

Amalgam 2017-2018



Rasgandhayan-The Chemical society
Gargi College



**Batch 2015-2018: Row 1: Swati Gangwar, Kajal, Dr Beena Negi, Dr Manju Saroj, Akanksha
Row2: Nandana, Babita, Bharti, Priyanka, Ruchika, Nisha, Akriti
Row 3: Ronika, Sangita, Anjana, Asha, Shivali, Himani, Swati Mittal, Princy, Aanchal
Row4: Chanchal, Jaya, Neetu, V. Vidhya, Mayanka, Henadri, Priya, Parul, Dhruvika, Gauri, Manshi
Not in pic: Manisha, Sonu, Km Archana, Priyanka Kandpal and Prasansha**

President's note

I feel extremely happy to know that our chemistry department is coming up with yet another issue of our Magazine "AMALGAM". I would like to take this opportunity to congratulate our Editor and the entire editorial team for their untiring efforts that they have put to bring out the 10th issue.

As I sit down to write this note I am nothing but overwhelmed and thankful to my department for making my three years of college a cherishable one. The days spent learning in this institution has moulded us, girls into women of vision and has led us to path of wisdom.

The events and lectures that we have conducted throughout the year give me an immense sense of satisfaction and happiness because the information and knowledge grasped will forever be with us. The department had arranged a variety of competitions which saw participation of students in a good number. And all of this would not have been possible without the unconditional and unnerving support of my vice president, cultural secretaries, general secretary and the executive members. I am really thankful to all the core team members and to the wonderful set of dedicated volunteers that our department has and evidently nothing would have been possible without the constant support of Principal Ma'am and my teachers, particularly the staff advisors Dr. Beena Negi and Dr. Manju K. Saroj, who have always been the guiding light.

A special thanks to all my mentors for their support, motivation and guidance. They have always shown unconditional faith in me and for that I'm filled with gratitude.

Rasgandhayan has been much more than a society to me; it has been a learning experience. An experience which would envelope me in nostalgia for a lifetime. An experience that has taught me the true meaning of the lines "Life isn't a matter of milestones, but of moments."Adios Amigos!

Mayanka Chaudhary

B.Sc. (Hons) Chemistry III year

(President of Rasgandhayan: The Chemical Society of Gargi College)



Cover story

Starting from the man painted green, the artist points out to the need to adopt greener methods in research work while portraying in contrast, the man in red. On one side, the artist indicates at the industries (notice the red and white stripes besides the red face) and on other hand the green techniques followed in our college (The green tinted apparatus). As chemists we can do our part to prevent pollution and a beautiful way of world can be created. The red apple is to indicate the need to spread awareness and prevent the destruction of earth by man. Also, the need for peaceful cooperative existence of nature and man is evident (Shown on left, peace sign). The time to take the responsibility of conserving of earth has arrived and we all must join hands to make our nature blossoms again.

Cover page design by Shagun Gupta, B.Sc (H) III year

From fertilizer to Zyklon B: 100 years of scientific discovery that brought life and death...

This year marks the 100th anniversary of an essential process developed by Fritz Haber which was later taken onto industrial scale by Carl Bosch known as Haber-Bosch process. Since its development, this discovery has certainly helped to feed billions but also has contributed to kill million. This discovery has proved to be both boon and bane to the mankind.



The ammonia synthesis process which uses nitrogen from the atmosphere as its key ingredient was invented by a German chemist Fritz Haber to solve the problems faced by farmers across the globe. By the early 20th century the farmers were running out of natural fertilizers for their crops. The Haber plant at Ludwigshafen, run by the chemical giant BASF transformed the scenario by producing ammonia in industrial quantity for the first time, marking the beginning of the Green revolution. They used to refer it to as creating "Bread from Air". Today more than 100 million tons of nitrogen is taken away from the atmosphere every year and converted to ammonia compounds in Haber-Bosch plant. These are then spread over surface of earth helping to transform arid and barren lands into productive fields, because of which our planet has been able to feed an unprecedented number of people.

But there is another far darker side to this great invention. The industrial production of nitrogen prolonged World War I by providing Germany with the gunpowder and other explosives necessary for the war effort. The Haber's process met both demands – natural fertilizers and explosives. In addition to these it has certain negative impacts on the environment as well, the pollution triggered by the release of ammonia fertilizers into water supplies across the globe and into the atmosphere. Nitrogen fertilizers get washed into natural water bodies such as lakes, rivers where they contribute to eutrophication, suffocating the life below due to thick layer of algae over water surface. Haber has also helped to develop Zyklon B, an effective insecticide which was used by the Nazis to murder more than a million people. Haber's work has been a mixed blessing. He was awarded Nobel Prize in chemistry in 1918 for his work. This process that has transformed our planet and revolutionized food availability, threatens to bring even greater, more dramatic changes over the next 100 years.

Muskan Gill
B.Sc (Hons) Chemistry II Year

The untimely obituary

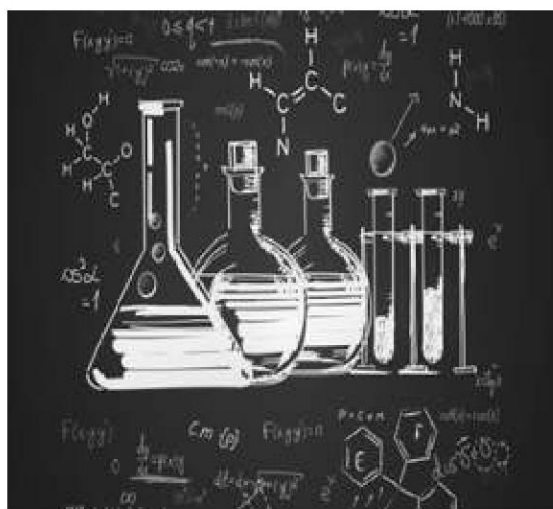
Opening the morning newspaper, scientist Alfred Nobel got the shock of his life when he found his obituary on the front page with the headline in a bold flourish "The Merchant of Death is Dead: Dr. Alfred Nobel, who became rich by finding ways to kill more people faster than ever before, died yesterday." In 1888, Nobel's brother succumbed to heart attack which the frenzy French media assumed to be the demise of the scientist all thanks to poor reporting and went on to write a scathing obituary branding Nobel a mass murderer developing new ways to "mutilate and kill" people. Though the error was rectified, the distressing incident played a severe impact on the scientist. Nobel played an important

role in invention of many powerful explosives including the dynamite. At that time, gun powder was the only option available for blasting mines. Alfred Nobel first started working with nitroglycerin, a powerful but unstable explosive and found ways to control it. Nobel's second important invention was that of dynamite in 1867. By chance, he discovered that nitroglycerin was absorbed to dryness by kieselguhr, a porous siliceous earth, and the resulting mixture was much safer to use and easier to handle than nitroglycerin alone. Next in line came the blasting gelatin, an even more powerful form of dynamite and ballistite, the precursor of explosive cordite; hence, cementing Nobel's position as the king of explosives. Thus, the untimely obituary brought on a crisis of conscience on him and led Nobel to reevaluate his career. According to biographer KenneFant, Nobel "became so obsessed with his posthumous reputation that he rewrote his last will, bequeathing most of his fortune to a cause upon which no future obituary writer would be able to cast aspersions." On 27 November 1895, at the Swedish-Norwegian Club in Paris, Nobel signed his last will and set aside the bulk of his estate to establish the Nobel Prizes to be awarded annually without distinction of nationality, for eminence in physical science, in chemistry, in medical science or physiology, for literary work "in an ideal direction" and "to the person or society that renders the greatest service to the cause of international fraternity, in the suppression or reduction of standing armies, or in the establishment or furtherance of peace congresses."

Nandana Pal Chowdhury

B.Sc. (Hons) Chemistry III Year

Friendship with chemistry



Friends are important in our life,
As oxygen is for being alive
We share things life long,
As covalent atoms share electrons
They are of many kinds,
As the number of carbon compounds we find
Our bonding is so strong,
As that between ions in ionic bonds
They are there in every stage of our life,
As there are hydrogens in most carbon compounds we
find
We can't afford to lose them,
As Mg²⁺ can't lose an electron again,
They are like that one electron
*This makes halogens stable like He, Ne, Ar, Xe and
Radon.*

Vidushi Gupta

B.Sc (Hons) Chemistry I year

Celebrating 100th birth anniversary of Dr. Asima Chatterjee



Asima Chatterjee was an Indian organic chemist known for her work in the field of phytomedicines. She completed her D.Sc degree from Calcutta University and was the first Indian woman to earn a Doctorate of Science from an Indian university. Among her notable instructors at that time were Prafulla Chandra Ray and Satyendra Nath Bose, she also had research experience from the University of Wisconsin, Madison and Caltech. After working on carotenoids, biologically active alkaloids and provitamins with many reputed foreign institutes, she started a vigorous investigation on the chemistry of Indian medicinal plants. She was the first female to receive the prestigious Shanti Swarup Bhatnagar award in 1961. She continued as the honorary coordinator of the special assistance programme to intensify teaching and research in natural product chemistry, sanctioned by the University Grants Commission in 1972. She established a regional research institute for development of Ayurveda drugs and a hospital for systematic clinical trials and successfully developed chemotherapeutic, antiseptic and antimalarial drugs. She published around 400 papers, which are much cited and have been included in several textbooks. Dr. Chatterjee was elected a fellow of the Indian National Science Academy (INSA) and was conferred Padma Bhushan in 1975. To add to her glorious career, in 1975 she became the first Indian woman to be elected as the President of the Indian Science Congress Association. To honour Dr Chatterjee's birth anniversary Google deployed Google Doodle on Sep 23, 2017. The year 2017 marks the 100th anniversary of Dr. Chatterjee and let us all salute the great chemist, for her endeavour, determination and commitment.

Harshita Goyal
B.Sc (Hons) Chemistry II Year

Eco friendly panacea to the plastic pollution

If there is one type of municipal solid waste that has become ubiquitous and largely seen along the shorelines and waterways of many developed and developing countries, it's plastic waste. Much of it is not recycled and ends up in landfills or as litter, adding to the major waste disposal problem faced by governments around the globe.

However, as always Mother Nature holds in her, the solution to this serious issue in the form of - plastic eating worms that may offer a relief from this mounting waste. Scientists have recently discovered a trash munching moth caterpillar that eats the notoriously resistant plastic polymer polyethylene. These miracle wax worms, the larvae of the GALLERIA MELLONELLA or Greater wax moth were discovered accidentally by Federica Bertocchini, a biologist at the institute of biomedicine and biotechnology of Cantabria in Spain. Bertocchini who is fond of beekeeping as a hobby, one day while cleaning the hives observed that they were infested with wax worms; she transferred those worms from hive into a small plastic bag, but soon discovered that there were holes in the plastic bag. Within 12 hours, there was a reduction in plastic mass of 92mg from the bag. The degradation rate is extremely fast compared to the other recent find outs, such as a bacterium with degradation rate of 0.13 mg a day.

