DEPARTMENT OF CHEMISTRY

BOSON

...AN ANNUAL NEWSLETTER

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BOSON is an annual newsletter founded by the Department of Chemistry, Pragjyotish College in 2016.

"You and everything around you are made of particles. But when the universe began, no particles had mass; they all sped around at the speed of light. Stars, planets and life could only emerge because particles gained their mass from a fundamental field associated with the Higgs boson."

The existence of this mass-giving field was confirmed in 2012, when the Higgs boson particle was discovered at CERN. The Higgs boson was proposed in 1964 by Peter Higgs, François Englert, and four other theorists to explain why certain particles have mass. However, it is not well known that the term Boson, owes its name to the pioneering work of the late Indian physicist Satyendra Nath Bose.

CHEMISTRY OF THE RUSTY PLANET, MARS

Mars, the fourth planet in our solar system, named after the Roman God of War, is quite special to us Earthlings. That is due to the fact that Mars is a terrestrial planet with an atmosphere having a crust with elements similar to that of Earth's. With other features such as craters, valleys, dunes, polar ice caps and its two small moons : Phobos and Demios; it is the most suitable planet to host human beings if we someday need... *Page No.: 09*

CLICK CHEMISTRY AND BIO-ORTHOGONAL REACTIONS

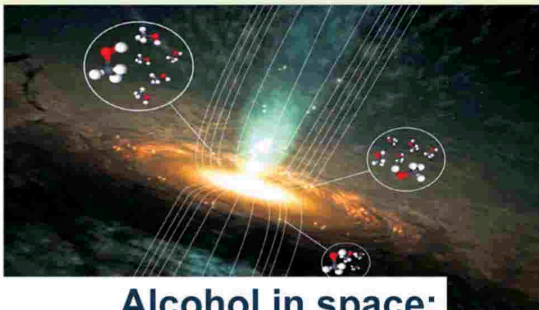
This year's chemistry Nobel prize is shared equally between the click chemistry pioneers Barry Sharpless and Morten Meldal, and Carolyn Bertozzi, for the development of click chemistry and bioorthogonal chemistry.

The logic behind this chemistry is simple: (1) New molecular properties are needed everywhere and such properties can emerge from the joining of small molecular building blocks and (2) Existing chemical methods can be developed more, which can make molecular connections easily.

The "click" in click chemistry was meant to convey the type of convenience and satisfaction that is afforded by snapping objects together with a luggage strap connector. It does not matter what the pieces are; if the two ends of the buckle can reach each other, the linkage is made. This power... *Page No.: 07*

DR. RUSH'S BILIOUS PILLS

History books often mention how Lewis and Clark had trekked through South Dakota and the rest of the Louisiana Territory with a microscope,compasses, sextants, three mercury thermometers, and other instruments. What books didn't mention is that they also carried with them six hundred mercury laxatives, each four times the size of an aspirin. The laxatives... *Page No.: 03*



Alcohol in space: Methanol for measuring magnetic fields

An important puzzle in astrochemistry has now finally been solved as a team of theoretical chemists and astronomers have succeeded in determining how to measure magnetic fields in space with methanol. This provides a new method for examining the birth of stars and planets. Over the last half-century, many molecules have been discovered in space using radio telescopes. With the help of these molecules astronomers have been able to ... *Page No.: 06*

THE VACCINE OF CANCER

Vaccines are medicines that help the body fight disease. They can train the immune system to find ... *Page No.: 05*

QUANTUM SPIN LIQUID

In 1973, Philip W. Anderson theorized the existence of a new state of matter that has been a ... *Page No.: 08*

ICE CUBE OF JELLY

Jelly ice cubes or reusable ice cubes is a very recent and ingenious invention by the researchers of ... *Page No.: 09*

PROFILE

The **D-Block** of Pragjyotish College doesn't only let out the smell of chemicals but also the students' aroma of passion who use them. Being the *D block*, it comprises a variety of properties but also shows the unity of a complex structure. This is the block of the Department of Chemistry, which started its journey in 1960. It has been gliding over the various crests and troughs that came along in this journey till now. Currently, the department has *6 (six) permanent faculties* and *one Guest faculty* with *three laboratory bearers*. It has two general laboratories and a sophisticated laboratory. One of the departmental faculties has got another research laboratory attached to the department. In recent years, the department has been organizing various events for the development of the students in all respects. The creation of a research environment at the undergraduate level is another great aspect of this department. Among the activities jointly performed by the teachers and students under the forum "***Dhatu***", releasing wall magazine ***PSI*** and publishing departmental annual newsletter ***BOSON*** are two major outcomes to society. This year the department is going to publish the 6th volume of *BOSON*. This reflects the creativity of students and gives them the opportunity to articulate their scientific thinking.

This volume of BOSON tries to encapsulate different facets of chemical science and technology like the historical aspects of it along with the futuristic upcoming innovations in this field. Besides, it also contains topics related to sustainable chemistry, astrochemistry, metallo chemistry and much more.

Photo: Department of Chemistry
Pragjyotish College, Ghy-09

ACHIEVMENTS

HIRAK JYOTI DEKA
Notable alumni
2014-2017 Batch
Join as DTO in 2022

SUBASHISH DAS
Cleared GUET, pursuing
M.Sc. in B.Barooah College

GITARTHA KALITA
Cleared GUET, pursuing
M.Sc in Arya Vidyapeeth
College

SURESH SAH
Cleared JAM, CUET, GUET,
pursuing M.Sc. in
Arya Vidyapeeth College

JYOTIPRASAD DAS
Cleared GUET, pursuing
M.Sc in Arya Vidyapeeth
College

CHANDAN DAS
Cleared CUET,
Pursuing MSc in
Tezpur University

SUKANYA PARASHAR
Cleared GUET, pursuing
M.Sc in Handique
Girls College

SANSWARANG GAYARI
Cleared CUET,
pursuing M.Sc in
Banaras Hindu University

ALCHEMY: THE ORIGINS OF MODERN CHEMISTRY

Gaurav Jyoti Dutta
5th Semester

The unknown has always captivated man. This fascination was once pioneered by people who were interested in studying the laws that govern the world and changing the state and nature of various things. This group of people became known as 'alchemists,' and the subject matter they were interested in became known as 'alchemy.'

Alchemy is the branch of natural philosophy, which is a philosophical and proto-scientific tradition that was historically practiced in China, India, Arabic countries, and Europe. It's derived from the Arabic word al-kīmiyāʾ which means 'art of alloying metals'. It included "perfection" of lead into gold, creation of "perfect bodies" which could give eternal life and to find a universal cure for all diseases (the elixir of life).Alchemy was not original in seeking these goals, for it had been preceded by religion, medicine, and metallurgy. The first chemists were the metallurgists, who were perhaps the most successful practitioners of science in that era.

The chemistry involved in alchemy appears to be a complicated succession of heatings of multiple mixtures of obscurely named materials. Most of the alchemical process involved metals like gold, silver, copper, lead, iron, and tin . Sulfur, "the stone that burns," was crucial. It was known from prehistoric times in native deposits and was also given off in metallurgical processes (the "roasting" of sulfide ores). Mercury, the liquid metal, united with most of the other metals, and the amalgam formed coloured powders (the sulfides) when treated with sulfur.

Alchemist then added the action on metals with other corrosive salts, mainly vitriols (copper and iron sulfates), alums (the aluminum sulfates of potassium and ammonium), and chlorides of sodium and ammonium. Then they used arsenic's property of coloring metals to obtain various coloured compounds.

Finally, the manipulation of these materials was to lead to the discovery of the mineral acids, the history of which began in Europe in the 13th century. The first was probably nitric acid, made by distilling together saltpetre (potassium nitrate) and vitriol or alum. More difficult to discover was sulfuric acid, which was distilled from vitriol or alum alone but required apparatus resistant to corrosion and heat. And most difficult was hydrochloric acid, distilled from common salt or sal ammoniac and vitriol or alum, for the vapors of this acid cannot be simply condensed but must be dissolved in water.

