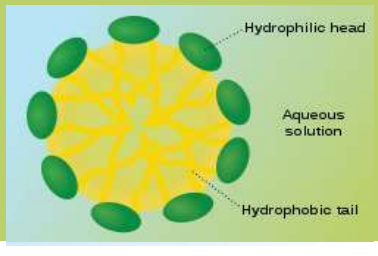
FUNCTION OF SHAMPOO

Shampoos are formulated by combining a surfactant (surface active agent or detergent), such as sodium lauryl sulfate or sodium laureth sulphate. It has a hydrophilic head group and a hydrophobic hydrocarbon containing tail .



Our skin produces sebum, a greasy substance, to coat and protect hair and the hair follicle. Sebum is hydrophobic. However, over time, sebum makes your hair look dirtyand sticks hair strands together, making your looks dull and greasy. Dust, pollen, and other particles are attracted to the sebum and stick to it.



Micelle

Surfactant lower the surface tension of water, making it less likely to stick to itself and more able to bind with oils and soiling particles. The Hydrophobic part binds to the sebum coating hair, as well as to any oily styling products. Arrange the hydrophilic part outside Surfactant form a micelle structure. When you rinse your hair, the detergent is swept away by the water, carrying sebum away with it.

Qualitative Analysis of Chocolates

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WHAT IS CHOCOLATE?

Chocolate is a Valentine's Day must-have and popular among people with a sweet tooth. Many also claim it lifts mood or even acts as an aphrodisiac, and we've all heard someone say it is habit forming. Chocolates have become one of the most popular flavours in the world of today. They form the basics ingredient in very many pastries and cake. Each manufacture combines secret formulas of the different varieties of the coca sweets to develop exclusive chocolates and try to make the exotic teat.

Chocolates are made from the seeds of COCOA trees. Spanish mythology consider these trees were grown in the garden of the PARADISE and believed that the chocolates drink was Divine. Chocolates are made from the seeds of these trees. In the modern factories tons of bitter cocoa beans are turned into one of the world Today chocolates are made available to us much guarded secret formula involving varying seeds, different ingredients, combinations of fermentation-roasting timings-temperature ,etc. Flavours such as mint, coffee, strawberry, etc. are some of the add ones. Also today the chocolates can contain ingredients as peanut, different types of nuts, dry fruits, caramels, crisped rice, etc.

Usually the chocolates can be categorized into the following groups

1.Bitter
2. Bitter sweets
3. Unsweetened
4.Dark sweetened
5. Milk chocolates
6.Cocoa powder
7.Cocoa Syrup

CHOCOLATES AND HEALTH

Good effects: Chocolate may be mild stimulant to humans, cocoa has antioxidant activity small but regular amounts of dark chocolates are associated with lower risk of heart attack. Dark chocolates contain THEOBROMINE ,which has been shown to harden tooth enamel. Cocoa percent of at least 74%, significantly improves the blood flow which were tested on smokers. Some studies have also observed a modest reduction in the blood pressure and flow mediated dilation after consuming dark chocolates daily. Eating dark chocolates may also prevent arteriosclerosis. Thus the best type of chocolates that is benefit for you is dark chocolate.

Bad effects: While chocolates have many good effects on consuming, it also has many negative side effects . It contains too many bad ingredients including, milk fats and saturated fats caffeine, oxalates and stearic acid. And while sugar may give energy, too much of it can cause tooth decay and gum disease if eating without regular and proper teeth brushing. Sugar plays a harmful role in tooth decay by providing bacteria in your mouth with energy . Dark chocolates contain a higher amount of caffeine than milk chocolates and this can affect your health. Too much caffeine lead to hypertension anxiety dehydration and inability to concentrate .

