Newsletter

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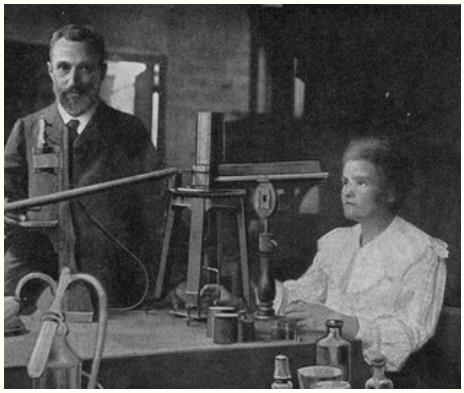
CHEMINFO

A Newsletter by Department of Chemistry

A Breif History of chemistry

The history of chemistry spans a period from very old times to the present. Since several millennia BC, civilizations were using technologies that would eventually form the basis of the various branches of chemistry. Examples include extracting metals from ores, making pottery and glazes, fermenting beer and wine, extracting chemicals from plants for medicine and perfume, rendering fat into soap, making glass, and making alloys like bronze.

Chemistry was preceded by its protoscience, alchemy, which operated a non-scientific approach to understanding the constituents of matter and their interactions. Despite being unsuccessful in explaining the nature of matter and its transformations, alchemists set the stage for modern chemistry by performing experiments and recording the results. Robert Boyle, although skeptical of elements and convinced of alchemy, played a key part in elevating the "sacred art" as an independent, fundamental and philosophical discipline in his work The Sceptical Chymist.



While both alchemy and chemistry are concerned with matter and its transformations, the crucial difference was given by the scientific method that chemists employed in their work. Chemistry, as a body of knowledge distinct from alchemy, became an established science with the work of Antoine Lavoisier, who developed a law of conservation of mass that demanded careful measurement and quantitative observations of chemical phenomena. The history of chemistry afterwards is intertwined with the history of thermodynamics, especially through the work of Willard Gibbs.

Principal's Column

I am extremely happy to know that the department of chemistry is bringing out its first volume of news letter "CHEMINFO", for the session 2022-23.The newsletter contains information about the activity and achievements of the department and a few selected articles on chemical science.This sort of newsletter will give the students right kind of support and encouragement and it will stimulate their creative thinking.

I convey my best wishes to the department in their splendid work.

Dr. Bhushan Chandra Pathak,
Principal,B.H College

Weird chemistry

Aktaruz zaman

1.Eels on cocaine

Researchers in Italy carried out an odd recent study involving eels. To determine the drug's effect on eels they exposed them to low-level doses of cocaine. They found this caused a degree of hyperactivity in the eels, as you'd probably expect but also led to thinking of their skin and the innings of their intestines. It also affected their hormone production.

This study did actually have a serious point.Eels can be exposed to cocaine as a result of polluted river water and it's estimated that 15g of cocaine flow through Italy's Sarno river every day. The study suggests cocaine could impact the eel's ability to protect themselves.

From disease and produce alarm pheromones and could affect their life cycles.

2.Glass is a liquid

A fun chemistry fact that may shock you is that glass is not solid – it is in fact, a liquid. That's right! However, as the glass molecules flow very slowly, this means they will not shatter or change shape. Often, this state is known as being amorphous somewhere between the two: a solid and a liquid.

3.Water expands when freezes

Typically, when something is cold, it shrinks. That's because temperature describes atomic vibration — the more vibration, the more space it takes, hence expansion. Water is an exception. Even though it vibrates less when it's frozen, the ice occupies more volume. That's due to the strange shape of the water molecule.

If you remember your Chemistry 101, the water molecule looks like Mickey Mouse, the oxygen atom sitting at the center (the face) and two hydrogen atoms each at an angle (Mickey's ears). Because of how oxygen and hydrogen bond, the water molecule is an open structure with a lot of space. When water freezes it releases energy because a lot of extra strong bonds can be made. But it does take up more space. And so, ice expands when it freezes. Another interesting fact worth mentioning is that hot water freezes faster than cold water.