It has been said that alchemy can be credited with the development of the science of chemistry. During the alchemical period the number of known substances was enlarged (e.g.: by the addition of sal ammoniac and saltpetre), alcohol and the mineral acids were discovered, and the basis was laid from which modern chemistry was to rise. Historians of chemistry have been tempted to credit alchemy with laying this base while at the same time regarding alchemy as mostly "wrong."

Conventional attempts at gold making were not dead, but by the 18th century alchemy had turned conclusively to religious aims. The rise of modern chemistry engendered not only general skepticism as to the possibility of making gold but also widespread dissatisfaction with the objectives of alchemy which were viewed as too limited. It has led many historians to view alchemy in general as a fraud.

DR. RUSH'S BILIOUS PILLS

Ashif Mustafijur Rahman
5th Semester

History books often mention how Lewis and C lark had trekked through South Dakota and the rest of the Louisiana Territory with a microscope,compasses, sextants, three mercury thermometers, and other instruments. What books didn't mention is that they also carried with them six hundred mercury laxatives, each four times the size of an aspirin. The laxatives were called Dr. Rush's Bilious Pills. Pills named after Benjamin Rush, a signer of the Declaration of Independence and a medical hero for bravely staying in Philadelphia during the yellow fever epidemic in 1793. His pet treatment, for any disease, was a mercury-chloride sludge administered orally. They were actually anti-bilious pills. A patient was said to be "bilious" when supposed poor flow of bile in the body caused a complex of symptoms including constipation, headache, and lassitude. Despite the progress medicine made overall between 1400 and 1800, doctors in that era remained closer to medicine men than medical men. With a sort of sympathetic magic, they figured that beautiful, alluring mercury could cure patients by bringing them to an ugly crisis — poison fighting poison. Dr. Rush made patients ingest the solution until they drooled, and often people's teeth and hair fell out after weeks or months of continuous treatment. His "cure" no doubt poisoned or outright killed swaths of people whom yellow fever might have spared. Even so, having perfected his treatment in Philadelphia, ten years later he sent Meriwether and William off with some pre packaged samples. As a handy side effect, Dr. Rush's pills have enabled modern archaeologists to track down campsites used by the explorers. With the weird food and questionable water they encountered in the wild, someone in their party was always queasy, and to this day, mercury deposits dot the soil in many places where the gang dug a latrine, perhaps after one of Dr. Rush's "Thunderclappers" had worked a little too well.

A milder version of Rush's Pills remained an official compound until the 1940s. The recipe for Compound Mild Mercurous Chloride Pills was nonetheless a big gun, combining four purgatives of slightly differing qualities. Early 19th-century physicians regarded jalap as "active" and "rapid." Gamboge, from Cambodia, was a "drastic" and "powerful" purge. Calomel was believed to stimulate the liver and the gallbladder, although the opposite was true. Colocynth, or bitter apple, from India and Saharan Africa, was termed a "drastic" and "powerful" purge. According to the United States Dispensatory of 1918, the compound extract of colocynth "combined with calomel, extract of jalap, and gamboge forms a highly efficient and safe cathartic, especially useful in congestion of the portal circle and torpidity of the liver."

Organic Frameworks with Metals : The MOFs

Metal Organic Frameworks are crystalline hybrid materials created from both organic and inorganic molecular self- assembly , pioneered in the late 1990s. More than 90,000 different MOF structures have been reported and the number grows daily. They are a class of compounds consisting of metal ions or clusters coordinated to organic ligands to form 1-,2-,3- dimensional polymers. They are a subclass of coordination polymers, with the special features that they are often porous. The organic ligands included are sometimes referred to as 'struts' and 'linkers', one example being 1,4-benzenedicarboxylic acid (BDC). The study of MOFs developed from coordination chemistry and solid state inorganic chemistry, especially the zeolites. Except for the use of preformed ligands, MOFs and zeolites are produced almost exclusively by hydrothermal or solvothermal techniques,where crystals are slowly grown from a hot solution. Implementing MOFs in industry necessitates a through understanding of the mechanical properties since most processing techniques expose the MOFs to substantial mechanical compressive stresses. Carboxylate based MOFs have by far received the most attention because

1. They are either commercially available or easily synthesized.

2. They have high acidity allowing for facile in situ deprotonation.

3. The metal-carboxylate bond formation is reversible, facilitating the formation of well ordered crystalline MOFs.

4. The bridging bidentate coordination ability of carboxylate groups favours the high degree of frame work connectivity and strong metal ligand bonds.

Research and development of novel materials for bioelectrochemical application have become a major thrust area in the energy sector. The pioneering work on MOFs catalyzed efficient energy conservation and storage, especially in EBFCs and biosensors.

The inherent properties of MOF such as

1. High porosity 2. Surface area 3. Flexibility and tenability 4. Enables unique prospects in electrocatalysis. 5. Fuel storage 6. Biomolecule retention. MOFs are particularly promising materials for membrane - based separation of CO_2 from N_2, CH_2, or H_2. All three gas separation have significant implications for climate change mitigation and energy production. Their are variety of applications of MOFs. MOF's high surface area also is a beneficial aspect for high performance gas Sensor. They can be used for refrigeration as MOFs lowers the energy consumption for air conditioning by engeneering then to hold onto a large amount of refrigerant gases.

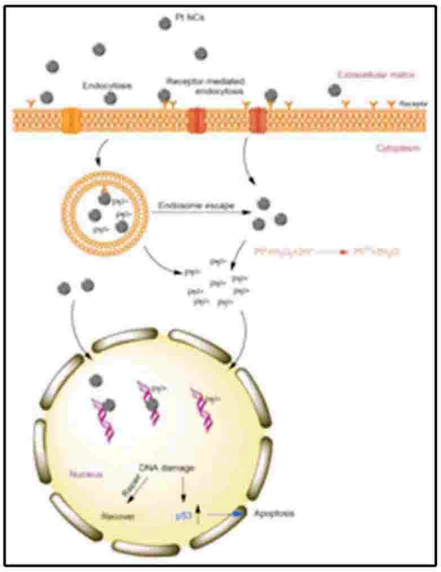
They are helpful in removing heavy matels from water.Researchers treated a MOF, known as Fe-BTC/PDA can quickly and selectively remove high amounts of heavy metals like lead and Mercury from water samples. MOF Vaccines are crystals that contain an antigen like the protein on the surface of influenza, except that since they're frozen inside a crystalline lattice, they can't denature or change shape.

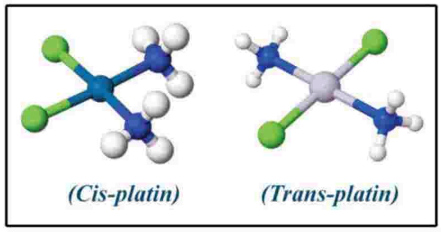
Luna Akhtara Ahmed
3rd Semester

PLATINIZED PRESCRIPTION

Nishita Kalita | 1st Semester

In the past 2-3 decades, a term is forefront in the healthcare industry and that is "CANCER". *Does cancer really mean death? Can chemistry cure this ? If yes , how ?* Now, Cancer is an abnormal repeated cell division which spreads all over the body. This uncontrolled cell division forms a mass of cells called tumors. It may be due to various reasons such as DNA deformation or any physical or biological factor. If we ask an oncologist for treatment of cancer, then he/she will prescribe *"PLATINIZED PRESCRIPTION"*. A Platinized prescription or platinum based drug (also called platin), chemotherapeutic agent is used to treat cancer. Commonly used platin include cisplatin, oxaliplatin, and carboplatin. This anti cancer drug has great potential in tumor targeted therapy and has shown promising results. Before 1860 cancer was considered to be non - curable disease but now it's not a life threatening disease if treated in the first stage. The Italian chemist Michele Peyrone researched platinum compounds. He experimented on Magnus green salt $[Pt(NH_3)_4][PtCl_4]$ and examined its reactivity. When he attempted to synthesize Magnus' green salt by adding excess ammonia to an acidified $PtCl_2$ solution, he observed the appearance of two products: one green (Magnus' green salt) and one yellow ($PtCl_2(NH_3)_2$). He concluded that this yellow precipitate is known as Peyrone Chloride. Alfred Warner explained the structure & stated that it's coordination complex compound with two isomers : cis and trans. Accidentally it's cis isomer in 1960 was found to be used as a cancer killing drug. This isomer (cis-platin) was analysed with rat. Cisplatin's chemical named Cis-Diamino-Dichloro-Platinum (II), as NH_3 and Cl are in same direction, they are termed as cis. It is a metallic (platinum) coordination compound with a square planar geometry and white or deep yellow to yellow-orange crystalline powder at room temperature. Now how does *this cisplatin operate in our body ?* Cisplatin is generally believed to be first transported into tumor cells through copper transporter 1 (CTR1). After entering the tumor cell, the platinum complex undergoes the activation step of chloro-ligand(s) replacement, generally by water molecules or other small molecules containing sulfhydryl groups. After a series of chemical reactions in the cytoplasm, platinum binds to DNA by forming intra- and inter-stranded crosslinks, changing the DNA structure and causing DNA damage. This DNA damage can prevent the cell cycle and induce apoptosis in rapidly proliferating tumor cells. This is how cisplatin restricts the further growth of abnormal cell division. *Did you notice why cisplatin is only used for chemotherapy, not transplatin?* It is because the rate of hydration and reaction with ammonia for transplatin is much faster than cisplatin. The high reactivity of transplatin results in rapid deactivation of the complex before reaching its target, likely contributing to its lack of anti-cancer activity. .