PROCEDURE FOR QUALITATIVE ANALYSIS OF CHOCOLATES

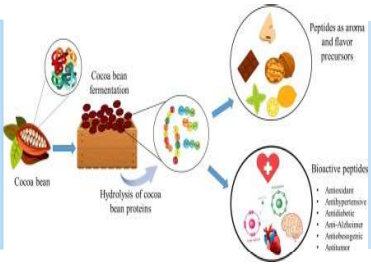
MATERIAL REQUIRED:

To find nutrients elements in chocolate ,we required some chemical reagents, salts, acids like-

1.Sodium hydroxide (NaOH)
Copper sulphate ($CuSO_4$)
3. Fehling's Solution A & B
4. Sulphuric acid (H_2SO_4)
5. Tollen's Reagent
6. Ammonium Chloride (NH_4Cl)
7. Ammonium Hydroxide (NH_4OH)

ANALYSIS

Test for Protein:
Experiment: 5ml of each sample of chocolate taken in different test tube. Add 1 pellet of NaOH to each & add 1-2 drops of $CuSO_4$ solution to each.
Observation: Appearance of violet colouration observed .
Inference: Presence of PROTEIN in sample.



Test for Fat:
Experiment: Take a small sample of each chocolate on different pieces of filter paper. Fold & unfold the paper to crush the sample over a flame.
Observation: Appearance of translucent spot around sampe which become larger on heating observed.
Inference: presence of FAT in sample.

Test for Sugar:
Experiment: 2ml of tollen's reagent was taken in different test tube, add a pinch of the chocolate into the each test tube. Then the solution taken into water bath.
Observation: A silver mirror surface is formed .
Inference: presence of SUGAR in the sample

Test for Calcium:
Experiment: A mixture of $NH_4OH + NH_4Cl + (NH_4)2CO_3$ is added with each chocolate.
Observation: A white precipitate was obtained.
Inference: Presence of CALCIUM in the sample.

Test for Iron:
Experiment: A mixture of NH_4Cl+NH_4OH is made .This is added to each sample of chocolate solution taken in different test tubes .
Observation: No brown precipitate was obtained.
Inference: Absence of IRON in the sample.

Test for Magnesium:
Experiment: A mixture of $NH_4Cl+NH_4OH+Na_3PO_4$ is made .This is added to each sample of chocolate solution taken in different test tubes .
Observation: No white precipitate was obtained.
Inference: Absence of MAGNESIUM in the sample.

CONCLUSION:

From this above analysis we can conclude that Chocolates have many good nutrient elements such as PROTEIN,SUGAR,FAT, CALCIUM. Which are very good for health & consuming dark chocolate is best among all types of chocolates. Cocoa is a widely-consumed confectionery food, and is also used as an ingredient in many preparations, such as drinks, cookies, cakes, breads, etc. Hence from now you should buy good chocolates for enjoy it's benefits.

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MEAT COOKING : D elicious Chemistry

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The flavour of cooked meat is related to the condition of preparation. Meat is composed primarily of protein, consisting either of chains of amino acids alone or complexes with metals, lipids, carbohydrates or nucleic acids.

On heating, denaturation at about 70^{0}C, the protein chain unfolds exposing hidden '-SH' groups. Further heating to about 110^{0}C results in oxidation of '-SH' groups to '-S-S-' linkages which leads to a decrease in meat tenderness. The hydrogen sulphide (H2S) is formed from the '-SH' groups, beginning at about 80^{0}C and it is an important flavour note in protein products. At lower concentrations, it blends and rounds out meaty flavour but is undesirable at higher concentrations.

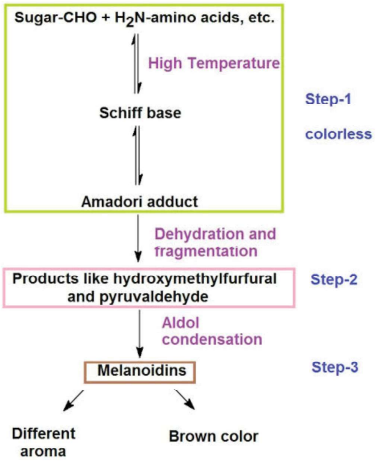
The reaction between sugar (mainly glucose and ribose) and amino acids present in meat is known as Maillard reaction. This is reaction is a form of non-enzymatic browning that occurs in meat when amino acids chemically reacts with carbohydrates of reducing sugars. Applying heat during cooking accelerates and continues this intricate process, which elevates the taste, aroma and appearance of meat. This Maillard reaction may proceed via two pathways-

1.Amadori rearrangement

2.the Strecker degradation.