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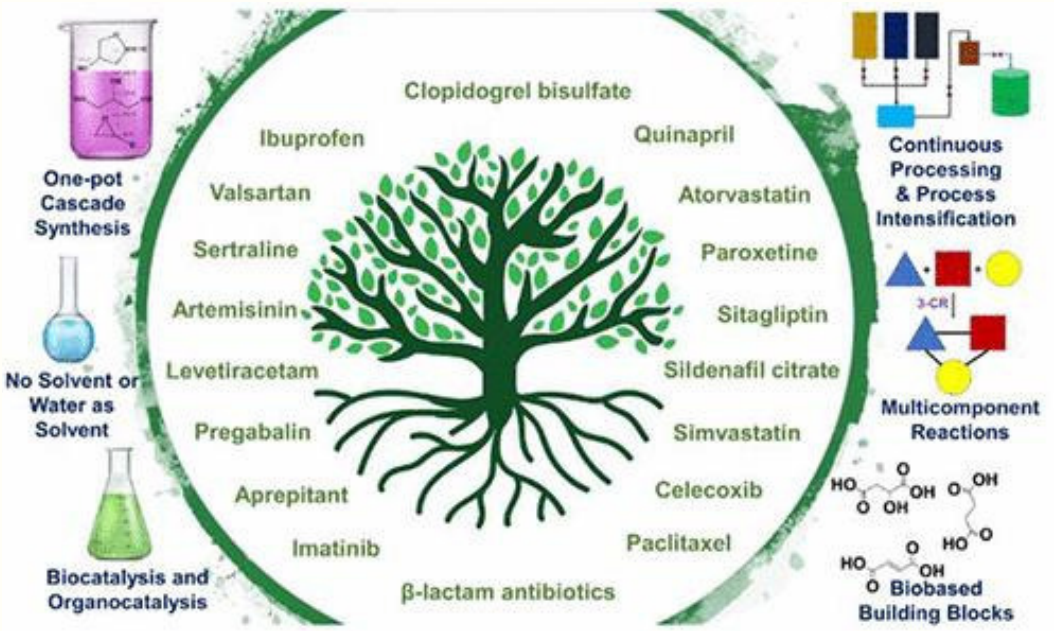
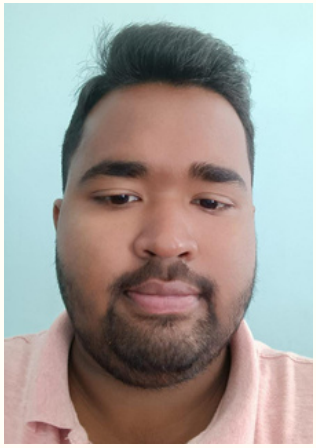
Green Approaches In Medicinal Chemistry for Sustainable Drug Design





Pankaj Saha

A guide to understanding and implementing effective green medicinal Chemistry for improved sustainibility is the drug discovery process. Extensive experimental and high failure rates are a well recognized downside to the drug discovery process, with the resultant high levels of inefficiency and waste producing a negative environmental effect. "Green Approaches in medicinal chemistry for sustainable Drug Design" reveals how medicinal chemistry can play a direct role in adressing the issue. It encourages the growth of green medicinal chemistry and supports medicinal chemist,drug discovery researchers,organic chemist,pharmacologists and all those in related fields across academic and industry in integrating these approaches into their own work.

It highlights the need for adoptis of Sustainable and Green Chemistry pathways. It also reveals risk factor associated with the drug development process and the ways Sustainable approaches can help.Additionally it identify novel and cost effective green medicinal chemistry approach for improved effeciency and Sustainibility.

Nishanta Buzarbaruah

"Agricultural Chemistry" is the study of chemistry and biochemistry in relation to the agricultural field. In agricultural chemistry, factors such as agricultural production, the utilization of agricultural products, and environmental matters are studied and ways to improve them are developed. In agricultural chemistry, the relationship between plants animals and the environment is emphasized to procure improvements in the agricultural sector.