Cisplatin was the first line platinum anticancer drug which is relatively an old drug but has a therapeutic effect on tumors with a known molecular mechanism . *What about the side effects ?* These side effects can seriously limit the application of platinum anticancer drugs . This query was now resolved by nanotechnology and nanoscience by modifying Pt NC -based drugs which improve anticancer efficiency and reduce systemic toxicity .

FACTS

- **J is the only letter that is not present in the periodic table.**
- **Graphene is considered a better heat and electricity conductor , as it is an allotrope of carbon.**
- **A rubber tire is technically one single, giant , polymerized molecule.**

THE VACCINE OF CANCER

Nabajyoti Das
1st Semester

Vaccines are medicines that help the body fight disease. They can train the immune system to find and destroy harmful germs and cells. There are many vaccines that we humans receive throughout our life to prevent common illnesses. There are also vaccines for cancer. There are vaccines that prevent cancer and vaccines that treat cancer.There are vaccines that can prevent healthy people from getting certain cancers caused by viruses. This type of vaccine will only work if a person gets the vaccine before they are infected with the virus.

There are 2 types of vaccines that prevent cancer approved by the U.S. Food and Drug Administration (FDA):

HPV vaccine: The vaccine protects against the human papillomavirus (HPV). If this virus stays in the body for a long time, it can cause some types of cancer. The FDA has approved HPV vaccines to prevent: Cervical, vaginal, vulvar , Anal cancers and Genital warts.

Hepatitis B vaccine: This vaccine protects against the hepatitis B virus (HBV). This virus can cause liver cancer.

There are vaccines that treat existing cancer, called treatment vaccines or therapeutic vaccines. These vaccines are a type of cancer treatment called immunotherapy. They work to boost the body's immune system to fight cancer.. Different treatment vaccines work in different ways.

How do cancer treatment vaccines work:

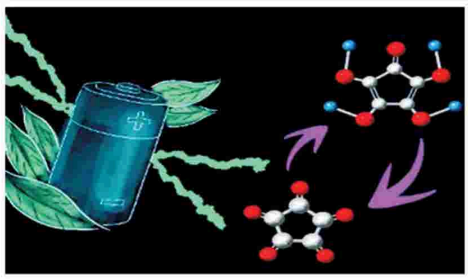
Antigens, found on the surface of cells, are substances the body thinks are harmful. The immune system attacks the antigens and, in most cases, gets rid of them. This leaves the immune system with a "memory" that helps it fight those antigens in the future. Cancer treatment vaccines boost the immune system's ability to find and destroy antigens. Often, cancer cells have certain molecules called cancer-specific antigens on their surface that healthy cells do not have. When a vaccine gives these molecules to a person, the molecules act as antigens which stimulae the immune response of body. Some cancer vaccines are personalized. This means they are made for just 1 person. This type of vaccine is produced from samples of the person's tumor that are removed during surgery. Other cancer vaccines are not personalized and target certain cancer antigens that are not specific to an individual person. Doctors give these vaccines to people whose tumors have those antigens on the surface of the tumor cells.Most cancer vaccines are only offered through clinical trials, which are research studies that use volunteers. In 2010, the FDA approved sipuleucel-T (Provenge) for people with metastatic prostate cancer. Another vaccine uses a weakened bacteria called Bacillus (BCG) that is injected into the body.

Making treatment vaccines that work is a challenge because: Cancer cells suppress the immune system and grow. Researchers are using adjuvants in vaccines to try to fix this problem. An adjuvant is a substance added to a vaccine to improve the body's immune response.People who are sick or older can have weak immune systems. Their bodies may not be able to produce a strong immune response after they receive a vaccine. That limits how well a vaccine works. Also, some cancer treatments may weaken a person's immune system. This limits how well the body can respond to a vaccine.For these reasons, some researchers think cancer treatment vaccines may work better for smaller tumors or cancer in its early stages.

FACTS

- Spider webs are actually protein fibre . It represents the chemical reaction of two major silk proteins , glycine and alanine.
- Apple seeds are extremely poisonous. It contains amygdalin which turns into cyanide if chewed.
- Frogs don't drink water because they can absorb it through their skin.
- Air becomes liquid at -190 °C

Photo : Unveiling of 5th edition of ***BOSON***, 2021



METAL-FREE ORGANIC LITHIUM-ION BATTERIES

Plabita Deka | Rehman Farjina Firdoush
1st Semester

When we look at the history of battery science, we notice a generational story unfolding. Like so many other technologies, batteries started out as very primitive devices improved with each successive generation. Almost every device we use today runs on battery. The first commercially available Li-ion battery came out in the early 1990s. Today, the lithium-ion battery represents the state-of-the-art technology of the day. A Li-ion battery is an advanced battery technology that uses lithium ions as a key component of its electrochemistry. During a discharge cycle, lithium atoms in the anode are ionized and separated from their electrons. Then, they move from the anode and pass through the electrolyte until they reach the cathode, where they recombine with their electrons and electrically neutralize. Li-ion batteries are capable of having a very high voltage and charge storage per unit mass and unit volume. The most common combination of electrodes is that of lithium cobalt oxide (cathode) and graphite (anode), which is most commonly found in portable electronic devices such as cell-phones and laptops. Because of their attributes, Li-ion batteries and cells are more suitable for some applications than other forms of battery technology including NiMH batteries, lead-acid batteries and Ni-Cd batteries. However, to gain the best from the Li-ion battery technology, it is necessary to understand not only the advantages, but also the disadvantages. Lithium-ion batteries are much pricier to manufacture than nickel-cadmium batteries. This type of batteries have short life time and they are sensitive to high temperature. The biggest disadvantage of Li-ion battery is that they require protection from being overcharged and completely discharged.

Thus, to overcome those disadvantages a join group of scientists from the university of California, Los Angeles (UCLA) and the Tohoku University have made progress towards attaining high voltage, metal free lithium-ion batteries that utilize a small organic molecule, croconic acid. This novel development brings us one step closer to achieving metal free, high energy and low-cost lithium-ion batteries with a greener future. Now, the study has proposed the small organic molecule can maintain a working voltage of around 4 volts. Unlike conventional lithium-ion batteries, which are reliant on rare-earth materials such as cobalt and lithium, organic batteries exploit naturally abundant elements such as carbon, hydrogen, nitrogen and oxygen. In addition, organic batteries have greater theoretical capacities than conventional lithium-ion batteries because their use of organic materials renders them a lightweight quality. However, the majority of reported organic batteries to date, possess a relatively low (1-3V) working voltage. Croconic acid has five carbon atoms bonded to each other in a pentagonal form, and each of the carbons is bonded to oxygen. It also has a high theoretical capacity of 638.6mAh/g, which is much higher than the conventional lithium-ion battery cathode materials ($LiCoO_2$~140mAh/g). Commenting on the research, one of the reasearchers Kobayashi explained that they investigated the electrochemical behavior of croconic acid in the high-voltage range above 3V using theoretical calculations and electrochemical experiments and they discovered that croconic acid stores lithium ions at roughly 4V, giving a very high theoretical energy density of 1949 Wh/kg, which is larger than most inorganic and organic lithium-ion batteries.