The researchers from UK and Spain said that wax moth lays eggs in beehives; the appetite of the larvae for plastic, stem from growing in bees' colonies and feeding on beeswax.



Wax is a natural plastic with chemical structure similar to polyethylene, suggesting about a similar and easy way to breakdown polyethylene. These worms usually a bane for beekeepers as they voraciously devour the wax that bees use to build honeycombs, can now turn into a boon by providing a solution to the trillion plastic bags being used per year by people across globe.

"The caterpillars are not just eating the plastic without modifying its chemical makeup. We showed that the polymer chains in polyethylene plastic are actually broken by the wax

worms," stated Paolo Bombelli of Cambridge. "The caterpillar produces something that breaks the chemical bond, perhaps in its salivary glands or symbiotic bacteria in its gut. The next steps for us will be to try and identify the molecular processes in this reaction and see if we can isolate the enzyme responsible," he added.

As the molecular details of the process become known, the researchers say it could be used to devise a biotechnological solution on an industrial scale for managing polyethylene waste.

Muskan Gill
B.Sc (Hons) Chemistry II Year

In the sublime imagination of the Beatific Vision, he catches a hint of a deeper reality, but why, he asks, this distinction between time and eternity? Can the apprehension of the Infinite Good be conditioned by the clock? Oh, for knowledge undimensioned, untimed, effect of no cause, cause of no effect!"

Sister Nivedita (Celebrating her 150th anniversary)

Light it up: The emerging voice of Ed Boyden

Edward Boyden, an American neuroscientist at MIT, recognized for his work on optogenetics is all set to make a breakthrough, by revolutionizing the way brain science is perceived. In his talk named - Light switch for the neurons, Dr. Boyden insisted to the audience, "A significant fraction of us in this room, if we live long enough, will encounter perhaps a brain disorder. Already, a billion people have had some kind of brain disorder that incapacitates them, and the numbers don't do justice to it though. These disorders – schizophrenia, Alzheimer's, depression, addiction- they not only steal our time to live, they change who we are. They take our identity and change our emotions."

The brain may not look much from the outside, just a few pounds of pinkish grey amorphous matter, but inside lay an intricate and complicated circuit, containing tens of thousands of different neuron cells; differing in shapes, constituent molecules, the way in which they project and connect to desired

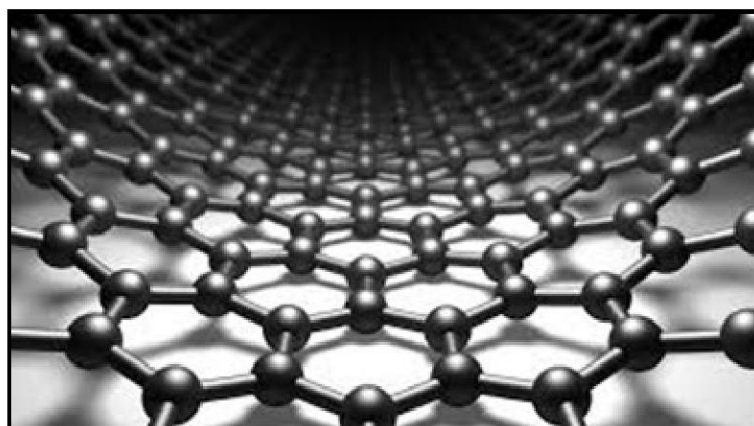


regions. Trained as an electrical engineer and physicist, Edward Boyden recognised each of the neuron cells as an incredible electrical device. Since, electricity is directionless, the scientist urged at the need of ultra precise control over the signals to bring about a desired change in the cells required. Boyden insists on the presence of some protein molecules existing in nature that are able to convert light into electricity, like solar cells. Here comes the ingenuity of the research, wherein Boyden and his team took a certain alga present in the aquatic bodies of the wild, that swims and navigates towards in order to photosynthesize optimally. On its membrane, there are present proteins that are activated in presence of light and converts it to electricity, called **channelrhodopsins**. Being a protein, it is encoded in the DNA of the organism. The scientists isolated the DNA, put it into a gene therapy vector like a tweaked, specific virus and introduced it into the desired (affected) mammalian neurons. Now, the neuron uses its own natural protein making machinery to fabricate those little light sensitive proteins and installs them all over like solar panels on a roof. Thus, one obtains neurons that can be activated with light!

According to Dr. Boyden, several diseases like Parkinsons, epilepsy or control seizures, schizophrenia can be solved with light instead of drugs. For example, when drugs fail in epileptic symptoms, one strategy is to remove a part of the brain, which obviously is irreversible and causes tremendous side effects. The scientist asks the possibility of 'turning off' the part of the brain until the seizure dies away. This can be achieved by making cells sensitive to be turned off with light. One can beam in light at all times, keeping the cells active and then remove it during the seizures. In fact, he also insists that with the help of channelrhodopsins, one can turn the bipolar cells in the eye into tiny cameras, that capture streamed light and can cure permanent blindness!

Nandana Pal Chowdhury
B.Sc(Hons) Chemistry III Year

Graphene nanoribbons: Boon to paralysis



Ever wondered what it would be like for a person crippled for life to walk again. Well, it does sound strange but with the advancement in the nanotechnology, it may soon be turned into a reality. Graphene is an allotrope (form) of carbon consisting of a single layer of carbon atoms arranged in a hexagonal lattice. It is the basic structural element of many other allotropes of carbon, such as

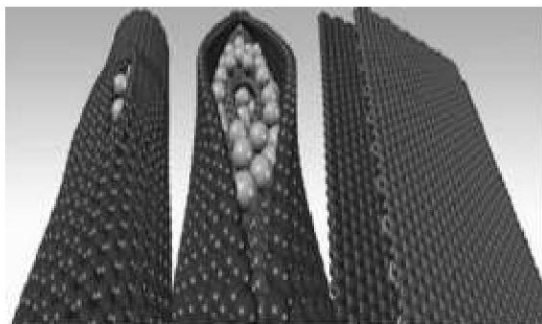
graphite, charcoal, carbon nanotubes and fullerenes.

The combination of graphene nanoribbons developed at Rice University Houston U.S.A and a common polymer can be of critical importance to healing damaged spinal cords in people, according to Rice chemist James Tour. Graphene nanoribbons customized for medical use by William Sikkema, a Rice

graduate student and co-lead author of the paper, are highly soluble in polyethylene glycol (PEG), a biocompatible polymer gel used in surgeries, pharmaceutical products and in other biological applications. When the biocompatible nanoribbons have their edges functionalized with PEG chains and are then further mixed with PEG, they form an electrically active network that helps the severed ends of a spinal cord reconnect.

“Neurons grow nicely on graphene because it’s a conductive surface and it stimulates neuronal growth,” Tour said.

The scientists have developed a way to add water-solubilizing polymer chains to the edges of our nanoribbons that preserves their conductivity while rendering them soluble, and they have just now started to see the potential for this in biomedical applications. Also the ribbonized graphene structures allow for much smaller amounts to be used while preserving a conductive pathway that bridges the



damaged spinal cords.

An illustration shows the process developed at Rice University that uses potassium atom insertion between layers of multiwalled carbon nanotubes to split them into graphene nanoribbons. This is followed by the addition of ethylene oxide (not shown) to render the edges with solubilizing polyethylene glycol addends on the edges. This leaves the flat surfaces of electrically conductive graphene nanoribbons intact to give a

conductive surface for neuron growth between the two ends of a severed spinal cord.

Advantage of using the graphene nanoribbons is that the graphene nanoscaffolds adhered well to the spinal cord tissue. It has been showed that these nanomaterials are biocompatible with the neurons and provide a scaffold for the ingrowth of regenerating axons after spinal cord injury. These graphene nanoribbons are completely biodegradable and disappear in few weeks, thereby helping in the growth of connective tissue elements, blood vessels, neurofilaments around the graphene nanoscaffolds. This method helps in self healing property of the spinal cord without the need for the drugs.

Similar results were successfully observed in paralysed mice and rats that were crippled but were able to use their limbs after receiving an injection of a liquid containing the tiny nanomolecular structures developed by the scientist Samuel Stupp and his colleagues of Northwestern University. Preliminary results with these lab animals are very encouraging.

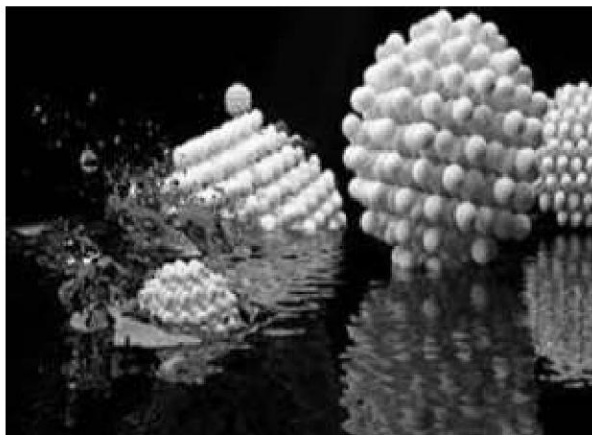
This discovery is on the cutting edge of the most exciting fields of the medical research- Regenerative Medicine. If this research is on the right track then one of these days very tragic diseases like Parkinson's and Alzheimer's will be a thing of past. And the crippled will walk again as the human body repairs itself in some of the most unimaginable ways and it will indeed be a milestone and will change the lives of millions with the disability.

Vaishnavi Rana

B.Sc (Hons) Chemistry II Year

Quantum dots

Quantum dots is an upcoming technology that is presently the centre of a lot of attention, all set to revolutionize the visual display technology. Naturally, the question arises as to "What are quantum dots?"



They are nano crystals with a unique property-When light shines on them, they become luminous and give off a very precise colour depending on their size. The size of the dots can be very finely tuned so that they give off the colour of light desired. In a normal LCD TV, blue LEDs coated in yellow phosphor are used to create the white light. Red, blue and green coloured filters, called sub pixel, mix to create more tints and use the glow from the white light to create the distinctive colour that make up the LCD TV picture. The LCD TVs that use quantum dots function a little differently. Instead of white light, they use plain blue LEDs

which while shining through the sub pixels, will also illuminate a bunch of quantum dots that give off red and green light . The TV makers claim that because the red, blue and green colours produced in a quantum dot set are very pure, they can shine through those filters with less wasted light.

The quantum dots can be arranged in a narrow tube right in front of LEDs or as an additional layer covering the entire screen itself. Besides finding application in solar panels and medical aid, quantum dots is the newest way of augmenting the existing kind of TV technology that TV maker say will give the viewers a "never before experience".