For example Application of lime or gypsum and research into and usage of weed control chemicals.

When chemical processes can be initiated into the soil, which can in turn affect, or influence the biochemical processes of plants by altering things like the nutritional value, or increasing yield, etc. it becomes very useful to agriculture as a whole as it helps minimize wastage and maximize production value in an efficient way. The branch of chemistry which deals with this is agricultural chemistry. It discusses solutions such as the addition of stimulants, or herbicides for growth. It introduces chemical processes into agriculture and its research is intertwined with other subjects such as forest conservation, the science of soil, meteorology, plant biochemistry, etc.
It deals with plant nutrition, the interaction between soil and fertilizers added to that soil, as well as the types of fertilizers and how they must be administered to improve plant life, quality of the yield and the quality of the soil.
Agricultural Chemistry can be defined as the science of chemistry and biochemistry in relation to agriculture and agricultural practices with the objective of improving the quality of soil and plant nutrition, increasing yield and preserving the environment.

The importance of chemistry in our lives is unprecedented. While it has its relevance in the larger sense of photosynthetic activity which is directly responsible for the air that we breathe in, chemistry also has the enormous potential to provide practical solutions to our lives, to alter the way we live and give us more convenience.While it is quite easy to view agriculture as purely biological activity, from the processing of food to the addition of preservatives, to the way fertilizers are used to improve the quality of the soil we grow our food in, chemical activity has a very large role to play.
Take for instance photosynthesis. The process of photosynthesis subscribes to the very simple, yet important chemical reaction of carbon dioxide reacting with water to produce glucose and oxygen.

$CO_2 + H_2O \rightarrow C_6H_{12}O_6 + O_2$

The existence of carbon dioxide in the atmosphere is directly utilized by the plant, which is why it continues to live, and grow, and produce oxygen as a net result which is responsible for life on earth. Having the knowledge of the enormous role photosynthesis has to play in plant life, man has been able to find innovative ways to create conducive conditions to allow plants to maximize their potential for photosynthetic activity.

Knowledge of this chemical process allows farmers and people engaged in agriculture to plant their seeds in places of sunlight and provide necessary requirements for the plant to utilize this sunlight to their maximum potential. Similarly, another important role chemistry plays in agriculture is in fertilizers. Fertilizers are organic, or even inorganic substances which, when administered to the soil, can supply the plant with an abundance of the nutrients they require to grow. Depending on the quality of the soil, there are different fertilizers that can be applied to it. Sometimes the soil does not have all the required nutrients for most efficient plant growth, hence, this becomes a very lucrative way to increase efficiency.

Organic fertilizers are those fertilizers that are generated from organic substances such as animal manure, compost, and other such natural discards. These substances are added to the soil for periods of time where microorganisms break them down and improve the nutrient content by increasing the amount of nitrogen, calcium, magnesium, phosphorus, sulfur, etc. in the soil. These fertilizers are then added to the soil in which plants grow, and they perform their functions on the plants.

Inorganic fertilizers on the other hand are synthesized fertilizers. The by-product is usually ammonia, which is then added with nitrogen to create urea or anhydrous ammonium nitrate. These fertilizers can help raise crop yields. One of the drawbacks of inorganic fertilizers is that it reduces the quality of the soil and the land over time. This along with drastic and rapid urbanization has also affected the land quality, which finds itself degrading over time. There is a large scope for mass desertification in the coming years, which is why farmers are weaning away from inorganic fertilizers.

Haber-Bosch Process-

The Haber-Bosch process is the process by which inorganic fertilizers are generated. It was created by Fritz Haber, a German chemist who won the Nobel Prize in 1918 for his efforts. Before this method was invented, it was not economically lucrative for farmers to purchase ammonia as it was a complicated process to generate. After Haber, it became easy for ammonia to be generated and then marketed to people.