Although the study did not reach the theoretical capacity, the researchers are optimistic that this can be improved by developing stable electrolytes and chemical modification of Croconic acid at high pressures. Since most electrolytes cannot withstand such strong ketoacid working voltages, the development of new electrolytes is crucial.

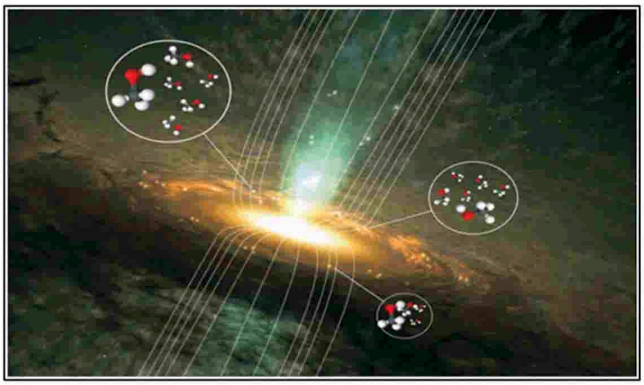
Hope for desert water storage: superhydrophobic sand

Sand, an abundant natural resource, is the cause behind the harsh environmental conditions of the desert, such as water shortages and sand storms. Because of the strong hydrophilicity of sand itself, water can be quickly absorbed by sand, which greatly impedes desert greening, water storage and transportation projects. In contrast to this conventional understanding of sand (i.e., superhydrophilicity), the development of "superhydrophobic sand", is aimed to address issues associated with the desert environment and sand resource utilization. In experiments, three kinds of hydrophobic sands with different surface structures and wettability properties were successfully prepared by cladding nonmetal (SiO_2) and metal (Ag and Cu) inorganic materials on sand grain surfaces and then modifying them with low-surface-energy chemicals. Combining superhydrophobicity with desert sand, superhydrophobic sand is shown to have excellent water repellency, allowing water to stably remain and flow on such a sand surface without any wetting or permeation. Furthermore, the superhydrophobic sand demonstrates a great water-holding capacity, such that a sand layer with a thickness of 2 cm can sustain a water column height of 35 cm. Very significantly, this sand exhibits extremely high thermal stability up to 400 °C when used for water storage. This result is unprecedented and sufficient for facing the high-temperature conditions of the desert environment and some others. In addition to reliable water storage, such superhydrophobic sand also demonstrates a great anti-flow-dragging effect during water transportation, whereby a water droplet can smoothly and quickly roll down a simulated sand channel (13 cm length) within 0.3 s (~0.45 m s^{-1}). All of these manifestations imply the significant potential of such "superhydrophobic sand" in its application to desert water storage and transportation.

Ripunjoy Deka | 5th Semester

ALCOHOL IN SPACE : METHANOL FOR MEASURING MAGNETIC FIELDS

Ankita Phukon | 5th Semester



An important puzzle in astrochemistry has now finally been solved as a team of theoretical chemists and astronomers have succeeded in determining how to measure magnetic fields in space with methanol. This provides a new method for examining the birth of stars and planets. Over the last half-century, many molecules have been discovered in space using radio telescopes. With the help of these molecules astronomers have been able to investigate just what happens in the dark and dense clouds where new stars and planets are born. From the signals of molecules they detect, scientists can measure temperature, pressure and even motion of the gas clouds but not magnetic fields which is one of the major contributors in the creation of stars. During the formation of new stars, methanol molecules occur as so-called 'masers', a phenomenon similar to lasers in which molecules in space emit intense microwave radiation. Astronomers capture this radiation with radio telescopes and use it to derive information about the magnetic fields around a star. Methanol is one of the strongest masers, and is found in areas where high mass stars are born in particular.

With the help of this new calculation scientists can use the strong light signals generated by methanol molecules to measure magnetic fields. A model has been developed in the laboratory of how methanol behaves in magnetic fields, starting from the principles of quantum mechanics & good agreement between theoretical calculations and the experimental data was found. That gave them the confidence to extrapolate to conditions they expect in space. Since methanol is a relatively simple molecule, they thought at first that the project would be easy Instead, it turned out to be very complicated and theoretical chemists Ad van der Avoird and Gerrit Groenenboom, both at Radboud University in the Netherlands, needed to make new calculations and correct previous work. The new results open up new possibilities for understanding magnetic fields in the universe.

FACTS

- Mercury and bromine are the only two elements that change from a solid to liquid at room temperature.
- Osmium is the earth's densest known stable element.
- Copper is the only metal that is naturally antibacterial.
- Water when freezes expands unlike other substances.

GOLDEN GOLD (MEDICINE WITH GOLD)

Gold has been used in medicine for thousands of years.Gold treatment includes different forms of gold salts. It is an effective medicine for controlling different types of arthritis and related diseases.In some people it helps to relieve joint pain and stiffness reducing swelling and bone damage as well as the chance of joint deformity and disability. Gold sodium thiomalate is a gold containing chemical(salt) used in treating rheumatoid arthritis. Other gold salts available include injectable aurothioglucose (solganal) and oral auranofin (Ridaura). Gold alloys are used in implants in various field of medicine and colloid gold is used in immunogold electron microscopy.Np-gold tablet is a combination medicine that is used to relieve pain and inflammation in conditions like ankylosing spondylitis and osteoarthritis. It's applied to relieve fever,muscle pain,back pain,toothache or pain in the ear and throat.

Gold also has some side effects like-

1. Skin rashes or itching,usually mild but in some instances may necessitate stopping treatment.
2. Ulcer,sores or white spot on lips or in mouth or throat
3. Skin pigmentation due to prolonged treatment
4. Loose stools or diahorrea, usually mild and transient.

Manash Jyoti Medhi | 5th Semester

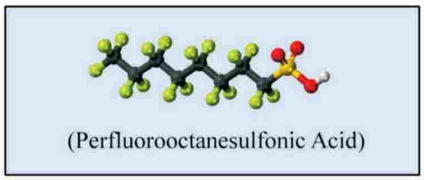
Photo : Cultural Rally, College Week 2020

Lecture by
Dr. Manjit Bhattacharyya,
Associate Professor, Cotton university

DISPOSAL OF "FOREVER CHEMICALS"

Chemicals have become a part of our life, sustaining many of our activities, preventing and controlling many diseases, increasing agricultural productivity. One cannot ignore the fact that these chemicals are also the main reason for our severe health problems and poison our environment. PFAS (Per-and Polyfluoroalkyl Substances) a group of manufactured chemicals commonly used since the 1940s are called "forever chemicals" for a reason. Bacteria cannot eat them; fire cannot incinerate them; and water cannot dilute them. And, if these toxic chemicals are buried, they leach into surrounding soil, becoming a persistent problem for generations to come. It has been in use over 70 years as non-stick and waterproofing agents. They are found in non-stick cookware, waterproof cosmetics, firefighting foams and protective gear, water-repellent and stain-resistent fabrics and products that resist grease and oil. However PFAS have made their way out of consumer goods and into our drinking water. PFAS exposure is strongly associated with decreased fertility, developmental effects in children, increased risks of various types of cancer, reduced immunity to fight infections and increased cholesterol levels.

How to get rid of PFAS, has been completely unclear until now- and the first approaches to destroying the resistant molecules are showing promising results. Heat is the key factor in breaking the carbon-fluorine bonds characteristic of this class of substances. In a study recently published in the Journal of Environmental Engineering the U.S Environmental Protection Agency found that a heat and pressure based technique known as supercritical water oxidation destroyed 99 percent of the PFASs present in a water sample. But the success of heat and pressure based technique does not entirely reduce the threat of forever chemicals. The



(Perfluorooctanesulfonic Acid)

technology is relatively complex and expensive because of the high temperature and heat involved. Also it is somehow unrealistic to clean contaminated soils and groundwater in this way.