Parul Sharma
B.Sc (Hons) Chemistry III

Side effects of cleaning up urban air

So far, the worldwide concern about air pollution, the Frankenstein's monster of the industrialized urban centers has been the lime lighted topic throughout forums of discussion, with the urge to reduce the levels of pollutants in the atmosphere. However, it was indeed surprising, when it was discovered



that the sinking levels of an air pollutant may soon cause unexpected side effects, as seen in a cleaning spree carried out in North American cities. It was found that as the levels of atmospheric nitric oxide due to air quality regulations dip, North American cities may soon experience higher levels of airborne organic hydroperoxides, with largely unknown implication for air quality and human health. Regulations aimed at improving air quality in urban area likes Los Angeles have made rapid progress on

reducing nitric oxide and hydrocarbon emission. Nitric oxide is emitted from engines and coal power plant while, hydrocarbons from many sources including gasoline-powered cars and trucks, solvents etc. The level of emissions have dropped rapidly as old cars have been taken off the street in favour of cleaner new cars and diesel trucks have been retrofitted. However, the drop in nitric oxide level is comparatively sharper than the decline in hydrocarbon level. This disparity can lead to production of chemicals called organic hydroperoxides. Organic hydroperoxides already exist in nature, in rural areas and other regions that lack large amounts of engine exhaust. It is known that in the presence of sunlight, these hydroperoxides form particulate aerosols and breathing in these particles tend to be bad for public health. Also, according to an upcoming study, it has been indicated that organic hydroperoxides are extremely effective in stimulating the rate of protein degradation in red cells, causing severe complications in the long run.

Babita

B.Sc (Hons) Chemistry III Year

Darker than Tartarus

Imagine a colour darker than the darkest black, a colour that questions the existence of dimensions: a black hole to all the light. Designed by Surrey Nano systems, Vanta Black is the darkest artificially



created black to have been known to mankind. Vertically Arranged Nanotube Array (VANTA) was developed by British researchers which can absorb upto 99.96 percent of ultraviolet, visible and infrared light. Even on running a high power laser through it, almost no light is reflected back. In the year 2016, the researchers upped its blackness by declaring that no spectrometer in the world can measure the amount of light it absorbs. The company has released a spray of Vanta Black that can absorb 99.8 percent of the light which can make three dimensional objects appear distinctly two dimensional. So, if a cube is sprayed with this, it would appear as a square and on changing their perspective only, will the viewer realise that it's in fact a cube.

How does this work? What is the mystery lying at the core of this strange colour?

It must be understood that Vanta Black is not a colour, dye, fabric or pigment. It is in fact a special coating made up from millions of carbon nanotubes. Each of these tubes is only around 20 nanometers thick and are so very closely packed that the light entering this system of tubes, gets trapped and absorbed as it bounces between them. This phenomenon can be understood with the example of a forest. Like in a forest, light gets trapped under the thick canopy of trees and bushes, so does it in the Vanta Black's bottom surface. As of now Vanta Black finds its applications in defense and space fields. A number of artists have been trying to get their hands on this for installations and artworks but only Indian sculptor Anish Kapoor is licensed by Surrey Nano systems, for its use.

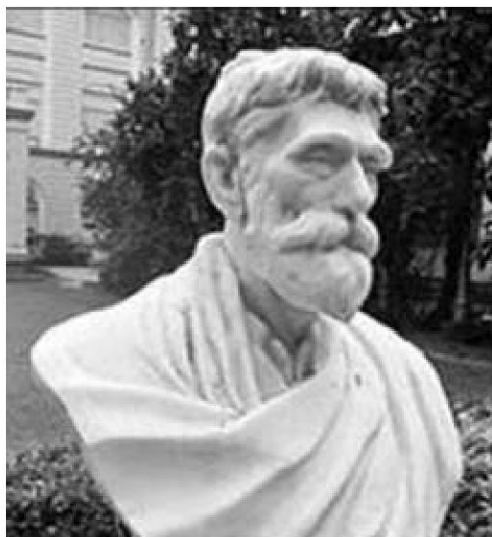
Dhruvika Bisht

B.Sc. (Hons) Chemistry III Year

Eminent chemist: Acharya Prafulla Chandra Ray

Prafulla Chandra Ray was an eminent Indian scientist who is hailed as the “Father of Indian pharmaceuticals”. His work on the nitrites and hyponitrites of metals, especially mercury, earned him worldwide fame. He was born in a well-to-do family and was educated at some of the premier educational institutes. An illness in his childhood days forced him to discontinue studies for a while, but he made the best possible use of the time and harboured a liking for literature.

He pursued higher education from the University of Edinburgh and stayed on a year there to conduct further research. Returning to his homeland, Ray started his academic at the Presidency College. Despite his worthy credentials he faced discrimination in the imperial regime which made him leave his job at Presidency to accept the position of ‘Palit Professor’ at the ‘Rajabazar Science



College’. During his tenure he researched compounds of transition-metals such as platinum and iridium and sulphides of organic substances. By the year 1920, this eminent chemist had penned more than 100 scientific literature and many of them were published in the Journal of Indian Chemical Society. The same year, he presided over the annual meet of ‘Indian Science Congress’, which is one of the foremost scientific associations of the country.

The pioneering chemist founded India’s first chemical manufacturing company, ‘Bengal Chemicals and Pharmaceuticals Works Ltd.’ The company has expanded over the years and currently deals with manufacture of alum, drugs and pharmaceuticals and household products such as naphthalene, floor and toilet cleaners.

An ardent social worker, he started a relief organisation when the state of Bengal was affected by massive floods in 1923 and collected nearly 2.5 million rupees in cash and kind and distributed it in the affected area in an organised manner. A voracious reader and lover of literature, he penned his own life story in the book entitled ‘Life and Experience of a Bengali Chemist’, in 1932.

He lived an astute life and spent most of his life serving the poor and contributing toward scientific advancements. He remained associated with the ‘SadharanBrahmoSamaj’ for most of his life and was even nominated the President of the division. He was a revered figure; many institutions are named after this scientist such as the ‘Acharya Prafulla Chandra College’ in Calcutta and the ‘Bagerhat P.C College’ of Bangladesh. Prafulla Chandra Ray was a recipient of the ‘Companion of the Order of the Indian Empire’, an honour that was conferred upon him in the year 1911. This eminent chemist was awarded several honorary doctorates which include ones from the ‘Durham University’ and ‘Dhaka University’.

KhyatiKalra

B.Sc(Hons) Chemistry II Yr

Fifty tasks of blue: The freakish life of online games

After starting with productive challenges like the #book_listchallenge, expanding up to fun awareness events like the #ice_bucket_challenge; finally, the world has stumbled upon a destructive cyber gaming sensation, lifted straight from a dystopian world, the #blue_whale_challenge, also, known as the Blue Whale Suicide Game. It is a social media phenomenon which enters various networks via secret groups. It is not a downloadable game, app or software. The game reportedly started in Russia in 2013 with F57, one of the names of the so-called “death groups” of VKontakte, Russia’s largest social network and allegedly caused its first suicide in 2015. Phillip Budeiken, a former psychology student who was expelled from the university, claimed that he invented the game. According to Budeiken, his purpose was to ‘clean’ the society by eliminating those he deemed as having no value. The horrifyingly dangerous game has been linked to 130 suicides across the world and India was found to be involved in this race with the suicide of numerous teenagers, suspected to be involved in this deadly online challenge.

Believe it or not, Ayurveda had put forth this concept ages back, known as Prajnyaparadha. Prajnya means intellect or wisdom and aparadha is offense i.e. willfully going against one’s wisdom and indulging in unhealthy practices deliberately. For e.g. Playing/watching violent sports or games or taking drugs are known to harm life sensibilities, but one consumes it, anyway. This game uses social media to target vulnerable adolescents and uses abuse tactics, grooming and manipulation to drive them to commit suicide. Spread over 50 days, the challenge reportedly instructs participants to complete 50 tasks that include self-harm, body mutilation and watching scary videos. The participants are made to believe through warning that their backing out would impact the lives of their near and dear ones. As the game progresses, participants reach the final day that supposedly culminates in the act of suicide. Some signs to identify adolescents at risk are: signs of self-harm, strange updates on social media, withdrawal from friends and family and activities one enjoyed earlier.



India’s Ministry of Electronics and IT has directed internet platforms like Google, Facebook, WhatsApp, Instagram and Yahoo to remove the links to the online game. This follows a petition from the Ministry of Women and Child Development, demanding a ban on the game. The emergence and proliferation of the Blue Whale Challenge on social media provides a somber reminder of the need to reinforce positive interactions for

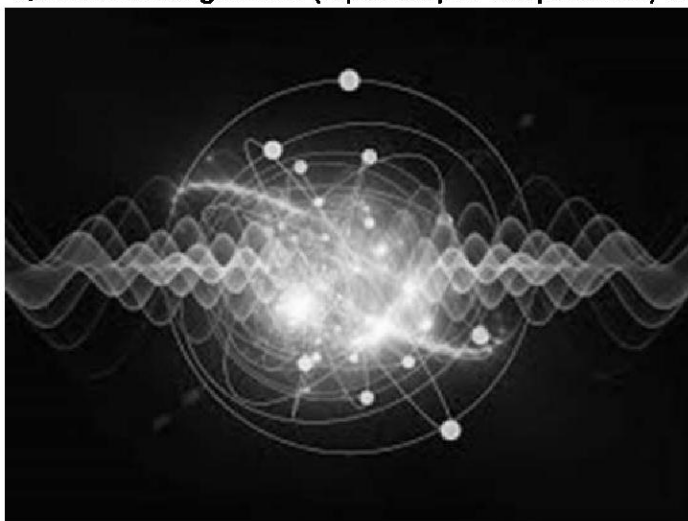
adolescents with their family and peers, when the internet has become ubiquitous. When someone is fighting their emotional battle, don’t be a bystander, instead reach out for them. While dreaming of Swastha Bharat; let’s pledge for the well being of mental health of our youth.

Anjana Singh
B.Sc (Hons) Chemistry III Yr

Apparition: A quantum reality?

All Harry Potter readers must be well aware of the magical method of transportation 'Apparition' where the user focuses hard on a desired location in his mind, disappears from his current location and instantly reappears at some other. In short, 'Apparition' is a form of teleportation, a soon to become reality. While physicists revelled at the success of Classical Mechanics in explanation of behaviour of macroscopic bodies assuming that the mysteries of the universe have been all unlocked, the joy was short lived as it was observed that at fundamental levels things became fuzzy and bizarre, dawning the age of Quantum Mechanics. Quantum Theory has very important applications, including Quantum Chemistry, superconducting magnets, light emitting diodes lasers, electron microscopy, medical and research imaging such as Magnetic Resonance Imaging etc.