The Haber-Bosch process was the first time an industrial chemical process used high pressure. This was done by taking nitrogen from the air along with hydrogen and subjecting them to extremely high pressures in decent temperatures. Ammonia is immediately extracted from the product formed. The lower the temperature, the higher the pressure, more the ammonia generated. At the commercial level, the temperature is from 400 degrees Celsius to 650 degrees Celsius and the pressure used ranges from 200 to 400 atmospheres.

Other Uses-

Agricultural Chemistry is used in the production of pesticides and insecticides, which are used on a large scale to prevent external organisms from harming the crops. This includes rodenticides, pediculicides, biocides, fungicides, herbicides, etc.

Agricultural Chemistry is used in the production of irrigation pipes, for the storage and preservation of crops and other products, in food processing, and in the salvage of chemicals. from agricultural waste.

Mahbuba Rahman Masum

In ancient India, chemistry was called “Rasayana” in Sanskrit. It is derived from the word “Rasa,” which means “extract,” maybe from roots, leaves, and stems of plants.
Ancient India's development in chemistry was not confined but found development in a variety of practical activities. In any early civilization, metallurgy has remained an activity from the Bronze Age and the Iron Age, to all other civilizations that followed.

In India , certain objects testify to the higher level of metallurgy achieved by the ancient Indians. By the side of Qutub Minar, a World heritage site, in Delhi, stands an Iron Pillar. It has been standing in the open for last 1500 years, withstanding the heat , wind and weather, but still has not ternished , except very minor natural erosion. This kind of rust proof iron was not possible till iron and steel was discovered few decades before.

The advance nature of ancient India's chemical science also finds expression in other fields, like distillation of perfumes and fragment ointments, manufacturing of dyes and chemicals, polishing of mirrors, preparation of pigments and colours. Paintings found on walls of Ajanta and Ellora (World heritage sites) which look fresh even after 1000 years, also testify to the high level of chemical science achieved in ancient India.

TYPES OF RASAYANA in ancient India :

- Pranamya – Promoter of vitality and longevity
- Medhakamya – Promoter of intelligence.
- Srikamya – Promoter of complexion.
- Naimittika Rasayanas help to fight a specific disease.

EXTRACTION OF METALS

- Copper from the pyrites : "Makshika, repeatedly soaked in Kshudra (honey), gandharva taila (oil of Ricinus communis), gomutra (urine of cow), ghrita (clarified butter) and kadali kanda sara (the extract of the bulbous root of Musa sapientum) and heated in a crucible, yields an essence in the shape of copper"
- Extraction of Zinc from calamine : "Rasaka" mixed with wool, lac, Terminalia Chebula and borax and roasted in a covered crucible, yields an essence of the appearance of tin.

ORIGIN OF ALCHEMY :

The origin of alchemy can be traced back to the Vedic age in India. According to Atharvaveda, medicinal plants are classified into two categories; ayusani i.e promoting longevity and bhaisajya i.e curing diseases. The term "ayusani" gave place to Rasayana in the Ayurvedic period. Therefore Rasayana represents drugs which enhance the circulation of body fluids and thus helps in prolongation of life.

BENEFITS OF RASAYANA

- Rasayana therapy prevents effect of ageing and provides longevity, improves mental and intellectual competence, preservation of youthfulness, increased luster, body complexion and glow of the skin, healthy condition of voice, excellent potentiality of the body and the sense-organssense-organs. One potent Rasayana that prevents ageing and degeneration is Brahma Rasayana. It is the best anti-ageing formula in Ayurveda.
- According to Ayurvedic texts two types of Rasayana were practiced :

  1) Kuti Praveshika: It was undertaken in a specially built three chambered (concentric) house. By this method every cell of the body gets rejuvenated. It is designed on the basis of first state of life in mother's womb.

  2) Vatatapika: This method was for those who found it impossible to undergo the first method because of its strict rules. In this method one was exposed to sun and wind during Rasayana therapy.