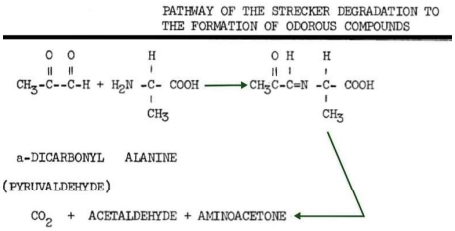
Chemistry behind the colour and odour of cooked meat:

The initial reaction is the condensation of the free -NH2 groups with reducing group of sugar to form an N-substituted glycosylamine. In the Amadori rearrangement, the N-substituted glycosylamine yields an N-substituted 1-amino-1-deoxy ketose.



which can undergo a number of further reactions to yield coloured and odoured components.

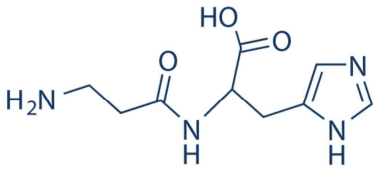
Compounds having a dicarbonyl structure may react with amino acids. This is the Strecker degradation. An aldehyde with one carbon atom less than its parent amino acid is formed, as well as free CO2.The amino group is transferred to the original carbonyl compound to form a new aminated compound that may react with another dicarbonyl molecule.



What makes meat tender and juicy?

The powdered tenderizer for softening meat contains papain, an enzyme obtained from the papaya. Papain works by breaking down meat proteins using a chemical process called hydrolysis.

Meat proteins are very large molecules. In hydrolysis, hydrogen atoms and hydroxide molecules attach themselves to the larger meat protein molecules and break the large proteins down into smaller molecules. This process is similar to the degradation process in humans, making it easy for the intestine to absorb the food particles. Food becomes more absorbable due to the effects of papain.



structure of papain

The water or vinegar gives an acidic solution with a pH of 4 or 5, which is slightly lower than the normal meat's pH. So it will not affect the flavour. If you are using vinegar, just allow it to rest for 20 minutes before cooking. Vinegar is a great tenderizer for meat.

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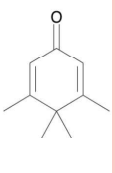
DO YOU KNOW?

Penguinone ($C_{10}H_{14}O$) is an organic compound and it's name is so as the structure is just like a penguin !!

Penguin



Penguinone

THE CHEMISTRY OF WORLD CUP BALL

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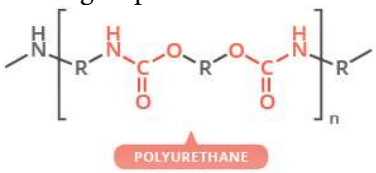
POLYURETHANE COATING

The surface covering of a football is composed of synthetic leather; in professional footballs, this is made from polyurethane polymers. The world cup ball is made from a number of polyurethane panels, which are thermally bonded together. This covering protects the ball and minimises water absorption. In cheaper footballs, the coating can be made from PVC.

Polyurethane is a polymer, a very large molecule build from many smaller units bonded togehter. The basic synthesis of plyurethanes involves the addition reaction of isocyanate and polyol molecules to from urethane groups

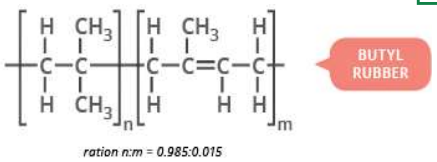


NYLON LINING

Several layers of lining are used between the covering of the football and The bladder to improve the bounce and strength of the ball.This lining is made of nylon,another class of polymers also known as polyamides. Polysters can be used for this purpose.

BUTYL BLADDER

The bladder is the part of thr ball in which the air is contained.Butyl rubber is often used because it retains the air better than the other option,latex.However, latex bladders can provide better surface tension



A number of chemical materials are used in the manufacture of the brazuca, the world cup football. The majority of these materials are polymers; these are very long molecules built up from many smaller component molecules. A simple, everyday example is polythene, used to make some plastic bags. Different classes of polymers are used to achieve particular properties for the ball.