Of the many important physical phenomena explained via Quantum Mechanics, the discovery of 'Quantum Entanglement' (A pathway to Teleportation) is of growing interest.



In simple words, 'Quantum Entanglement' is a phenomenon where two particles are linked together no matter how far they are; disturbing one particle disturbs the other. With the help of classical information and 'Quantum Entanglement', one can transmit quantum information (exact state of atom/photon) from one location to another. European researchers have teleported photons over a distance of 88 miles between two Canary Islands. They used lasers to transport the information in one photon's quantum state from one island to another via 'Quantum Entanglement'-without actually traversing the intervening distance.

Since, it is possible to transport subatomic particles, is the teleportation of macroscopic bodies, like a human, a potentially upcoming probability? Human body has over a trillion of atoms which means a person would have to be broken down into individual particles before each is Entangled, Read, Digitalized and Teleported to a new location and it might take quadrillions of years. Worse still, there is no way of knowing if one would survive being stripped down to atoms and reconstructed i.e. when atoms are teleported, they are often destroyed with a copy of rebuilt from the data. So, one could effectively die and be brought back to life- or would it even be the same person arriving if at all survival becomes likely, or a new clone?

Shagun Gupta
B.Sc. (Hons) Chemistry III Year

Did the haunting notes of armonica kill Beethoven?

Benjamin Franklin was enchanted when he first heard a glass bowl piece, while in Europe but noticed the fundamental difficulty in producing complex music on the set up. Being an inventor, he created a much more elegant instrument, of ingenious design, the glass armonica- armonica being the Italian word for 'harmony'. The instrument with its delicate sound and unusual appearance with 37 glass bowls of different sizes, threaded together on a spindle and colour-coded with paint to identify the notes, became immensely popular- even more so than the violin. In fact, Franz Mesmer, the German physician who theorized mesmerism, often known as the herald of the modern hypnotism, used the unique intonations of the armonica to bring about deeper hypnosis in his patients. However, the haunting lilt of the armonica soon gave way to fear, with listeners suspecting something supernatural and peculiar about the sound.



The most famous outing of the instrument was during Donizetti's tragedy, Lucia di Lammermoor - unsurprisingly, during the famous 'mad scene' in the play, cementing the glass armonica's place as the soundtrack to other-world activities. It was reported that the notes caused insanity, nervous disorders, convulsions and some rumours about even the waking of the dead, causing it to be banned from the public eye. As if to add to the mystery; **Ludwig van Beethoven**, one of the greatest composers of all times who broke barriers and brought about the romantic era in classical music was a fervent lover of the armonica and has been historically known to have suffered from a wretched condition of severe headaches, depression, deafness and feverish conditions.

Light was thrown onto this curious event in musical history, when modern day scientists, tested strands of Beethoven's hair and a fragment of his skull and unexpectedly, found signs of acute exposure to lead. **Plumbism**, Beethoven scholars say could be a possible reason for his infamous temper and occasional memory slips. Plumbism or lead poisoning is associated with irritability, hearing loss, seizures, high blood pressure, headache and mood disorders. It was not an uncommon ailment in those days especially when lead could be found in utensils, water pipes, paints. In fact one of the famous victims of the ailment was artist Van Gogh who used lead based paints. One of the symptoms of lead poisoning is the swelling of the retinas which can cause one to see light like halos; the evidence lying in paintings like *The Starry Night*.

To return to the enigma of Beethoven's death; the most amazing piece of evidence surfaced when it was found that lead was usually present in the armonica's stemware and in the paint applied to each bowl so as to differentiate notes. Beethoven, since his youth must have devoted hours at mastering the armonica's glasses and thus, his reckless behaviour, prolonged pain and untimely death was a direct consequence of the exposure. With the advent of scientific proofs, even those baseless rumours of the long gone era seem true; albeit it's the beautiful, tinkling instrument that poses as the real perpetrator rather than the music. Though several sources refute the claim, many researchers strongly believe in the theory. But, then who knows what lies hidden in the fathomless mellifluous depths of 'Moonlight sonata'?

Nandana Pal Chowdhury
B.Sc(Hons) Chemistry III Year

Shimmering hues of nature: A structural mystery



Peacock, the national bird of India and indeed, one of the most marvelous creations of God, evokes instant joy and admiration and even piety with its gorgeous and brilliant hues. The shimmering butterflies, fishes, fruits observed in nature have long intrigued researchers. For a long time scientists used to believe that these vibrant shades were due to the presence of some kind of pigment but with the advent of high precision electron microscope, the mystery behind these colors was solved. Most interestingly, it was found that the colour was not due to the presence of any tint; rather it

was related to the tiny structures present on their feathers.

Structural colouration is defined as “production of colour by microscopically structured surfaces fine enough to interfere with visible light, sometimes in combination with pigments”. Structural coloration is based on the principle of wave interference, explained by physicist Thomas Young.

Young described iridescence as the result of interference between reflections from thin layers, combined with refraction of light caused by the microscopic structure of the feather barbules. As the viewing angle changes, the refracted light becomes visible in a glowing, shimmering iridescent display. A number of fixed structures often referred to as nature’s photonic crystals i.e. materials with an arrangement of atoms in a precise nano selective pattern that repeats itself identically and at regular intervals; can create structural colours. Some examples are-

1. Diffraction grating constructed of layers of chitin and air gives rise to the iridescent colours of butterfly wings and the tail feathers of birds such as the peacock.
2. Selective mirror structures to create interference effects are formed of micron-sized bowl-shaped pits lined with multiple layers of chitin in the wing scales of the emerald swallowtail butterfly.
3. Crystal fibres formed of hexagonal arrays of hollow nanofibres, create the bright iridescent colours of the bristles of *Aphrodita*, the sea mouse.

Wings of butterflies have two or three types of scales in alternative positions. In blue morph butterfly, the waves of red light cancel themselves and only the blue light reaches our eyes. Scientists have thus developed meta materials that change their optical character simply by changing their shape and structure.

A South American beetle has inspired the making of micro mirrors for tunable optical diodes and other optical devices. The beetle has a shell made up of stacked nano layers that control both the polarity and the wavelength of light. The reflection of light from the beetle was finely tuned to the wavelengths of red, green and orange. Such lovely creations of nature have inspired and motivated scientists to discover new ways and technology to enhance the clarity of displays in cell phones and TV and revolutionize the viewing experience.

Muskan Gill
B.Sc. (Hons) Chemistry II Year

I saw it on WhatsApp!!

“ATTENTION! Tonight between 12:30-3:30 am dangerous high radiation cosmic rays from Mars will pass close to the earth. They can cause bodily harm if you keep personal electronics near you. Please forward to your loved ones. I have done my part, now it's your turn.” “VERY URGENT: If you have your own picture as WhatsApp DP please remove it immediately, message intended especially for women. ISIS has hackers can use it in wrong ways. –AK Mittal (IPS), *_Commissioner Delhi._*. Share this as much as you can.” A peep into most family and friends group chats on WhatsApp is enough to catch loads of such forwarded texts and it seems as if all of a sudden Mars has become a star(since only stars emit cosmic rays) and ISIS will edit DPs because it has nothing else to do.

Being on social media means you are exposed to a daily dose of hoaxes, rumours, conspiracy theories and misleading news. Such nuggets of information pertaining to wide range of emotions from outrage, pride, anger and patriotism to fear and concern for loved ones overwhelm the user to easily consume, rarely verify and widely share. This makes the truth and what sounds like the truth difficult to discern. Moreover,

with the group feature of messaging apps, the network structure has become so dense that any information spreads almost instantaneously within one group and then to numerous others. Such WhatsApp rumor-mongering has led to many incidences of inciting widespread tensions. On 26 Feb 2017 in Bangalore, the crucial Measles-Rubella (MR) vaccination drive got under way due to an anti-vaccination campaign feeding on misinformation spread by social media.

Rumour of RBI declaring Rs.10 coins invalid spread panic and chaos as vendors refused to accept the coins. Unlike other social networking sites, WhatsApp, being private and closed by end to end encryption makes it impossible to know the source and the number of circulation. A simple Google search will help you separate fact and fiction in matter of seconds that the UNESCO certainly hasn't named Narendra Modi as the world's best Prime minister or Jana Gana Mana as the best national anthem, the new Rs.2000 note has no concealed GPS chip etc.

Above all, the most powerful weapon against the viral rumor problem is inculcating rationality through critical thinking because the target of any hoax message is always the gullibility that exists all human beings in different measures. Critical thinking is reflective and reasonable thinking that is focused on deciding what to believe or do. Another technique to fool people into believing fake information is the use of scientific jargon as misleading labels and the buzz words-“herbal”, “organic” and the most frequently used-“CANCER. Many messages appeal to emotions rather than evidence-based arguments and this can override our logical thinking: “share to save you loved ones”, “Few seconds to share can save million lives”. But we must remember that facts are facts and we should never let our emotions overpower our intelligence.

Social networking has revolutionized mass communication. Never before in the history of humans have we had such access to information and news from all over the world all of which is just a click away. It is on each of us to use this convenience responsibly and with probity. So, examine the information you receive and feel empowered to determine its validity.



Shaelja Mishra
B.Sc. (Hons) Chemistry II Yea

Events 2017-18

To address the mushrooming questions that keep popping up in budding bright minds, a chain of events are organized throughout the year by the Chemistry Department to give the students a deeper insight and exposure to novel work done by eminent researchers and to enlighten them on the scientific events taking place around the globe by the means of fun events. The academic year of 2017-18 was likewise enlivened by multitude of competitions, quizzes, debates, extempore, lectures; with enthusiastic participation from students of various disciplines. Celebrating the multihued spirit of chemical sciences, come, let's take a peep into the kaleidoscope of events organised by the Chemistry Department of Gargi College round the year 2017-18.

Inaugural lecture

Rasgandhayan, the chemical society hosted its formal inauguration lecture on **August 3, 2017** with full zest and zeal. It was a matter of pride for the department to have Prof. A K Susheela, Executive director of Fluorosis foundation of India and Former professor of AIIMS to deliver the inaugural talk. Enlightening the audience on health impacts of fluorine and fluoride, the speaker in her passionate fervour, provided deep insight into the problems faced in rural situations with the help of beautiful case studies.

We could not have a better way of celebrating the Golden Jubilee of



establishment of our department and Silver Jubilee of inception of Chemistry honours.

World Biofuel Day

On **August 10, 1983**, Sir Rudolph Diesel, the inventor of the diesel engine, successfully ran a mechanical engine with peanut oil for the first time and foretold that vegetable oil will replace fossil fuel in the coming century. True to his prediction, the industrialised world's thirst for energy has increased tremendously, causing serious



energy crisis. Thus, with the growing need for energy in the face of rapidly depleting natural energy resources, it is an absolute necessity to create awareness about the importance of non fossil fuels.