MATERIAL AND PROCESS

- During medieval period alchemists were busy to develop new methods, they used earlier knowledge of metals, minerals and plant materials; different types of inorganic substances such as minerals including gems and metals and organic substances which include plants , animal products were used but it was inorganic products that were largely used . Most frequently used metals were gold, silver, iron, lead, copper, zinc, tin and mercury. Besides these arsenic, sulphur, orpiment (arsenious sulphide, As2S2), realgar (arsenic sulphide, As2S3) and cinnabar (mercuric sulphide Hg2S2) were also used .The important minerals were generally called rasas which were further divided into maha (superior) and upa (subsidiary) rasas. The metals were called dhatus. Although mercury is a metal but it was considered maharasa, the king of rasas.In the alchemical texts various plants have been mentioned some of which have medicinal value. The roots, leaves or seeds of these plants aid indigestion. According to Alberuni most of the medicines prepared in Rasayana were from plant sources but comparatively the use of metals and minerals in alchemy was more pronounced. The alchemical texts have given the details of processes for the preparation of different types of bhasmas . Some of the bhasmas prepared by rasavadins showing their experimental skills are:

  1.Gold bhasma : In a thin gold leaves were to be coated with a paste of mercuric sulphide and the juice of custard lime. This process was to be repeated ten times, after which bhasma could be used as medicine.

  2. Silver bhasma : One method of preparing this was that silver foils were to be coated on both sides with kajali prepared from mercury and sulphur, and ground in citrus juice. These were then placed between two earthen plates, sealed and heated in a sand-bath for a day, over a strong fire. When it got cold, the product was mixed with powdered pyrites in equal quantities and ground well with lime juice and then heated for a long time till the silver was reduced to its bhasma form.

LABORATORIES & INSTRUMENTS:

The rasavadins also set up their laboratories called rasashala. In these laboratories different apparatus, appliances, instruments for heating, steaming, distilling etc. were kept. The laboratory was to be erected in a place rich in medicinal herbs and it had to be spacious, furnished with four doors. The apparatus included kosthi (for the extraction of essence pair of bellows, pestle and mortar, earthen material for crucibles of various types, dried cow dung cakes for heating purposes, iron pans, conch-shells etc) . As rasavadins used to have extensive knowledge of metals and minerals, they by their frequent experiments also prepared mineral medicines which were later in use along with Ayurvedic and Unani medicines.

These were coated on both sides with kajali prepared from mercury and sulphur, and ground in citrus juice. These were then placed between two earthen plates, sealed and heated in a sand-bath for a day, over a strong fire. When it got cold, the product was mixed with powdered pyrites in equal quantities and ground well with lime juice and then heated for a long time till the silver was reduced to its bhasma form.

Metallurgy,Glass making, pottery, jewellery making, dyeing of clothes and tanning of leather etc. were the major chemical arts and crafts in the early periods. Following were the major chemical products that contributed to the development of chemistry

1.Metallurgy : The iron pillar of Delhi is a 7 meter high pillar which is notable for the composition of the metals used in its construction.

The pillar is 98% pure wrought iron, and is a testament that high level of skill achieved by ancient Indian ironsmiths at that time.

2.Glass : A number of such glass objects were found at Maski in south India (1000-900 BC) , Hastinapur and Taxila (1000-200 BC).