Footballs consist of three main component parts: the covering (the outermost layer), the lining and the bladder. Obviously, these will be designed in a manner that provides the most favourable aerodynamic properties for the ball - however, that's veering dangerously into physics territory. None of these properties would be achievable without chemistry providing the materials required, so here's a breakdown of the different types of polymers used in each component part of the ball.

COVERING- The covering of the ball is made of six polyurethane panels, which are thermally bonded together. This covering is important to protect the ball, and to prevent it from absorbing too much water the water absorption of the brazuca ball is just 0.2%. This makes the ball much lighter than the leather-coated balls used in the past. Some balls may also have a polyurethane foam layer underneath the covering.
Polyurethane are built up from compounds Called isocyanates and polyols. The middle parts of these molecules can be varied to give different polyurethanes with differing properties. Polyurethanes have a wide range of applications, including foam in seating,adhesives, synthetic fibres and even skateboard wheels. Cheaper footballs may use PVC instead of polyurethane for the coating. They may also be stitched together, rather than thermally bonded. This stitching will be made from another class of polymers called polyesters; on higher end balls this stitching may be reinforced with Kevlar.

LINING- Underneath the covering layer, the ball will have several layers of lining. In the World Cup ball, these are made from another class of polymers, polyamides, more commonly referred to as nylon.

BLADDER- The bladder is the part of the football that holds the air. In the Brazuca, this is made from butyl rubber, but it can also be made from latex. Both have their benefits: butyl rubber retains the air for a longer period of time, whilst latex provides better surface tension. Butyl rubber can also be found in the valve through which air can be pumped into the ball, where it aids air retention. Silicone valves can also be used.
Most modern chewing gum also uses food grade butyl rubber to give the gum its elasticity.
This is just a peek into the world of polymers-any plastics you use on a day-to-day basis are composed from polymers, as well as your clothing, and many other everyday items. Without synthetic polymers, the World Cup would be kicking off today with a much more rudimentary ball!

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•Soccer Ball Construction- soccer ball world The Science Behind Brazuca- Livemint

LIPSTICK : THE SECRET CHEMISTRY

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A red lips with a bright look..... It is the dream of all the women of the world. Ifyou are a lipstick lover, you have to know the Chemistry behind it.

Ancient Uses

Did you know that cosmetics have probably used for over 6000 years? In ancient Egypt & China, both women & men used chemicals to darken their eyelids & paint their nails. Over time people used clay to create cosmetics. But what about the cosmetics you might see in local drugstore?

What is the Chemistry behind it & is it really safe to use?

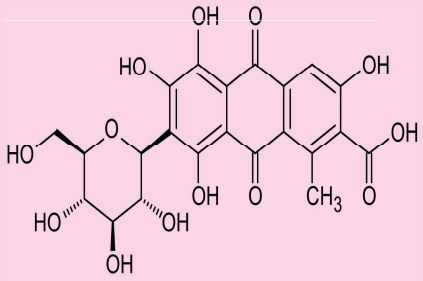
Ingredients in Lipstick

Let's now look specially at lipstick, the main components are waxes & oils. These are compounds containing mainly hydrogen and carbon. The wax is what gives the lipstick its structure & glossiness. Chemists add a wide range of naturally occurring waxes to lipstick.

For example, they might add beeswax which mostly contains esters, organic acids and hydrocarbons. Chemists add various other ingredi-ents to lipstick. For example, they add oils, such as olive oil which soften the lips & add glossiness. Pigment & dyes provide colours, & fragrance then cover up the nasty smell of the other chemicals.

Some lipstick even contain the compound capsaicin, which is the cause of spiciness in chili peppers. Capsaicin irritates the skin & causes it to plump up!

The chemist's job doesn't end with the basic ingredients. Chemists have to overcome certain issues so that their products will be effective and popular.



One such issue is melting. Lipstick wouldn't be much good if the solid waxes melted on your lips and ran down your chin! To solve this problem, chemists mix in some carnauba wax, which has a high melting point of around 87 ^{0}C.