Another team of scientists has found a cheap, effective way to destroy so called 'forever chemicals'. The PFAS which are found in spectrum of products and contaminate water and soil around the world, are remarkably durable. The latest innovation in PFAS disposal involves just two common ingredients; lye, which is used to make soap; and dimethyl sulfoxide(DMSO), a solvent that can penetrate human skin and other membranes. DMSO has been approved by the Food and Drug Administration for use in a bladder pain medication and some cancer drug. When combined in boiling water, the mixture successfully degraded a type of PFAS that is found in non-stick cookware and firefighting form. The experiment was done by two researchers of Northwestern University Dr. Dichtel and his graduate student Brittany Trang. They rendered PFAS molecules harmless by mixing them with two inexpensive compounds at a low boil. In a matter of hours, the PFAS molecules fell apart. The new technique might provide a way to destroy PFAS chemicals once they have been pulled out of contaminated water or soil. Although the method does not work on all types of PFAS, it show, promise for breaking down about 40% of forever chemicals that share a similar chemical signature. This new solution has yet to be tested in the field, but it could be scaled up to treat PFAS chemicals off-site after they are filtered out from drinking water or other contaminated resources.

People and wildlife are exposed to hundreds of PFAS simultaneously from various environmental routes, including drinking water, and via consumer products. The special carbon-fluorine structure of PFAS mean that these are the most persistent chemicals we are facing today. High persistence of PFAS means that the past and continuous production and use of PFAS will lead to a build-up in the global environment. The clean-up of PFAS in contaminated sites is extremely challenging at best and impossible when it comes to the vast ocean. Because of their extreme persistence, they will last decades or centuries, even after emissions have ended, exposing future generations and wildlife in every corner of the globe.

Jyotishmoy Sharma | 5th Semester

CLICK CHEMISTRY AND BIOORTHOGONAL REACTIONS

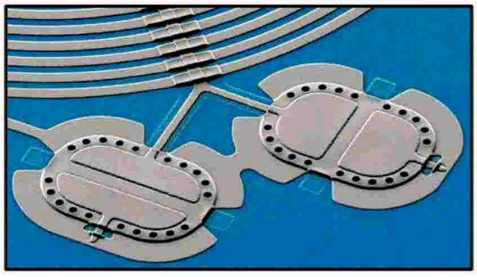
Dibyendu Rakshit | 5th Semester

This year's chemistry Nobel prize is shared equally between the click chemistry pioneers Barry Sharpless and Morten Meldal, and Carolyn Bertozzi, for the development of click chemistry and bioorthogonal chemistry.

The logic behind this chemistry is simple: (1) New molecular properties are needed everywhere and such properties can emerge from the joining of small molecular building blocksand and (2) Existing chemical methods can be developed more, which can make molecular connections easily.

The "click" in click chemistry was meant to convey the type of convenience and satisfaction that is afforded by snapping objects together with a luggage strap connector. It does not matter what the pieces are; if the two ends of the buckle can reach each other, the linkage is made. This powerful idea—that good chemistry can enable impactful chemical entities to be created by anyone—has motivated or supported an enormous range of endeavours in many fields including materials science, surface science, analytical chemistry, chemical biology, and drug development. And since methods for the selective and reliable making of bonds are actually quite difficult to discover, the sibling fields of click and bioorthogonal chemistry have synergistically led to the development of new sophisticated chemical reactions along with the highest level of mechanistic insight.

Biocompatible click reactions can be used to deliver drugs – the first human trial of an anticancer drug that selectively releases the active ingredient at the tumour site is currently underway.Bioorthogonal are reactions of functional groups that are so selective for each other that they can be ligated in a richly functionalized biological milieu. In this context, the term 'orthogonal' stems from studies on protecting group chemistry in peptide synthesis, distinguishing the mutually exclusive reactivity of different protecting groups under specific deprotection conditions. Bioorthogonal chemistry refers to any chemical reaction that can occur inside of living systems without interfering with native biochemical processes. A combination of selective chemical transformations and methods to modify biological species has yielded new insights into cellular processes. Key to these new techniques are bioorthogonal chemical reactions, whose components must react rapidly and selectively with each other under physiological conditions in the presence of the plethora of functionality found within living systems. Bioorthogonal chemistry represents a class of high-yielding chemical reactions that proceed rapidly and selectively in biological environments without side reactions towards endogenous functional groups. Rooted in the principles of physical organic chemistry, bioorthogonal reactions are intrinsically selective transformations not commonly found in biology. Key reactions include native chemical ligation and the Staudinger ligation, copper-catalysed azide-alkyne cycloaddition, strain-promoted [3 + 2] reactions, tetrazine ligation, metal-catalysed coupling reactions, oxime and hydrazone ligations as well as photoinducible bioorthogonal reactions. Bioorthogonal chemistry has significant overlap with the broader field of 'click chemistry'.



BREAKING HEISENBERG: EVADING THE UNCERTAINTY PRINCIPLE

In everyday life, calculating the speed and position of a moving object is relatively straightforward. We can measure a car traveling at 60 kilometer per hour or a tortoise crawling at 0.5 kilometer per hour and simultaneously pinpoint where the objects are located. But in the quantum world of particles, making these calculations is not possible due to a fundamental mathematical relationship called the uncertainty principle. Formulated by Werner Heisenberg in 1927, the uncertainty principle states that we cannot know both the position and speed of a particle, such as a photon or electron. In other words, if we could shrink a tortoise down to the size of an electron, we would only be able to precisely calculate its speed or its location, not both at the same time. Recently, a team consisting or Prof. Mika Sillanpää at Aalto University, Finland & Matt Woolley (University of KJew South Wales, Australia) have shown that there is a way to get around the uncertainty principle. Instead of elementary particles, they carried out the experiments using much larger objects: two vibrating drumheads one-fifth of the width of a human hair. The drumheads were carefully coerced into behaving quantum mechanically. In their work, the drumheads exhibit a collective quantum motion. The drums vibrate in an opposite phase to each other, such that when one of them is in an end position of the vibration cycle, the other is in the opposite position at the same time. In this situation, the quantum uncertainty of the drum's motion is cancelled if the two drums are treated as one quantum-mechanical entity. This means that the researchers were able to simultaneously measure the position and the momentum of the two drumheads -- which should not be possible according to the Heisenberg's uncertainty principle. Breaking the rule allows them to be able to characterize extremely weak forces driving the druhaheads. One of the drums responds to all the forces of the other drum in the opposing way, kind of with a negative mass, according to them. Furthermore, the researchers also exploited this result to provide the most solid evidence to date that such large objects can exhibit what is known as quantum entanglement. Entangled objects cannot be described independently each other, even though they may have an arbitrarily large spatial separation. Entanglement allows pairs of objects to behave in ways that contradict classical physics, and is the key resource behind emerging quantum technologies. A quantum computer can, for example, carry out the types of calculations needed to invent new medicines much faster than any supercomputer ever could.

Sohail Akhter | Bitupan Deka
1st Semester

QUANTUM SPIN LIQUID

In 1973, Philip W. Anderson theorized the existence of a new state of matter that has been a major focus of the field, especially in the race for quantum computers.This bizarre state of matter is called a quantum spin liquid and, contrary to the name, has nothing to do with everyday liquids like water. Instead, it's all about magnets that never freeze and the way electrons in them spin. In regular magnets, when the temperature drops below a certain temperature, the electrons stabilize and form a solid piece of matter with magnetic properties. In quantum spin liquid, the electrons don't stabilize when cooled, don't form into a solid, and are constantly changing and fluctuating (like a liquid) in one of the most entangled quantum states ever conceived. A quantum spin liquid is a phase of matter that can be formed by interacting quantum spins in certain magnetic materials. Quantum spin liquids (QSL) are generally characterized by their long-range quantum entanglement, fractionalized excitations, and absence of ordinary magnetic order. The simplest kind of magnetic phase is paramagnet, where each individual spin behaves independently of the rest, just like atoms in an ideal gas. This highly disordered phase is the generic state of magnets at high temperatures, where thermal fluctuations dominate. Upon cooling, the spins will often enter a ferromagnet (or antiferromagnet) phase. In this phase, interactions between the spins cause them to align into large-scale patterns, such as domains, stripes, or checkerboards. These long-range patterns are referred to as "magnetic order," and are analogous to the regular crystal structure formed by many solids. Quantum spin liquids offer a dramatic alternative to this typical behavior. One intuitive description of this state is as a "liquid" of disordered spins, in comparison to a ferromagnetic spin state, much in the way liquid water is in a disordered state compared to crystalline ice. However, unlike other disordered states, a quantum spin liquid state preserves its disorder to very low temperatures. A more modern characterization of quantum spin liquids involves their topological order, long-range quantum entanglement properties. The conditions required to form quantum spin liquid is often found in nature and the most common example is copper based mineral Herbertsmithite. Materials supporting quantum spin liquid states may have applications in data storage and memory. In particular, it is possible to realize topological quantum computation by means of spin-liquid states. In the near future, development of quantum spin liquids may also help us in the understanding of high temperature superconductivity.