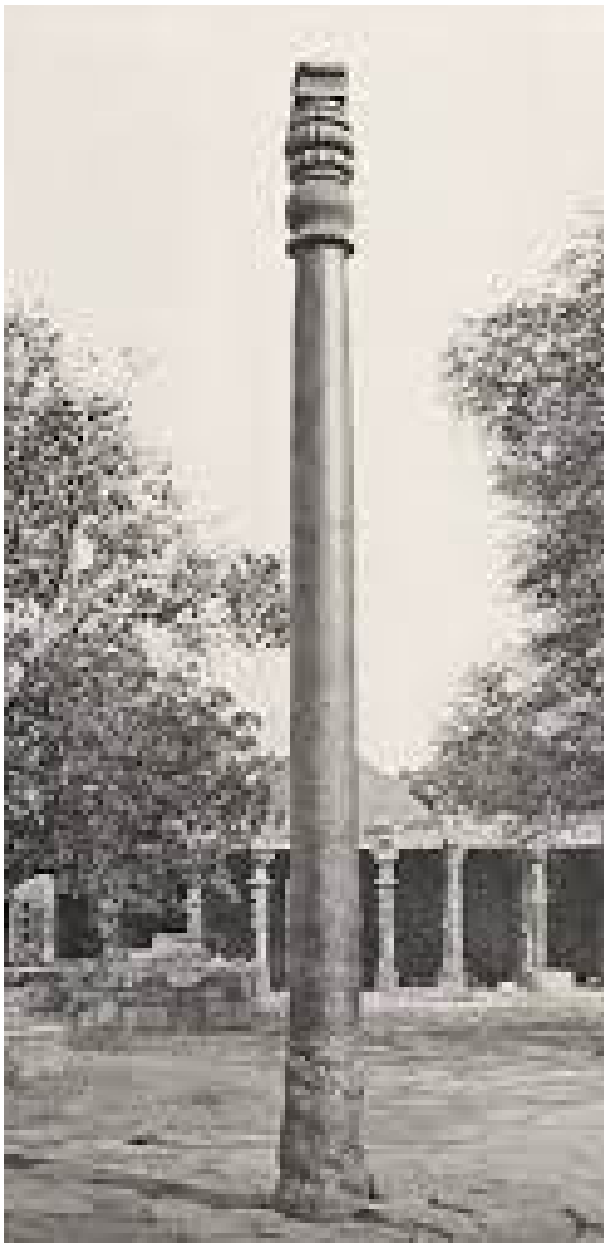
3. PAPER : From the Chinese traveller I-tsing account it appears that paper was known to India in the seventh century AD.

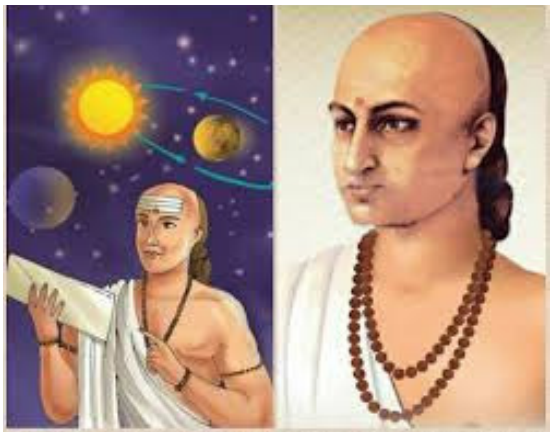
4. SOAP : Ancient Indians used certain plants and their fruits like the soap nuts of Reetha and Shikakai for washing clothes. Indians definitely began to make proper soaps in the eighteenth century AD.

5. DYEING : Plants and their products like madder, turmeric and safflower were the principal dyeing materials in ancient India.

6. COSMETICS & PERFUMES : : A large number of references to cosmetics and perfumes in Sanskrit literature were found like in Brihat Samhita of Varahamihira.

7. INK : An inkpot was unearthed during the excavations at Taxila, which suggests that ink was known and used in India from fourth century BC.





CONCLUSION : Thus it can be concluded that the concept of Rasayana or alchemy in India originated with the importance attached to a healthy body and desire for long life since ancient times. It originated in different countries independently but influencing each other's practices due tof cultural exchange. In India it kept on developing in medieval times. Various alchemists came into prominence in medieval India. Indian alchemists were actively engaged in doing alchemical experiments. The rasavadins were actively engaged in their laboratories doing experiments and were well versed with the nature and properties of various metals and plant essences and thus prepared different types of medicines in the form of bhasmas etc. which were used as medicines and these bhasmas are still used in Ayurvedic and Siddha systems of medicine. Along with medicine, Rasayana also gave rise to the science of metallurgy. Due to the frequent experiments performed by rasavadins on various metals, there was growth in the science of metallurgy also. Various alchemical treatises on Rasayana were also written in medieval period.