To remind the students of their duty to the Mother Earth, the department organized the events of slogan and essay writing competition with enthusiastic participation from students of various departments.

Winners of essay writing competition

1. Shivani Sharma, B.Sc. (Hons) Botany III Year
2. Babita, B.Sc. (Hons) Chemistry III Year
3. Ankita Sharma, B.Sc. (Hons) Chemistry II Year

Winners of slogan writing competition

1. Divya Chawla, B.Sc. (Hons) Chemistry I Year
2. Vidushi Gupta, B.Sc. (Hons) Chemistry I Year

Interactive session with alumna

The Chemical Society organized an interactive session on "Law as a career option" with the department's very own alumna Divya Subramanian (Batch 2002-2005) on **August 23, 2017** during the ECA break.



The excited students peppered her with curious questions regarding the opportunities in pursuing law as a career after a background of chemical sciences, the challenges faced, the preferable institutions for the path etc. The alumna was very gracious in her answers, satisfying everybody's enquiry, besides sharing her memories and funny anecdotes from her

college life, making the event fun filled and bright.

*Educational seminar
on Laboratory
Glassware*

On **August 30, 2017**, the Chemical Society organised an educational seminar on the topic of "Laboratory Glassware" for students, teachers and lab staff of the Chemistry Department. The lecture cum interactive session with the invited expert from Borosil Glass Works Ltd. proved to be an eye opening one with the oft questioned topics like types of glass and their properties, safe working in laboratory, good pipetting technique etc answered with logical explanations. The seminar was very useful and served the purpose of motivating the students of the Chemistry Department to become responsible laboratory workers.

*The Dr. C.K. Khurana
memorial lecture*

The Chemical Society of Gargi College had the privilege of inviting Dr. Sasanka Deka, Assistant Professor, Department of Chemistry, University of Delhi to deliver a lecture on the topic of "An introduction to nanoscience and nanotechnology: Big world of small things" on the occasion of Dr. CK Khurana Memorial talk, on **September 6, 2017**. Emotions poured in from every heart as Dr. Sushmita Chaudhary gave a touching introductory note to the meet, remembering Dr Khurana as a true leader and friend.

The lecture given by Dr. Deka focused on the importance of nanotechnology in



revolutionizing the sectors of energy, medicine, biochemistry and electronic products and applications. The speaker kept it very informative but explanatory at the grass root levels, reaching out to the

audience of young students of the Chemistry Department, thus, taking the lecture to a different level altogether.

World Ozone Day

In 1994, the UN General Assembly proclaimed **September 16, 2017** as the International Day for the Preservation of the Ozone Layer, commemorating the signing of the Montreal Protocol in 1987. The day is celebrated throughout the world on September 16 in a bid to spread awareness about the depletion of ozone layer and in the search for solutions to preserve it. To mark the occasion, the Chemical Society organised the events of eco friendly greeting card making and extempore. Both the events were celebrated with much splendor, marked with heavy participation from students of all disciplines, reflecting the deep desire of the young generation to preserve the nature.

Winners of Extempore competition

1. Niti Yadav, B.Sc. (Hons) Zoology I Year

2. Nandana Pal Chowdhury, B.Sc. (Hons) Chemistry IIIrd Year

3. L. Nancy, B.Sc. Physical Science IIrd Year

Winners of Eco friendly greeting card making competition

1. Divya B.Sc. (Hons) Chemistry II Year
2. Kunjum, B.El. Ed II Year
3. Poorvi & Smriti B.Sc. Chemistry (Hons) II Year, Vidhusi Chemistry (Hons) I Year

Better Living through Green Chemistry

To pay a tribute to Dr. Asima Chatterjee (The first Female Recipient of India's Most Prestigious Science award, Shanti Swarup Bhatnagar) her award) 100th birth anniversary, the Chemical Society of Gargi College organized a guest lecture on "Better Living through Green Chemistry" for the students of the Chemistry Department on **October 13, 2017**.

The speaker for the lecture, Dr. Ram Mohan, presently working in Illinois Wesleyan University, USA emphasized on the need of synthesis of "Green Products" by greener route in his lecture. He pointed out to the benefits of pursuing chemistry in a responsible fashion and the need for the privileged sect of the society to reach out to the common people, to bring science out from research labs to everyday life. The lecture was indeed very interactive and informative, and the students enjoyed it thoroughly.

Green Chemistry for a Sustainable Future

On **January 17, 2018**, the Chemical Society of Gargi College organised a guest lecture entitled "Green Chemistry for a sustainable Future" by Professor Javed Iqbal, Founder and Chairman Cosmic Discoveries

(Pharmaceutical Start Up), Hyderabad and formerly professor at IIT Kanpur. In his lecture, Professor Iqbal highlighted on design and synthesis of novel drugs based on an understanding of how drugs work in the body at molecular level. He encouraged the budding chemists to find ways to mitigate the problem of chemical pollution and cultivate interest in Green chemistry to participate in holistic, sustainable development as mature and responsible chemists.

Science Day Celebration

The National Science Day is celebrated on **February 28, 2018** to mark the discovery of the Raman Effect and pay tribute to Sir C.V. Raman, the first Indian Nobel Laureate in science. The Chemical Society celebrated



the momentous day by organizing a written science quest based on scientific general knowledge to spread the spirit of limitless possibilities and unquenchable thirst of knowledge amongst the students. Though the level of questions in the quest was a notch high, the session was a massive success with zealous participation of a number of students from various departments.

Winners of science quest:

1. Mehak Loyal, B.Sc. Physical Science II yr
Anjana, B.Sc. (Hons) Chemistry III yr
Vaishnavi Rana, B.Sc. (Hons) Chemistry II yr
2. Muskan Gill, B.Sc. (Hons) Chemistry II yr
3. Bharti, B.Sc. (Hons) Chemistry II yr

Scintillations 2018

Scintillations **March 20-21, 2018**, the science fest of Gargi College was successfully organised by the department of sciences with great spirit and enthusiasm. It was a two day event that witnessed inter and intra- college participation in heavy numbers. Rasgandhayan - The Chemical Society of Gargi College, just like previous years performed spectacularly. Out of the many events organised for students, scientific crossword and fun-in-lab were organised by the Chemistry Department. Scientific crossword had puzzles related to all fields of science while the Fun-in-lab had interesting Chemistry tasks given to students.



There was also a session of presidential speech in which president of each department highlighted the achievements of their respective department. Festival ended amidst much cheering with the valedictory session.

Educational trip to Yakult, Sonapat

The Chemical Society organised an interesting visit to YAKULT DANONE INDIA

Pvt. Ltd., the producer of the popular probiotic drink Yakult on **March 29, 2018**. The staff presented an insightful presentation about Yakult to begin the visit. It was a matter of great amazement to students and teachers alike when it was informed to them that a bottle of Yakult contains about 6.5 billion unique bacteria known as *Lactobacillus casei strain Shirota*. This bacterium helps to improve digestion and build immunity. All the processes of manufacturing, starting from the germinating of the Shirota strain bacteria to the enlargement of the seed initiation into desired production were observed by the students.



The students were amazed to witness the unique quality control and packaging of the final product. The staff took great pains to explain each and every aspect of their unit to the students. The fun filled session ended on a strong note of excitement with a group photograph. The visit showed us the application of what we study and also gave a glimpse of a new career path into the emerging world of probiotics.

Importance of essential oils

A guest lecture entitled "Chemistry of essential oils and their importance" by Professor Ashok K Prasad, Department of Chemistry, University of Delhi held on **April 4, 2018**. The students were surprised to

know that the essential oils are "essential" in the sense that they contain the "essence of" the plant's fragrance and certainly are not indispensable in a given living organism. Professor Prasad pointed out how simple nuclei can result in formation of complex molecules in plants with the help ele



mentary reactions. It was enlightening to see the highlights of Professor Prasad vast work and the all the students thoroughly enjoyed the session.

Valedictory & Degree distribution TO Batch 2013-2016

The valedictory function 2017-18 was organised on **April 10, 2018** by the Chemistry Department to award students who participated in various competitions and events throughout the academic year and also invited the B.Sc (H) batch 2013-16 to receive their degrees on the occasion. The distribution proceeded to the conferment of the prestigious Dr Minakshi Sharma Memorial Award. This was followed by awarding the union and magazine committee for working diligently throughout and making the year a success. The event rounded on a joyous note with the alumna parting their experiences with the students amidst much laughter and tears, bringing a fitting end to the glorious academic year 2017-18.

Glimpses 2017-18



Inaugural talk 2017-2018



Essay & Slogan writing competitions on World Biofuel Day

Glimpses 2017-18



Glimpses 2017-18



Seminar on laboratory glassware by expert from Borosil glass works ltd



FUN FILLED MOMENTS OF TEACHER'S DAY

Glimpses 2017-18



DR. C.K KHURANA MEMORIAL TALK BY DR SHASHANKA DEKA



ECO FRIENDLY GREETING CARD MAKING & EXTEMPORE COMPETITION ON OZONE DAY CELEBRATION

Glimpses 2017-18



Dr. Asima Chatterjee's birth anniversary talk by Prof Ram Mohan



Group photograph with Professor Javed Iqbal, formerly professor at IIT Kanpur

Glimpses 2017-18



SCIENTIFIC CROSSWORD AND FUN-IN-LAB AT SCINTILLATIONS 2018



EDUCATIONAL TRIP TO YAKULT

Glimpses 2017-18



VALEDICTORY FUNCTION HELD ON APRIL 7, 2018

Glimpses 2017-18



Degree Distribution Ceremony to Batch 2013-2016



**VALEDICTORY
FUNCTION**

Eminent chemist: C.N.R. Rao- A living legend of science

ChintamaniNagesa Ramachandra Rao popularly known as C.N.R. Rao is not only one of the greatest chemists India has ever produced but also only the third scientist in the history of India to get the highest civilian award, the Bharat Ratna,. Prof. Rao is a well-recognized international authority on solid state and material chemistry.

C.N.R. Rao was born in Bangalore; he obtained his bachelor's degree and master's degree from Mysore University and Banaras Hindu University respectively. He completed his Ph.D. from University of Purdue at the age of 24! Rao was one of the earliest to synthesize two-dimensional oxide materials. His research work had a deep impact in the fields of application like high temperature superconductivity and huge magneto resistance. For the last two decades he has been doing extensive research on different nano materials, particularly graphene, nanowires and nanotubes. His knowledge and contribution in the field of science can be gauged from the fact that Rao has honorary doctorates from 60 universities from around the world. He has authored around 1,500 research papers and 45 scientific books.