Mrigakshy Chakravarty
5th Semester

FACTS

- Every hydrogen atom in our body is likely 13.5 billion years old because they were created at the birth of the universe.
- Chalk is made of trillions of microscopic skeleton fossils of plankton.
- Foods like ranch dressing or coffee creamer contain titanium dioxide which can also be found in plastic , paint and sunscreen.

CHEMISTRY OF THE RUSTY PLANET, MARS

Mars, the fourth planet in our solar system , named after the Roman God of War, is quite special to us Earthlings. That is due to the fact that Mars is a terrestrial planet with an atmosphere having a crust with elements similar to that of Earth's. With other features such as craters, valleys, dunes, polar ice caps and its two small moons : Phobos and Demios ; it is the most suitable planet to host human beings if we someday need to flee earth.

It's quite a bit shocking how we hope to colonise the Red Planet one day.Now to get a broad idea about the chemistry on Mars let us take a trip to the Red Planet.As we set foot on the rocky planet we might feel shivering cold as the temperature is very low there. That is due to the fact that Mars is at a greater distance from the Sun and it has a very thin atmosphere composed mainly of carbon dioxide. The average temperature is about -80°F, although it can range from -195°F near the poles during winter to as much as 70°F at midday near the equator. The planet's thin cold atmosphere is why liquid water likely cannot exist on the Martian surface. The atmosphere on Mars is 95.32% carbon dioxide, 2.7% nitrogen, 1.6% argon, 0.13% oxygen and 0.08% carbon monoxide, with minor amounts of water , nitrogen oxide, neon, krypton and xenon. The CO_2 rich atmosphere is about 100 times less dense than on Earth's , but it is nevertheless thick enough to support weather, clouds and winds.

We might be amused by how red the planet is. The bright rust colour is due to iron rich minerals in its regolith . The iron minerals oxidize or rust giving the planet's soil a reddish appearance, hence the name The Red Planet.

The surface of the planet consists of minerals containing silicon and oxygen, metals, and other materials that typically make up rock. Explains the rocky terrains of Mars covered deeply by finely grained iron(II) oxide dust. As we move down the surface we find a metallic core consisting primarily of iron and nickel with about 16-17% sulfur. Surrounded by a silicate mantle the iron(II) sulfide core is about twice as rich in lighter elements like oxygen and hydrogen as Earth's. Besides silicone and oxygen , the most abundant elements on the Martian surface are magnesium, iron, aluminium, calcium, and potassium.

Now let's continue the journey to Olympus Mons, the largest volcano in the solar system, located on Mars. The gigantic volcano is rich in composed of silicates, iron oxide, aluminium, magnesium, calcium, and sulfur dioxide.

From there as we move to the poles we will come across the polar caps. The caps hold enough water if melted will cover the entire surface of the planet upto 11 metres deep. The caps are covered in frozen CO_2. Though the planet now may appear dry to us, once the planet is suspected to be covered with an ocean 1000 metres deep. But now water exists only as ice at the caps and also beneath the Martian surface. Now as we have completed our journey there might be a question how will we ever colonize mars with such rocky terrains, lack of vegetation, alkaline soil, no precipitation ,and freezing temperature etc. Well Elon Musk has an idea. Musk plans to use a series of low fallout nuclear explosions to heat up the planet's poles to release the frozen carbon dioxide. CO2 being a greenhouse gas will trap the heat and eventually raise the planet's temperature to create a more hospitable atmosphere. Let's hope he succeeds in his plans to colonize Mars. Wouldn't it be great living on Mars , having Martian citizenship altogether? Until then let's try not to destroy our current home Earth with plastic, pollution , etc.

Nihar Ranjan Thakuria
1st Semester

ICE CUBE OF JELLY

Jelly ice cubes or reusable ice cubes is a very recent and ingenious invention by the researchers of University of California,Davis, which can prove to be a useful applicant in far-future food innovation. It may one day replace the regular ice cubes in our cold drinks!

Jelly and regular ice cubes use the same cooling agent i.e.water. The chemistry behind ice cube's cooling effect is pretty simple. Ice cube melts by absorbing maximum heat required for melting thereby cooling the area from where heat was absorbed. Something similar happens in case of jelly ice cubes, the key difference being the structure and composition,as it uses hydrogel . The gel structure traps the water,which melts in case of ordinary ice. Jelly ice can thus be repeatedly frozen and thawed.

Jelly ice cubes may make the storage of frozen food more cleaner.As regular ice melts, bacteria can hitch a ride in that water to other foods stored in the same place. In this way ,it can cross contaminate food commodities. But hydrogel doesn't turn to liquid and can also be cleaned with bleach.In the field of cooling effect, regular ice cubes prove to be more efficient but only by a small difference .

One of the major advantages of this ice cube is that it is eco-friendly,which is a very important characteristic in today's world. It's sponge structure is made mostly of a protein called gelatin (a substance made from animal collagen usually bones and cow or pig hides), which makes it a very good compost. After about 10 uses,one can use these cubes to boost garden growth. Re-using these also saves water.Another benefit is that it can be molded into any shape. And that's what has research, medical and food companies interested. For *e.g. hydrogel* could be used to hold test tubes. When scientists need test tubes to stay cold outside the freezer, they often put them into a tub of ice. But maybe,the gel instead could be fashioned into a shape where we could put the test tubes. Even though reusable ice cubes has it's advantages , it is said to be still working on, which gives it room for even more efficiency.

Rikita Das Gupta
5th Semester

SWEET PLASTICS :
DEGRADABLE PLASTICS USING SUGAR COMPOUNDS

Swagata Mazumder
1st Semester

Packaging waste forms a significant part of municipal solid waste and has caused increasing environmental concerns. A wide range of oil-based polymers is currently used in packaging applications which are all non-biodegradable, and some are difficult to recycle or reuse due to being complex composites. Recently, significant progress has been made in the development of biodegradable plastics, from renewable natural resources. Development a new class of degradable plastic polymers using sugar compounds resulted from the collaboration of scientists from the UK's University of Birmingham and the Duke University , US. They have developed the two new polymers, starting with sugars : one that is stretchy like rubber, and another that is tough but pliable like many plastics used in everyday life.These two polymers are based on isosorbide and isomannide , produced by using sugars as a starting point for synthesis. Both polymers have superior properties to conventional thermoplastic elastomers, and are degradable and mechanically recyclable. The polymer made from isosorbide displayed superior elastic recovery and toughness, which was shown to be a result of the stereochemistry of the sugar groups in the materials. The isoidide-based polymer showed a stiffness and malleability similar to common plastics, and a strength that is similar to high grade engineering plastics such as Nylon-6. The researchers showed that the difference in elastic recovery results from the way that the sugar stereochemistry directs the network of hydrogen bonds between and within the long-chain molecules. The researchers found that the mechanical properties and degradation rates can be controlled independently of one another. Hence, this system opens the door to using the unique shapes of sugars to independently tune the degradability for a specific use without significantly altering the properties of the material.The complex structure and stereoisomerism found in natural compounds provide an advantage in creating mechanically robust sustainable materials. However, the most outstanding feature of this system is the distinct property difference arising from stereochemically distinct hydrogen bonding in otherwise compositionally and stoichiometrically identical materials. It has been shown that the ability to independently tune, or decouple, the hydrolytic degradation rate from the thermomechanical properties while also controlling these features through simple copolymerization or blending strategies. Simply, it affords a path to materials with on-demand property by tuning, which is made possible only by stereochemistry manipulation.