Is Lipstick Safe?

Medical experts say that, there is no safe level of lead in the blood. The FDA (Food & Drug Administration) says it does not consider the lead levels it found in lipstick to be a safety issue.

Lipsticks contain harmful heavy metals like Cadmium, Magnesium, Chromium, etc. All these metals can cause dangerous diseases and organ damage. Extremely high amount of Cadmium can increase the risk of renal failure. It can cause severe stomach problems also.

Daily use of Lipstick can damage your beautiful lips. So for safety your lips, you have to leave lipstick as far as possible.

Did you know?

During the Second World War, British Prime Minister Winston Churchill rationed all cosmetics except lipstick. He said lipstick boosted morale!

Did you know?

A common pigment in red lipstick is carmine red, which is derived from boiling an insect!

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Johnson, R. (1999). What's that stuff? Lipstick. Chemistry & Engineering News, 77(28), 31

Rodger, C., & Broughton, D. (1998). The in-situ analysis of lipsticks by surface enhanced resonance Raman scattering. Analyst, 1 23(9), 1823-1826.

SMARTPHONES SMART CHEMISTRY

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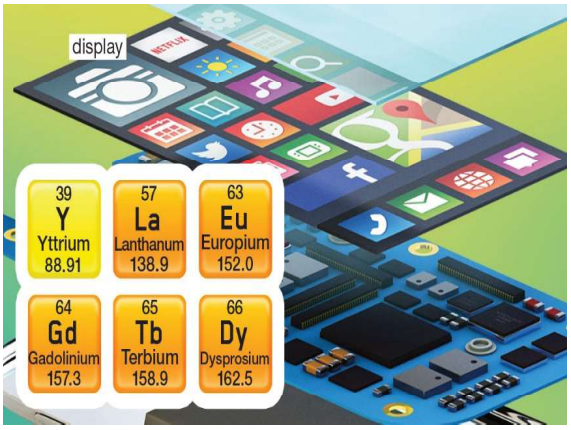


"Mobile is the enabling centerpiece of digital convergence. Mobile is the glue for all other digital industries to use when approaching convergence, but mobile is also the digital gateway for the real world to join in this global metamorphosis of human behavior."

-Tomi Ahonen

INTRODUCTION

Communication makes human different from any other species on earth. We can share our thoughts and ideas more effectively than any other organism. Today, there are numerous ways to communicate with others. A smartphone is the most used means of communication.

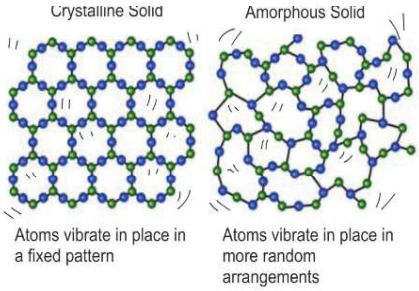
It has made our life easier than other. Today we can easily talk or do video call across the world within seconds. A mobile phone was developed with the sole aim to make people connected when they are away from home.

WHAT IS THE CHEMISTRY BEHIND THE SMARTPHONE

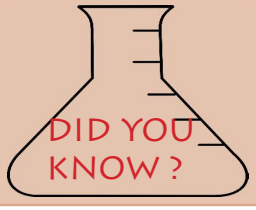
You will be surprised to know how chemistry related with smartphones, of the 83 stable elements, at least 70 of them can be found in the phone. Of the 70 elements mainly metals makes the smartphone too 'Smart'.
Smartphone are made of around 30 elements including copper, gold, silver that are used in wiring and also lithium and cobalt which are used in phone's battery. It also certain a variety of toxic materials such as Pb, Ni, Zn, Li, Be, Hg, As etc. Also boron, iron, nickel used in its microphone and speaker.