Prof. Rao has been influential in formulating the country's science policies over many years. He was a member of the scientific Advisory Council to Prime Minister Indira Gandhi. Subsequently, he headed the Scientific Advisory Councils to four Prime Ministers: Rajiv Gandhi, H.D. Deve Gowda, I.K. Gujral and most recently, Manmohan Singh. Prof. Rao promoted initiatives in high temperature conductivity and more recently in nano sciences, which provided funding for Indian scientists to carry

out frontline research in these fields.

At his urging, five Indian Institutes of Science Education and Research have been setup to capture promising students at the undergraduate stage and provide them high-quality science training in a research environment. He has received several prestigious international science awards and is a member of many of the world's science academies. He remains an active researcher with a phenomenal output. Rao's contribution in the field of science in India is immense and we pray for his long life and we would try to fulfill his dream of India becoming leader in science and technology.

Parul Sharma

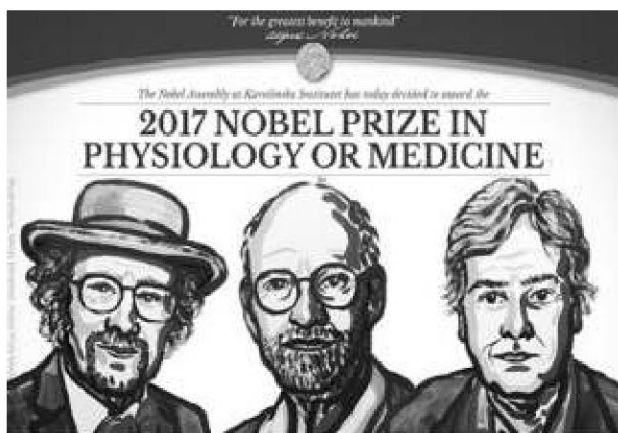
B.Sc (Hons) Chemistry IIIYear

Nobel Prize in Medicine 2017

Life on Earth is adapted to the rotation of our planet. For many years we have known that living organisms, including humans, have an internal, biological clock that helps them anticipate and adapt to the regular rhythm of the day. But how does this clock actually work? Jeffrey C. Hall, Michael Rosbash

and Michael W. Young were able to peek inside our biological clock and elucidate its inner workings. Their discoveries explain how plants, animals and humans adapt their biological rhythm so that it is synchronized with the Earth's revolutions.

These three Americans — **Jeffrey C. Hall, Michael Rosbash and Michael W. Young**— have won the 2017 Nobel Prize in physiology and medicine for their discoveries about the mechanisms that control an organism's circadian responses to light and dark.



Using fruit flies as a model organism, this year's Nobel laureates isolated a gene that controls the normal daily biological rhythm. They showed that this gene encodes a protein that accumulates in the cell during the night, and is then degraded during the day. Subsequently, they identified additional protein components of this machinery, exposing the mechanism governing the self-sustaining clockwork inside the cell. We now recognize that biological clocks function by the same principles in cells of other multi cellular organisms, including humans.

This year's Nobel Laureates, who were also studying fruit flies, aimed to discover how the clock actually works. In 1984, Jeffrey Hall and Michael Rosbash, working in close collaboration at Brandeis University in Boston, and Michael Young at the Rockefeller University in New York, succeeded in isolating the *period* gene. Jeffrey Hall and Michael Rosbash then went on to discover that PER, the protein encoded by *period*, accumulated during the night and was degraded during the day. Thus, PER protein levels oscillate over a 24-hour cycle, in synchrony with the circadian rhythm.

With exquisite precision, our inner clock adapts our physiology to the dramatically different phases of the day. The clock regulates critical functions such as behaviour, hormone levels, sleep, body temperature and metabolism. Our wellbeing is affected when there is a temporary mismatch between our external environment and this internal biological clock, for example when we travel across several time zones and experience "jet lag". There are also indications that chronic misalignment between our lifestyle and the rhythm dictated by our inner timekeeper is associated with increased risk for various diseases.

Researchers in the field of circadian biology — or "chronobiology," as it is nicknamed — said that the scientists' work has had a major influence on their work in human health and medicine.

Alzheimer's, depression, attention-deficit/hyperactivity disorder (ADHD), heart disease, obesity and diabetes and other metabolic issues are among the many conditions that appear to be linked to circadian rhythms being out of whack. They theorized that the brain may have a single, central clock controlling the cycles we've observed such as the rise and fall of our body temperature and blood pressure throughout the day. Now we know each living thing, including those without brains, may have many different clocks.

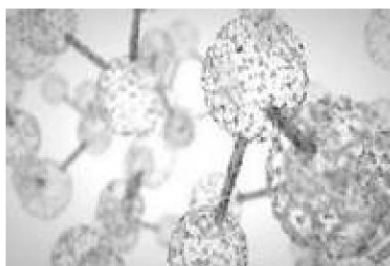
On announcing the winner in Stockholm on 2nd October 2017, the Nobel Prize committee said the scientists elucidated how a life-form's "inner clock" can fluctuate to optimize our behaviour and physiology. "Their discoveries explain how plants, animals and humans adapt their biological rhythm so that it is synchronized with the Earth's revolutions."

Vaishnavi Rana

B.Sc(Hons) Chemistry IIYea

The fascinating scientific ventures of the year 2017

1. The new state of matter



Normal 3-D crystals have a repeating pattern in space, but remain unchanged with respect to time; on the other hand, a time crystal or **space-time crystal** is a new and strange state of matter that repeats periodically on time, as well as in space, leading the crystal to change from time to time. Such an object would continuously change back and forth in a heartbeat like motion that repeats forever, a bit like a perpetual motion machine. The researchers studied how a special property of particles known as quantum spin could be repeatedly reversed by an external force at regular intervals. They predicted that on doing so to a set of particles, the interactions between the particles would produce their own oscillations in the spin, creating a "driven" time crystal.

2. The virucidal frog skin peptide



Kissing a frog might not get you the prince or princess of your dreams, but it does put you in close contact with frog slime – the mucus coating that keeps these amphibians' skin moist and protected. But, maybe a little frog slime from the right species is not that bad, after all? The slime of a frog called *Hydrophylaxbahuvistara* found in the southern India province of Kerala contains "**Urumin**", a naturally occurring virucidal, hostdefence peptide of 27 amino acids, which is effective against 8 different H_1N_1 and 4 different H_3N_2 viruses, as well as influenza A. The researchers have named it "Urumin", after the urumi, a deadly, flexible, whip-like sword used in Kalaripayattu; the martial arts form native to Kerala. This is of especial relevance because of the rise of drug-resistant influenza around the world. And given the propensity of influenza to cause pandemics, battling a drug-resistant virus without the right drug can be a nightmare.

3. Magic in Dragon blood



For thousands of years, Komodo dragons have thrived on an isolated chain of rocky Indonesian islands despite severe ecological competitions; tsunamis and drought. Scientists noted that the komodo dragons were immune to the poison induced from bites of other dragons. On progression, they discovered that the blood of komodo dragons, the world's largest lizards, was a mind blowing storehouse of **antimicrobial peptides**. Bishop and his team have identified more than 200 peptides in Komodo blood that hadn't been seen before, using a process he calls bio-prospecting. One of the dragon peptides was used to design a synthetic substance, called DRGN-1, which breaks down the layer of bacteria that attaches to the surface of a wound and can impede healing. In the lab, the substance healed infected wounds on mice faster than existing options, potentially giving doctors a new tool to fight antibiotic-resistant infections.

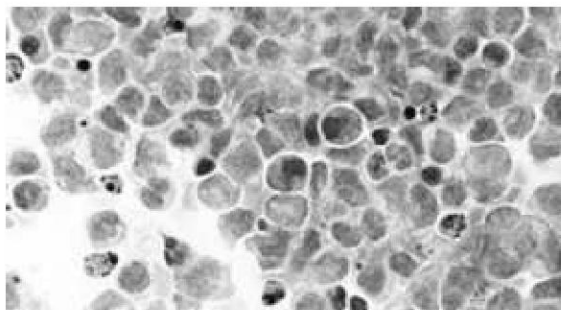
4. Discovering the Fountain of Youth



Lead researcher David Sinclair and his team's work have led the scientific community in a frenzy of excitement; the scientists having identified a cellular mechanism that allows them to **reverse ageing** in mouse DNA and protect it from further damage. They observed that the cell of younger mice contained more of compound NAD^+ than their older counterparts. After many researches it was found that any damage in the DNA is repaired by a compound called PARP1. When the amount of NAD^+ in a cell is considerably high, PARP1 does its job and keeps our DNA healthy. But when

NAD^+ decreases naturally with age, PARP1 starts declining as well and the damage builds up. Sinclair and his team developed a drug that contains the precursor to NAD^+ known as **NMN** or **nicotinamide mononucleotide**. The boosting of older mice with NMN was enough to kickstart the healing of the damaged DNA. Within days, there was a marked difference in the agility, brain functioning, communication skills of the lab mice. Believe it or not, humans are next in line!

5. Advent of the "living drug"



An extraordinary research has successfully developed an immunotherapy drug that turns the patient's own blood cells into cancer killers. The most riveting fact of the treatment that is to be marketed under the name Kymriah, is neither a pill nor an injections but a personalized medicine service that functions as a "living drug". The treatment has to be created for each individual patient using their own T cells. The T cells are removed from patient's bloodstream, genetically

engineered to recognize and kill cancer. The weaponized cells are then multiplied and reintroduced into the patient. In an ongoing clinical trial, the treatment was administered to **advanced lymphoma** patients who had not responded to standard treatments and unbelievably, within three months, 37 percent of the patients showed no signs of cancer.

Kajal Thakur (Source: Reader Digest Magazine)

B.Sc (Hons) Chemistry III Year

Roads that stay cool, keep cities cooler

The battle against rising temperature has spilled onto the streets. Los Angeles is experimenting with a coating material for road surfaces that is designed to counter the "Urban heat island effect". The urban heat island effect means that asphalt streets, dark roofs, sparse vegetation and car-clogged roads makes cities a few degrees warmer than rural areas surrounding them.

The urban heat island effect is a phenomenon that affects many millions of people worldwide. The higher temperature experienced in urban areas compared to the surrounding countryside has enormous consequences for the health and well being of people living in cities. The rampant urbanization and increased anthropogenic heat production are the main causes of UHI. The UHI effect also leads to increased energy needs that further contribute to the heating of our urban landscape and the associated

environmental & public health consequences. Pavements & roofs dominate the urban surface exposed to solar irradiation. Asphalt concrete (AC) is one of the most common pavement surfacing materials & is a significant contributor to UHI. Densely graded AC has low albedo & high volumetric heat capacity which results in surface temperature reaching upwards of 60°C on hot days.