Photo : Releasing the wall magazine PSI, 2021

Photo : Cultural Rally, College Week 2022

FACTS

- Water's solid state is less dense than its liquid state . This results in ice floats on water.
- DNA is flame retardant . When its heated up phosphorus generates phosphoric acid that chemically replaces water and produces flame.

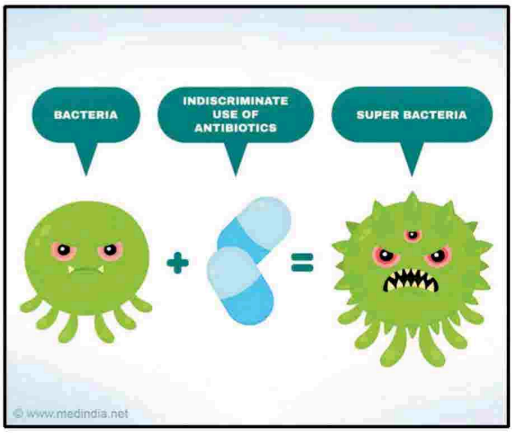
THE SILENT PANDEMIC : ANTIBIOTIC RESISTANCE

Jumoni Sharma | 1st Semester

An antibiotic is a type of antimicrobial substance active against bacteria. It is the most important type of antibacterial agent for fighting bacterial infections, and antibiotic medications are widely used in the treatment and prevention of such infections. They may either kill or inhibit the growth of bacteria.

Antibiotic resistance is sometimes referred to as the silent pandemic – a contagion that spreads without us really knowing its extent or severity. But research is in progress to find new ways of fighting bacteria. And as with COVID-19, everyone can help to reduce the spread – and save lives. Now, it is time to stop referring to the antibiotic resistance pandemic as 'silent'. Continuing to use such a term denies the reality that antibiotic-resistant bacterial infections, driven by misuse and abuse of antibiotics by humans against microbial ecosystems that we should be living in symbiosis with, is wrong. Now, how does this resistance develop? Some bacteria are naturally resistant to antibiotics & others acquire resistance to antibiotics. This can happen through mutations, where the bacterium develops resistance by chance as it divides, giving it a survival advantage. It can also happen when bacteria transfer resistance genes between one another via what are known as plasmids, tiny DNA molecules that bacteria usually share with one another. According to one forecast, we risk being in a situation within a generation, by 2050, where 10 million people a year worldwide die from infections involving resistant bacteria. But the problem has more dimensions than can be expressed purely in terms of death rates. If there are no drugs that can be used to deal with it , it becomes less self-evident that people should expose themselves to situations in which the risk of contracting an infection is heightened. Such situations include all surgeries, cancer treatments and immunosuppressive therapies, to name but a few, it may be risky to even visit a hospital, where resistant bacteria are naturally more prevalent than in many other settings.

Uses of antibiotics sparingly-Using fewer antibiotics gives bacteria fewer exposure opportunities, which delays the development of resistance. Today, the food industry uses as many antibiotics as the healthcare sector. Another important aspect is to reduce the release of antibiotics into the environment from sewage, for example, or from factories that manufacture them. We can prevent it by following only the course of treatment exactly as prescribed by the doctor. If we get a chance to shout from the rooftops to regain the attention that antibiotic resistance deserves, it's time to think more carefully about the terminology we use, humans need to take responsibility for the destruction of a (microbial) environment, which should be protected from antibiotics except when clearly necessary, in order to limit further emergence of bacterial resistance and maintain health through critical human–microbial and animal–microbial symbiotic relationship.



STUDENTS ATTENDED ONE DAY WORKSHOP IN IIT GUWAHATI

On 21 September 2022, 17 students of Department of Chemistry, Pragjyotish College with Dr. Saitanya Kr. Bharadwaj, Assistant Professor visited IIT Guwahati to attend a one day workshop. The workshop is organized with an objective to introduce various Advanced Scientific Instruments to the undergraduate students under the scientific social responsibility scheme sponsored by DST-SERB under the guidance of Dr. Chivukula Vasudeva Sastri, Professor Department of Chemistry, IIT Guwahati.

The workshop gave a chance to get familiarized with the following instruments namely Differential scanning colorimeter (DSC), Field emission scanning electron microscope (FESEM), X-ray diffraction (XRD), Single crystal XRD, Atomic force microscope (AFM), Nuclear magnetic resonance spectroscopy (NMR), X-ray photoelectron spectroscopy (XPS), Universal testing machine (UTM), Glove box and Diode array spectrophotometer. All instruments were guided by an operator who explained in details about the instruments like its basic/governing principle, uses, pros and cons. During the tour, students jotted down some notes and had a question-answer session regarding the instruments. They also interacted with the research scholars regarding the future options and various perspectives in these fields. The conduciveness of the environment of the institution helped them to learn more on the usage and need for such instruments which could help students to apply in future especially for those who are

interested in the field of research.

The workshop ended at about 3:00 pm. They were offered tea, lunch and snacks. They returned with a positive thought of doing something in the field of science. It can be concluded that the trip was successful and they believed that the objective was achieved. They learned something new and beneficial for them. They are thankful to their teacher for whom they got this opportunity to take part in the workshop and to witness the highly sophisticated instruments and labs so closely, and also to get a chance to talk with the PhD scholars during their graduation period. They are indebted to Prof. C. V. Sastri for organizing such workshop for undergraduate students.

IS BORON NITRIDE THE NEW CARBON?

Graphene had a substantial impact on transport, medicine, electronics, energy, defence, desalination; and other major fields. However, with the introduction of single atom thin hexagonal boron nitride (hBN), which has been named "White graphene" for its transparency and properties similar to that of graphene. It can also withstand higher temperatures than graphene, and is an electrical insulator unlike graphene. The properties of hBN can be enhanced when rolled into nanotubes, which are rolled up sheets of single layered atoms. Hexagonal boron nitride, similar to graphene, possesses a chicken wire-like chemical structure. This chicken wire structure in graphene is made completely of carbon atoms organised in a hexagonal repeating pattern. The hexagons in hBN are made up of alternating boron and nitrogen atoms. Researchers have discovered that two-dimensional sheets of hBN have excellent strength, stiffness, and resilience at high temperatures. These qualities are enhanced further when hBN sheets are rolled into nanotubes, especially when the nanotubes are aligned. However, synthesising stable and high quality hBN nanotubes is difficult as the efforts have resulted in non-aligned and low quality tubes. Scientists suggest that successful synthesis of aligned and stable nanotubes might help in use in physical devices, membranes and composites.

By,
Radhika Mishra,Alumni 19-22 Batch
Reference:
https://news.mit.edu/2022/nanotube-boron-nitride-1031

TRANING PROGRAM IN PANDU COLLEGE

On the date of 17 November, 2022 four students from Pragjyotish College visited the prestigious Pandu College. Our objective was to attend a "Hands on Training Program for Sophisticated Instrument Facilities".

The event was organised by Pandu College to introduce Fourier Transform Infrared (FTIR) spectrometer, UV-visible spectrometer and gas chromatography to students of different institutions. Our visit earned us a lecture from respected Dr. Arabinda Baruah sir, Assistant professor of Guahati University and explainaton of the inner workings of the aforementioned instruments by resources person of Agilent technologies. The lecture given by Dr. Barauh was very informative and interactive. It helped us to fill up the holes in our knowledge and ignited a new passion for the topic. In our session with representatives of Agilent Technologies we got to see the instrumentation and inner workings of the instrument which we have only seen in illustrations. Our workshop ended at about 4 pm. In the end we enjoyed the lunch offered by the organizers.

After our visit we came back home with a newfound interest on spectroscopy. It can be concluded that the trip was successful and we believed that our objective was achieved. We would like to thank Pandu College for their initiative and also our teachers for encouraging us to take this opportunity, take part in the program and witness the highly sophisticated instruments so closely, and got a chance to attend an lecture from Dr. Arabinda Baruah sir.