SMARTPHONE'S DISPLAY

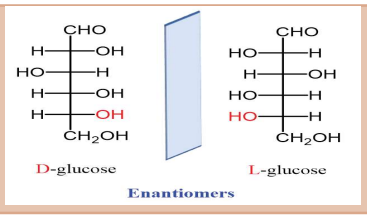
Smartphone display is the main thing a user sees when buying a smartphone. This is because the display screen happens to interact with the software and do various things.
The world's first synthetic glass-ceramic, a material that shares many properties with both glass and ceramic. Glass is an amorphous solid, because it lacks a crystalline structure. Glass-ceramics are at least 50% crystalline, and, in some cases, they are more than 95% crystalline.



Smartphone technology is evolving at a dizzying pace. It certainly represent our speed of development and the further progress of mobile computing will continue to act as a stimulus and opportunity for innovative approaches to education and many more field.

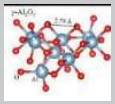
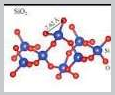


Glucose has 16 isomers in which only 1 isomer is edible for humans i.e. D-glucose that's why maximum commercially produced glucose packs are sold in name of glucon-D.



ELEMENTS OF SMARTPHONE

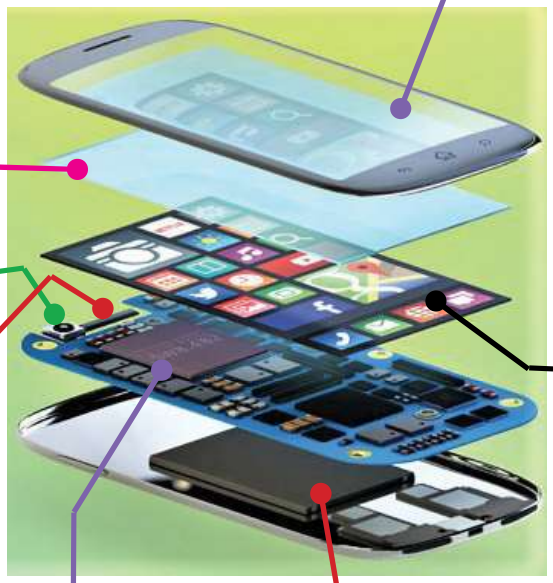
GORILLA GLASS

Smartphone screen contain aluminosilicate glass, made from the compounds alumina (Al2O3) and silica (SiO2). The potassium ions help strengthen the glass.

TOUCH SCREEN

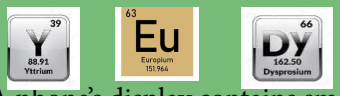
A thin layer of indium tin oxide, a mixture of indium oxide and tin oxide- conducts electricity. When you touch the screen, a change in the electrical field occur and communicates your finger location to the phone's chip.



CAMERA

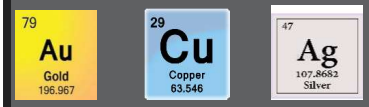
Boron in the lens, with silicates, but also in the chip. Rare earth elements in the lens and often the lens is made of plastic.

DISPLAY



A phone's display contains small quantities of yttrium, europium, and dysprosium help to produce the color on the liquid crystal display (LCD). Gadolinium, Terbium, Lanthanum give the screen its glow.

CIRCUITRY

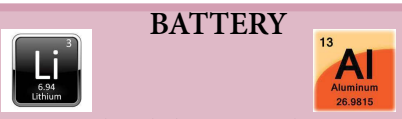


The circuit board has gold, copper and silver. The connectors are coated in gold. The wiring is copper. Solder-alloy of tin, silver and copper- binds parts of circuit board.

COMPUTER CHIP

The chip is phone's brain. It has many transistors made of antimony, phosphorus, gallium arsenide. The chip is embedded with silicon.

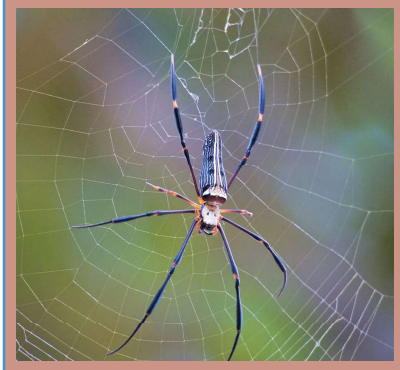
BATTERY



Commonly a lithium-ion battery encased in Aluminum. Positive electrode made up of layers of lithium cobalt oxide, carbon (graphite) negative electrode. Lithium ions move from positive to negative electrode during use, and flow in reverse during charging.