In Los Angeles roads covers nearly 30-45% of the surface area in a city, so they are a key factor driving how hot it might get. By 2050 temperature in downtown LA expected to exceed 35 degrees Celsius for 22 days per year. In 1990 only six days were that warm. Traditional asphalt absorbs up to 90% of the sun's radiation. To get rid of this city is using a material known as **cool seal**, a grey-coloured coating that reflects solar rays, compared with dark asphalt, which absorbs them. A similar material is used on taxiways & pavement where military spy planes are stored to make them less visible to satellites using infrared cameras. In preliminary test, areas of pavement covered in cool seal measured an average 11 degrees cooler in summer months than those covered black asphalt. The coating costs above \$ 40,000 per mile & lasts seven years. The experiment is a part of a wider city initiative launched by Los Angeles mayor Eric Garcetti to reduce its average temperature by 3 degrees Fahrenheit over the next 20 years.

Babita

B.Sc (Hons) Chemistry III Year

Niels Bohr wanted someone to look into a new calculation he was going to present, during his work in the Manhattan Project. Bohr knew that no one other than the fiercely witty and bold physicist, Richard Feynman would have the audacity to challenge or question his work. On being summoned, Feynman expressed his astonishment of being so chosen. Gradually, he got lost in the calculations, murmuring gibberish and all of a sudden, while looking intently at the calculations, shouted, "What is this, fool? There are 7 unknowns and just 6 equations. Are you nuts?" To hear someone calling his Nobel Prize winner, physicist, father as nuts, Aage Bohr was about to retaliate violently, but Niels Bohr stopped his son. Feynman, unaware of the proceedings continued, absorbed in work till 4am in the morning. On his way out, Feynman asked Aage, "Why did your father pick me and not one among the multitude of geniuses here in the project?" Aage replied, "Because, none of the geniuses would dare call my father nuts". Feynman cracked into a laugh, "You mean, I would call Dr. Bohr nuts! Are you nuts?"

The first human cyborg: Kevin Warwick

Remember watching the sci-fi flick, with "Robocop" tearing around the street ends with fiery speed, gunning down his killers? In case you are not aware, Robocop is a human selected for the "Robocop program" which replaces most of his body with cybernetics, except for his brain making him a human cyborg. And, who can forget the famous robot series of the ultimate robotics genius, author Isaac Asimov, where artificial intelligence governs the code of human life.



Well, indeed these work that seem all fiction based today could just become the ultimate reality tomorrow. And the first step towards integration of artificial neural network with the human system has already begun. **Kevin Warwick**, a British scientist has become the first Human Cyborg, as a result of his efforts and experiments on "The Direct Interfaces of Nervous

System of Human Beings and link to Robotics."With the aim to become a better human being, he has surgically implanted a Silicon Chip transponder in the nerves of his hand with the help of Dr. George Boulous who carried out the operation and can now control doors, lights, computers and other electrical system without even lifting his finger! With the help of this transplanted chip he can send signals through his nervous system to his computer. Prof. Warwick has got his wife, Irena, to be transplanted with a similar chip and the couple can communicate and share their thoughts, emotions without any verbal means, in the form of electrical signal transferred via Internet. In short, they can have electronic communication quite similar to a conversation carried out between two robots as often witnessed in movies. Within 30 years, the "Human Cyborg" predicts that the humans will not be talking in the old fashioned verbal way but directly, brain to brain. The experiments are to develop several therapeutic applications, including solutions to complex problems such as Parkinson's disease. For instance, using Artificial Intelligence in conjunction with deep brain stimulation, it is possible to suppress the tremors in patients by using electrodes implanted in the brain.

Chanchal Saini

B.Sc Chemistry (Hons) III year

Understanding the molecular basis of the forest aroma

Ever wondered about the spiky cool, soothing scent that tantalizes our senses and envelopes the mind, while walking through the pine woods in the hill stations? The aroma in the forest is due to the presence of biogenic volatile organic molecules emitted into the atmosphere by the pine trees. Among biogenic



volatile organic molecules is a class of compounds called monoterpenes, which react with ozone, hydroxyl radical, nitrogen oxides and other gases in the atmosphere. The monoterpene responsible for the fresh scent is the molecule **alpha-pinene**, of which forests release about 50 trillion grams each year into the troposphere. Alpha-pinene in its solid phase has an already determined bicyclic or two-ring structure. In the troposphere, however alpha-pinene is a gas. In order to accurately predict how alpha-pinene reacts in the troposphere and thus how it affects ambient air,

researchers need a detailed understanding of its molecular structure. Because alpha-pinene exists in the gas phase at low concentrations it requires highly sensitive experimental techniques; no one had previously identified its gas-phase molecular structure. "Up to now, structure determination of complex molecules such as monoterpenes was only possible in the condensed phase," Huet said. Huet's lab is developing methods sensitive enough to determine the structure of the monoterpene gases. The researchers have identified the quantum parameters of rotational constants that best describes the data with no structural assumptions. They repeated this analysis for all naturally occurring isotopic versions of alpha-pinene in which carbon-13 isotopes replace different carbon-12 isotopes in the molecule. This set of rotational constant describes the complete structure of alpha-pinene gas. Huet believes that this research will aid in identifying the structure of other monoterpenes in their gaseous phases, as well, and enlighten the scientific community of the molecular basis of several other olfactory mysteries.

Kajal Thakur

B.Sc (Hons) Chemistry III Year

Cancer detection using nanoparticles

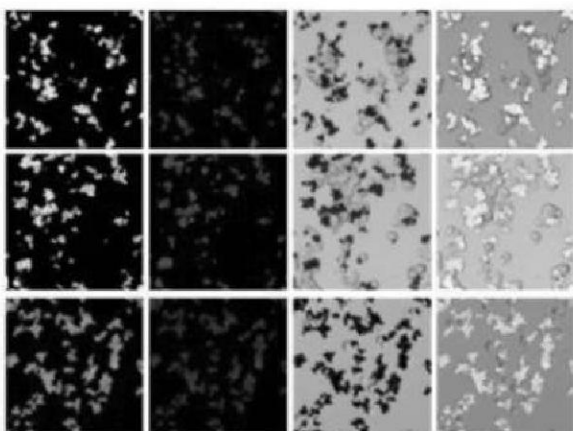
Cancer has become one of the most lethal human diseases all around the world, which brings an urgent need for the development of effective early diagnostic and therapeutic strategies. The past decade has witnessed the successful introduction of a plethora of nanoparticles for cancer diagnosis, imaging, and treatment.

Using light-emitting nanoparticles, Rutgers University-New Brunswick scientists have invented a highly effective method to detect tiny tumours and track their spread, potentially leading to earlier cancer detection and more precise treatment. The technology could improve patient cure rates and survival times.

"We've always had this dream that we can track the progression of cancer in real time, and that's what we've done here," said Prabhas V. Moghe, a corresponding author of the study and distinguished professor of biomedical engineering and chemical and biochemical engineering at Rutgers-New Brunswick. "We've tracked the disease in its very incipient stages."

The study in *Nature Biomedical Engineering* shows that the new method is better than magnetic resonance imaging (MRI) and other cancer surveillance technologies. The ability to spot early tumours

that are starting to spread remains a major challenge in cancer diagnosis and treatment, as most imaging methods fail to detect small cancerous lesions. But the Rutgers study shows that tiny tumours in mice can be detected with the injection of nanoprobess, which are microscopic optical devices that emit short-wave infrared light as they travel through the bloodstream. The nanoprobess were significantly faster than MRIs at detecting the minute spread of tiny lesions and tumours in the adrenal glands and bones in mice. That would likely translate to detection months earlier in people, potentially resulting in saved lives, said Vidya Ganapathy, a corresponding author and assistant research professor in the Department of Biomedical Engineering.

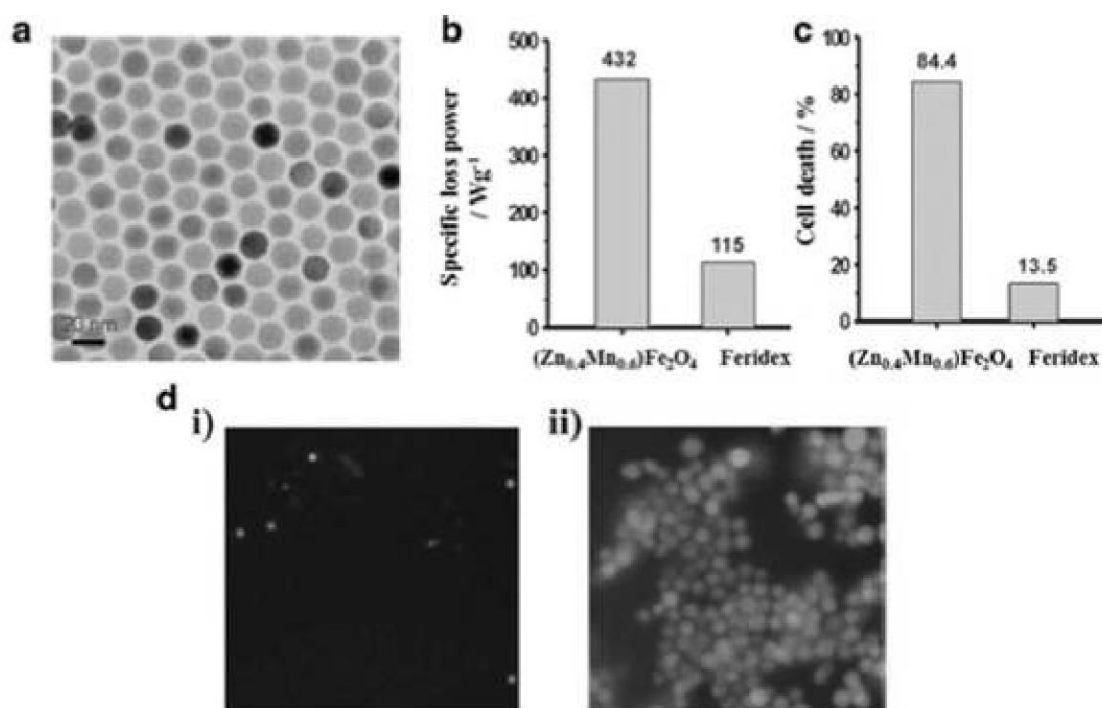


"Cancer cells can lodge in different niches in the body, and the probe follows the spreading cells wherever they go," she said. "You can treat the tumours intelligently because now you know the address of the cancer."

The technology could be used to detect and track the 100-plus types of cancer, and could be available within five years, Moghe said. "You can potentially determine the stage of the cancer and then figure out what's the right approach for a particular patient," he said. In the future, nanoprobess could be used in any surgeries to mark tissues that surgeons want to remove, the researchers said. The probes could also be used to track the effectiveness of immunotherapy.