Recent Activities and Achievements
Department of Chemistry

Faculty Activities

Dr Rodali Talukdar

1.Attended duty of Gunotsav.
2.External duty in other institutions in practical exam.
3. Attended as supervising officer at GLC College.
4.Judge of science exhibition competition held during the celebration of Science Day held in GLC College.
5.Imparted science education to the school students of GNBN High School,BPRD.

Prabhat Chandra Choudhury

1.Attended duty of Gunotsav.
2.External duty in other institutions in practical exam.
3.Acting as Union in-charge of B.H. College students Union for the last few years.
4.Prabhat Chandra Choudhury met honourable Chief Minister of Assam along with the president of G.B,Principal, BH college,Howly to discuss some developmental aspects of the college .
5.He is also one of the assembly level Master Trainer's of Election of Barpeta District ,Assam,India.

Dhiraj Kumar Sarma

1.Attended duty of Gunotsav.
2.External duty in other institutions in practical exam.

Rajib Pandit

1.External duty in other institutions in practical exam.

Faculty Achievement

Prabhat Chandra Choudhury and Dhiraj Kumar Sarma both joined PhD course at Bhattadev University.

Departmental Activities

Freshmen Social Celebration

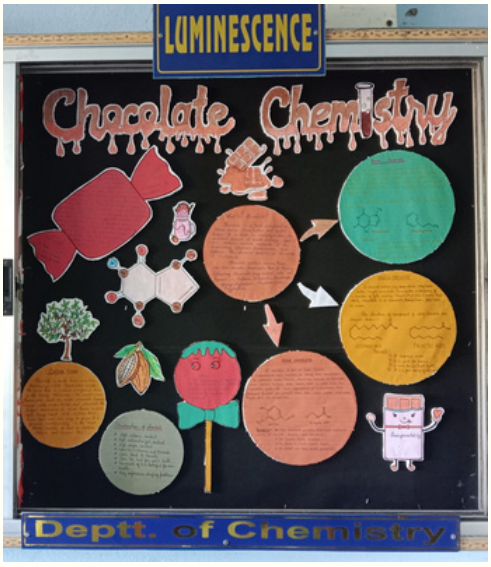
Departmental picnic 2022

Students Activities

1.Participated in wall magazine competition.
2.Participated in cultural rally 2023
3.Participated in National Science Day celebration organized by The Science Forum.

Speech delivered at Science day

Cultural Rally, 2023



Wall magazine

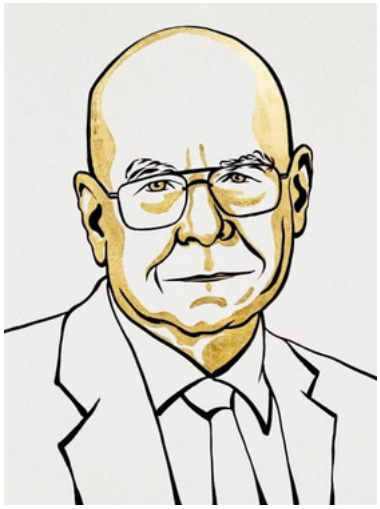
Students Achievements

Nitish Kalita recieved Silver medal at Skit competion and Gold medal at Orchestra competition at Gauhati University Inter College Youth Festival 2021-22

Zuktee Kashyap recieved 1st position in Folk Orchestra competition , 2nd position in Chorus competition , 2nd position in Cultural rally in the Intercollege Youth Festival 2021-22 under Gauhati University

Carolyn R.Bertozzi

Morten Meldal



K. Barry Sharpless

The Nobel Prize in Chemistry 2022 was awarded jointly to Carolyn R. Bertozzi, Morten Meldal and K. Barry Sharpless "for the development of click chemistry and bioorthogonal chemistry".

Carolyn R Bertozzi, Morten Meldal and K Barry Sharpless have been awarded the Nobel Prize 2022 in Chemistry “for the development of Click Chemistry and Bioorthogonal Chemistry”.

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