Are you a Spiderman fan then you must aware of Peter Parker's web shooters. But did you know what the real spider silk composed of & how powerful it is?

Spider silk , one of the most versatilr materials on earth, is classified into two parts - Dragline (streaming from centre) & flag silk (lines between dragline) .
Kevlar (material used in bullet proof vests) has an elasticity of 2.7% . In comparison the elasticity of European garden spider dragline silk is 24% and its flag silk is 270%.



Toughness (ability to absorbed energy) of Kevlar is 50 MK m^{-3} . The dragline and flag silk of spider is 190 and 150 MJ m^{-3} respectively. The only downside is spider silk has lower strength (ability to withstand an applied load) .

spider silk is a protein fibre majorly composed of Alanine and glycine amino acid. Material chemists have been trying to produce higher strength of spider silk for years. But it's difficult to produce large amount of silk. Scientist produced the silk Protein in milk of genetically modified goats. Cambridge researchers have managed to design a hydrogel that mimics spider silk.

THE CHEMISTRY OF PHEROMONES

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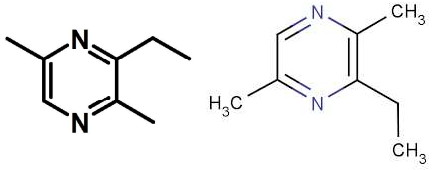
Sometimes we are amazed by the unity of some insects(bee, ant etc.).How do they do any work with such unity? Even though they lack of communication systems like humans(telephone, massaging).So how do they do that? They do that with the help of a chemical hand called 'Pheromones'.
Pheromones are potent signaling molecules that are fundamental for organizing a wide range of social behavior in many vertebrates & invertebrates.
So, from ant to elephant & from rhino beetle to rhino, pheromone is present. Plants also have pheromones.
There are many types of pheromones.

i)Alarm
ii)Sexual
iii)Aggregation
iv)Territorial
v)Trail
vi)Recruitment etc.

Different types of pheromones are present in different types of animals. First discovered pheromone is Bombykol, extracted from silk moth(Bombyx mori) by Adolf Butenandt.
In insects like ants, bees beetles, moths & others uses pheromones in various physiochemical works.

In insects like ants, bees beetles, moths & others uses pheromones in various physiochemical works.

I) **ALARM PHEROMONES**: In social insects like ant, alarm pheromones are an essential part of physiology to maintain integrity &sociality.
Fire ant(Solenopsis invicta) excretes a pheromone containing Pyrazine. It is so minute in concentration that 1mL pheromone contain 1 pg of pyrazine.



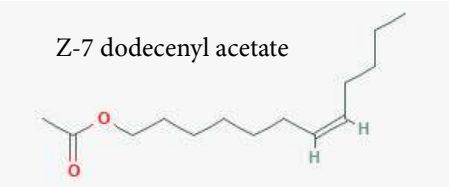
These two isomers of Pyrazine used by two different species.

Honey bee(Apis nearctica)releases alarm pheromone when a bee stings another animal species to be defensive to nest.Pheromone released from Koschernikov's gland contains total more than 40 chemicals including hexyl acetate,2-nonanol etc.

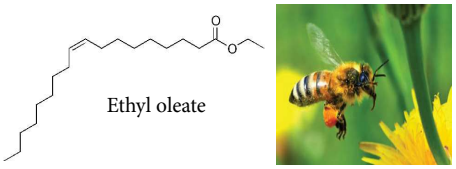
CH_3-CH_2-CH_2-CH_2-CH_2-$COOC_2H_5$
Hexyl Acetate

CH_3-CO-CH_2-CH_2-CH_2-CH_2-CH_3
2-heptanone

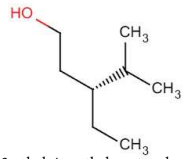
TERRITORIAL PHEROMONES:
This type of pheromones are used to define the boundary or territory of a particular species.
Elephants,specifically female elephants secretes Z-7 Dodecenyl acetate.It is diffiused in nature by their urine & it extends it's presence in the environment without hampering its detection.About 1nM amount of Z-7 Dodecenyl acetate is bound to albumin protein which excretes with urine.