Gourav Jyoti Dutta
5th semester

NATIONAL SCIENCE DAY WAS OBSERVED BY PRAGJYOTISH COLLEGE STUDENTS

On the occasion of the National Science Day, the 5th semester honours students of the Chemistry Department, Pragjyotish College, under the departmental forum "*Dhatu*", demonstrated different interesting and adventurous chemical experiments among the school students of Kaliram Barua Girls' High School, Bharalumukh.*National Science Day* (NSD) is celebrated every year on 28th February to honour the discovery of the Raman effect by *Sir Chandrasekhara Venkata Raman*. The main aim of the celebration is to share the importance of science and inculcate scientific temperament among the students through quizzes, lectures, competitions, and showing experiments.Students of the Department of Chemistry, Pragjyotish College celebrate the NSD every year by doing different activities on the college campus. This year the forum decided to visit a nearby school to show some magical chemical experiments. The same was performed with the prior permission of the Headmistress of *Kaliram Barua Girls' High School* at Bharalumukh. Students of the school were very excited and expressed their views towards taking up a scientific life. The college students also showed some experiments from their textbooks and explained the concept of acid-base, redox reactions, precipitation reactions, science in everyday life etc. School students also got some hands-on training during the event.

দুহিতা ...a column dedicated to woman achievers in the field of science and technology

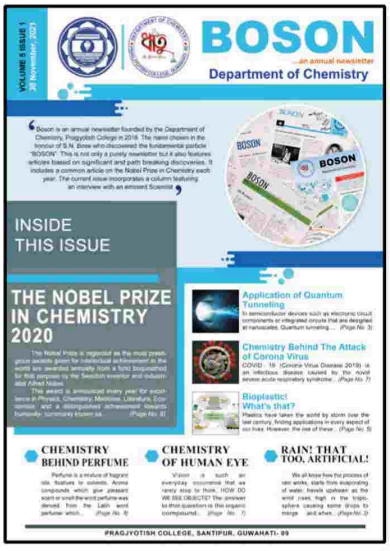
নল্ল'থ'ম্বি কালাইছেল্‌ভি ঃ CSIR ৰ প্ৰথমগৰাকী মহিলা মুৰব্বী ঃ

'The Council for Scientific and Industrial Research', চমুকৈ CSIR -ৰ প্ৰথমগৰাকী মহিলা মুৰব্বী হিচাপে বিভিন্ন মহলৰ দৃষ্টি আকৰ্ষণ কৰিবলৈ সক্ষম হৈছে আত ৰ্জাতিক খ্যাতিসম্পন্ন বিজ্ঞানী নল্ল'থ'ম্বি কালাইছেল্‌ভিয়ে। তামিলনাডুৰ থিৰুনেলভেলি জিলাৰ বিক্ৰমসিংহপুৰম নামৰ এখন সৰু চহৰত জন্ম লাভ কৰা কালাইছেল্‌ভিয়ে তামিলনাডুৰ চৰকাৰী শিক্ষানুষ্ঠানতে স্কুলীয়া আৰু কলেজীয়া শিক্ষা সমাপ্ত কৰে। উল্লেখ্য যে দেউতাক আৰু শিক্ষকসকলৰ দ্বাৰা তেওঁ এজন ল'ৰাৰ দৰে ডাঙৰ দীঘল হৈছিল। কালাইছেল্‌ভিৰ এগৰাকী সহকৰ্মীয়ে তেওঁৰ শৈশৱকালৰ কথা সুৱৰি এইদৰে কৈছে ঃ "এজন শিশু হিচাপে কালাইছেল্‌ভিয়ে ল'ৰাই খেলা সকলো খেল খেলিছিল আৰু সেইবোৰ উপভোগ কৰিছিল।" পৰৱৰ্তী কালত তেওঁ চিদাম্বৰমৰ আন্নামালাই বিশ্ববিদ্যালয়ৰ পৰা ডক্টৰেট ডিগ্ৰী লাভ কৰে। কালাইছেল্‌ভি আৰম্ভণিতে আছিল এগৰাকী জৈৱ ৰসায়নবিদ (Organic Chemist)। ডক্টৰেট ডিগ্ৰী লাভ কৰাৰ পিছত তেওঁ এখন ব্যক্তিগত মহাবিদ্যালয়ত ছাত্ৰ-ছাত্ৰীসকলক জৈৱ ৰসায়ন পঢ়ুৱাইছিল। পিছলৈ তেওঁ গৱেষণাৰ প্ৰধান ক্ষেত্ৰ হিচাপে নিৰ্বাচন কৰে ***'বিদ্যুৎ ৰসায়ন বিভাগ'***। এই ক্ষেত্ৰৰ এগৰাকী কৃতবিদ্য গৱেষক হিচাপে কালাইছেল্‌ভিয়ে 'লিথিয়াম-আয়ন বেটাৰী'ৰ দক্ষতা বৃদ্ধি কৰাৰ ক্ষেত্ৰত অভূতপূৰ্ব সফলতা লাভ কৰে, যিয়ে তেওঁক উক্ত ক্ষেত্ৰৰ এগৰাকী অন্যতম শ্ৰেষ্ঠ বিজ্ঞানী হিচাপে তেওঁৰ স্থান নিৰূপন কৰে। এই সন্দৰ্ভত কালাইছেল্‌ভিৰ পূৰ্বৰ এগৰাকী সহকৰ্মীয়ে লিখিছে ঃ "She is credited with developing novel used as electrodes in lithium-ion batteries that improve their storage capacities"

উল্লেখ্য যে ১৯৯৭ চনত নল্ল'থ'ম্বি কালাইছেল্‌ভিয়ে "Central Electochemical Research Institute" -ত বিজ্ঞানী হিচাপে যোগদান কৰে আৰু ২০১৯ চনত উক্ত অনুষ্ঠানৰ সঞ্চালক পদত অধিষ্ঠিত হয়। CECRI -ত এগৰাকী জৈৱ ৰসায়নবিদ হিচাপে যোগদান কৰা কালাইছেল্‌ভিয়ে কিদৰে বিদ্যুৎ ৰসায়ন বিভাগলৈ নিজৰ গৱেষণা-কৰ্ম স্থানান্তৰিত কৰে সেই সন্দৰ্ভত এগৰাকী বিজ্ঞানী ড° প্ৰেম কুমাৰে কৈছে ঃ "But she took a liking for electrochemistry when she started working on lithium-ion batteries. She is a very fast learner and soon started publishing research paper on the subject." কালাইছেল্‌ভিয়ে পৰৱৰ্তী সময়ত কেইবাটাও বৃহৎ প্ৰকল্প লাভ কৰে আৰু Raman Fellowship ৰ অধীনত টেক্সাছ বিশ্ববিদ্যালয়ত গৱেষণা কৰ্ম আগবঢ়ায়।

মনকৰিবলগীয়া যে নল্ল'থ'ম্বি কালাইছেল্‌ভি যে কেৱল এগৰাকী অন্যতম শ্ৰেষ্ঠ বিজ্ঞানী সেইটো নহয়; ইংৰাজী আৰু তামিল ভাষাৰ এগৰাকী সুবক্তা হিচাপেও তেওঁৰ ৰৈ ৰৈ যোৱা খ্যাতি আছে। তেওঁ নানা ব্যস্ততাৰ মাজতো স্কুল-কলেজসমূহত তৰ্ক প্ৰতিযোগিতা, আলোচনাচক্ৰ আদিৰ আয়োজন কৰি ছাত্ৰ-ছাত্ৰীসকলৰ মানসিক বিকাশ সাধনত গুৰুত্বপূৰ্ণ ভূমিকা পালন কৰি আছে।

সংগ্ৰহ ঃ ড° পৰশমণি দাস



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Editor's Message

I'm afraid that it may sound like a YouTube video's end message, but I will try my best . If you have reached this portion and are still proceeding to read further, then congratulations to us. Now, I can assume that we have been successful in giving an interesting newsletter this year. It's just an effort to create kinks in the plateau of so -called monotonous science learning. We believe that learning science should be like learning about life , which resembles the spectra from a spectrophotometer ,with great signals accompanying a lot of noises. It devoids monotone and so do we. It's been great working and learning with new students entering college as well as with the old ones.

I hope this edition will give at least a quanta of new information. Thank you.

Regards,
Ashif Mustafijur Rahman

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