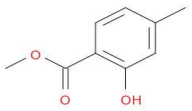
Old forager honey bees secretes a territorial pheromone containing Ethyl Oleate which defines the area of foraging and flowering plants.



SEX PHEROMONES: This is one of most important types of pheromones. Almost total insect family completes their sexual mating with the influence of this pheromone.
Polyergus breviceps ant species queen ant produces sex pheromones in mandibular gland as a blend of methyl-6-methyl salicylate and 3-ethyl-4-methyl pentanol.In isolation,they do not attract males but in combination,they attracts hundreds of males.

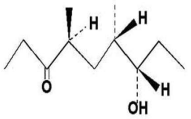


3-ethyl-4-methyl pentanol



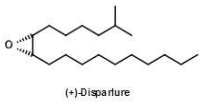
methyl-4-methyl salicylate

Cigeratte beetle(Lasioderma sericorne) produces sex pheromone serricornin which is very much weak in concentration.About 1.5 mg of serricornin can be isolated from 65000 female beetles.The slightest whiff of it causes gathering of male species and attempt frenzied copulation.

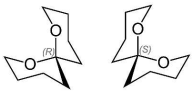


Serricornin

Pheromone of gypsy moth (Lymantria dispar dispar) disperlure,can be isolated from the moths and only 2*10-12g is active as a lure for males.

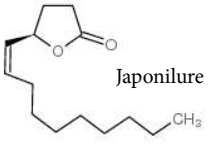


There is some exception in olive flies(Bacrocera oleae).The male and female species both produces pheromone olean to attract each other.
And another thing is that the one enantiomer(R) of olean attracts the male whilst the another(S) attracts the females.



Olean Pheromone

The sex pheromone of Japanese beetle(Popillia japonica),Japonilure,also given off by the females,is more effective in attraction by apprx. An amount of 2μg



Japonilure

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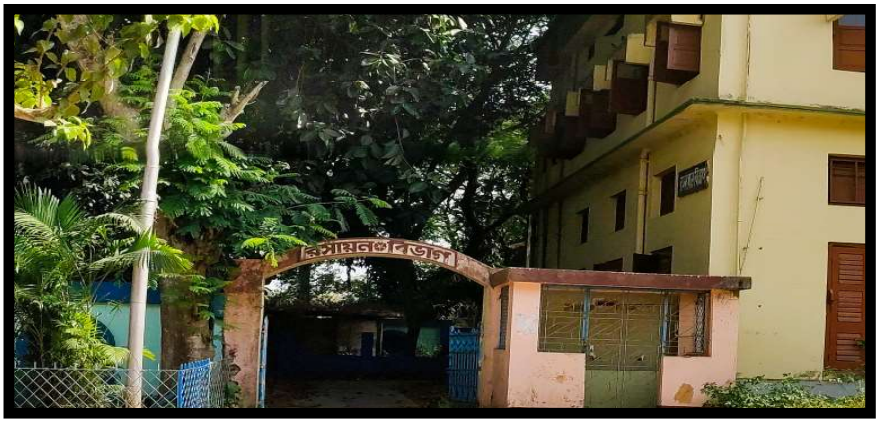
Awards & Honors : 1. All India Rank 008 in the National Eligibility Test (NET) held in June, 2011.
2. Junior Research Fellowship (JRF) and Senior Research Fellowship (JRF) funded by CSIR from 2012-2016.

PHOTO ALBUM 2019-22

Departmental Fresher's 2019

Parents'-Teachers' meeting 2021-22

Celebration of 175 years of college , Batch 2019-22



Batch 2021-24

Batch 2020-23

Inaugural ceremony of 'Rasaynika'

"Studying science doesn't mean blindly acquiring knowledge about facts and formulas rather it emphasize on the path through which one can know the truth & reality behind any kind of phenomena"

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