These tools, however, have specific deficiencies. Fluorescent probes that image individual molecules have poor depth penetration into cells. The alternative, magnetic resonance imaging (MRI) probes, resolves cells in three dimensions but with low resolution. Bin Liu at the A*STAR Institute of Materials Research and Engineering, Singapore, and co-workers have now solved this problem with a biocompatible polymer that combines MRI and fluorescence imaging in a single molecular probe "Single molecular hyper branched nanoprobess for fluorescence and magnetic resonance dual modal imaging".

Some limitations still exist, and more data is needed to translate the results obtained in animal models into applications in humans. The experimental models in humans are not yet standardized and much more heterogeneous than animal models because of high heterogeneity in blood flow, which often makes comparison of results troublesome. We anticipate that many of the current problems will be resolved in the near future, and we expect that much of the current research will be translated into clinical applications.



a TEM image of 15-nm $(\text{Zn}_{0.4}\text{Fe}_{0.6})\text{Fe}_2\text{O}_4$ nanoparticles. **b** SLP values for $(\text{Zn}_{0.4}\text{Mn}_{0.6})\text{Fe}_2\text{O}_4$ and Feridex in a 500 kHz AC magnetic field with an amplitude of 3.7kAm^{-1} . **c** Percentage of HeLa cells killed after treatment with $(\text{Zn}_{0.4}\text{Mn}_{0.6})\text{Fe}_2\text{O}_4$ nanoparticles or Feridex and the subsequent application of an AC magnetic field for 10 min. **d** Fluorescence microscopy images of AC magnetic field applied HeLa cells treated with i) $(\text{Zn}_{0.4}\text{Mn}_{0.6})\text{Fe}_2\text{O}_4$ nanoparticles or ii) Feridex. Calcein staining indicates live cells with green fluorescence.

Ayishwarya Dutta

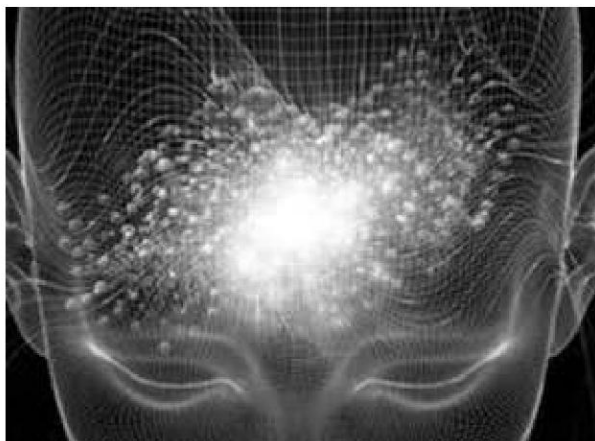
B.Sc. (Hons) Chemistry II Year

“The chemists are a strange class of mortals, impelled by an almost insane impulse to seek their pleasures amid smoke and vapour, soot and flame, poisons and poverty; yet among all these evils I seem to live so sweetly that may I die if I were to change places with the Persian king.”
- Johann Joachim Becher (Physician, Alchemist)

Mind: Storehouse of strength

Helen Keller once said, ***“Mind is the source of all bondage and also the source of liberation.”***

Indeed, mind is a supernatural imaginary force which guides and controls all our actions. As radar guides the ship in the vast ocean, mind gives us orientation to shape life and achieve desired goal in the sea of life. Our reflexes are controlled by the enormous strength mind possesses. It gives us the strength to reason anything and analyze it to fruition. It facilitates decision making. It is that magical key which



unlocks all the doors to destination.

The most important ingredient of success is a strong will power and it has direct correlation with strong mind. What we mean by will power? It is faith in self. For achieving success, man tries, plans and labours hard, so long as there is faith in his mind. Faith can move mountains. It ever keeps the rays of hope alive in despair and disaster fighting against all odds. Faith gives a man his individuality, self-assertion and leads him to action. Truly, creativity, innovations, analytical abilities are all manifestations of the versatility of the powerful mind. It is the seed of success.

The almighty God has gifted all the human beings with beautiful body to carry out their tasks efficiently. We have similar parts and almost similar features. But the demarcation line which sets apart the ordinary from extraordinary, the average from the outstanding is the mind endowed with merit and knowledge and not the physical strength. When darkness and despair surround somebody, when failure confronts someone, when sorrow prevails and life seems meaningless to somebody, it is that strong mind and dogged determination which illuminates his/her life with light of aspiration. It makes u lead a life in its fullest form. It is the stability of mind that helps us attain a state of bliss and satisfaction.

Nobody can deny or dispute about the unending powers of mind but the contribution of body to some extent has to be given its due share. This is well illustrated by the saying – A healthy mind resides in a healthy body. The body is the instrument through which we have to work and for the achievement of anything great one needs a sophisticated instrument. Hence, the body has to be taken care of as we care for a delicate instrument to get success.

Anjana Singh

B.Sc (Hons) Chemistry III Year

The Human Genome Project

The Human Genome Project was an international scientific research project with the goal of mapping the sequence of nucleotide base pairs that make up the human DNA, in order to identify the genes from both physical and functional standpoint. It remains the world's largest collaborative biological and chemical project. The idea of the mega project was picked up in 1984 by the US government and due to widespread international cooperation and advances in the field of genomics and computing technology; a 'rough draft' of the genome was finished by the year 2000. The International Human Genome Sequencing Consortium published the first draft of the human genome in the journal *Nature* in February

2001 with the sequence of the entire genome's three billion base pairs some 90 percent complete. The full sequence was completed and published in April 2003. If the obtained sequences were to be stored in typed form in books, and if each page of the book contained 1000 letters and each book contained 1000 pages, then 3300 such books would be required to store the information of DNA sequence from a single human cell. The project can be explained by divulging in the following questions-

What is a genome?

A genome is an organism's complete set of DNA, including all of its genes. Each genome contains all of the information needed to build and maintain that organism. In humans, a copy of the entire genome—more than 3 billion DNA base pairs—is contained in all cells that have a nucleus.

What was the Human Genome Project and why has it been important?

The Human Genome Project was an international research effort to determine the sequence of the human genome and identify the genes that it contains. The Project was coordinated by the National Institutes of Health (NIH) and the U.S. Department of Energy. Additional contributors included universities across the United States and international partners in the United Kingdom, France, Germany, Japan, and China. The work of the Human Genome Project has allowed researchers to begin to understand the blueprint for building a person. As researchers learn more about the functions of genes and proteins, this knowledge will have a major impact in the fields of medicine, biotechnology, and the life sciences.



What were the goals of the Human Genome Project?

The main goals of the Human Genome Project were to provide a complete and accurate sequence of the 3 billion DNA base pairs that make up the human genome and to find all of the estimated 20,000 to 25,000 human genes. The Project also aimed to sequence the genomes of several other organisms that are important to medical research, such as the mouse and the fruit fly.

In addition to sequencing DNA, the Human Genome Project sought to develop new tools to obtain and analyze the data and to make this information widely available. Also, because advances in genetics have consequences for individuals and society, the Human Genome Project committed to exploring the consequences of genomic research through its Ethical, Legal, and Social Implications (ELSI) program.

What was the methodology of sequencing of base pairs in Human Genome Project?

For sequencing, the total DNA from a cell was isolated and converted into random fragments of relatively smaller sizes and cloned in suitable host using specialised vectors called BAC (bacterial artificial chromosomes) and YAC (yeast artificial chromosomes). The cloning resulted into amplification of each piece of DNA fragment which were sequenced using automated DNA sequencers that worked on the principle of overlapping, developed by Frederick Sanger. The enormous amount of data expected to be generated necessitated the use of high speed computational devices for the enormous data storage and analysis. Thus, the HGP was closely associated with the rapid development of a new area in biology called Bioinformatics.

What did the Human Genome Project accomplish?

In April 2003, researchers announced that the Human Genome Project had completed a high-quality sequence of essentially the entire human genome. This sequence closed the gaps from a working draft of the genome, which was published in 2001. It also identified the locations of many human genes and provided information about their structure and organization. The Project made the sequence of the human genome and tools to analyze the data freely available via the Internet.

In addition to the human genome, the Human Genome Project sequenced the genomes of several other organisms, including brewers' yeast, the roundworm, and the fruit fly. In 2002, researchers announced that they had also completed a working draft of the mouse genome. By studying the similarities and differences between human genes and those of other organisms, researchers came to discover the functions of particular genes and identify which genes were critical for life.

What were some of the ethical, legal, and social implications addressed by the Human Genome Project?

The Ethical, Legal, and Social Implications (ELSI) program was founded in 1990 as an integral part of the Human Genome Project. The mission of the ELSI program was to identify and address issues raised by genomic research that would affect individuals, families, and society. A percentage of the Human Genome Project budget at the National Institutes of Health and the U.S. Department of Energy was devoted to ELSI research.

The research goals of ELSI were to:

1. Examine and understand the complex issues surrounding human DNA sequence and genetic variation within humans.
2. Examine how the health care system will be impacted by the integration of genetic information.
3. Examine how gene-environment interactions will be affected in a non-clinical setting.
4. Investigate how genetic information will shape already established views in philosophy, theology, and ethics.
5. Investigate how genetic information will be used based on race, ethnicity, and socioeconomic factors.

Khyati Kalra

B.Sc (Hons) Chemistry II Year

Study on Phosphorylation

Phosphorylation has been a long-standing problem in context with the origins of life. Researchers around the globe are in the quest for solutions to phosphorylate organic molecules under aqueous conditions. Phosphorylation is an important process in the biochemistry and is crucial for the synthesis of three different classes of biomolecules which are the main components of life. These main components are nucleotides as in DNA and RNA which store the genetic information, peptides that are formed by amino acids and phospholipids which are the most important constituent in the cell membrane. In the recent study titled as "Phosphorylation, Oligomerization and Self-assembly in Water Under Potential Prebiotic Conditions" which was published on November 6, 2017 in the journal Nature Chemistry from our laboratory at the Scripps Research Institute, we have shown that an amidophosphorylating reagent, known as diamidophosphate (DAP) can efficiently phosphorylate prebiological molecules such as nucleosides and nucleotides. The prebiotic-relevant amino acids such as glycine, aspartic acid and glutamic acid have shown to undergo oligomerization and phosphorylation.

What was spectacular about these findings was the fact that fatty acids in combination with glycerol in the presence of DAP forms phospholipids that can self-assemble to form vesicles that can encapsulate pyranine dye. Further studies are underway to evaluate the properties of these phospholipids with respect to dynamics and drug carrier properties.

This study was published in the journal Nature Chemistry from the lab of Prof. Krishnamurthy, the Scripps Research Institute by the authors Clémentine Gibard‡, Subhendu Bhowmik‡, Megha Karki‡, Eun-Kyong Kim, Ramanarayanan Krishnamurthy* ‡ These authors contributed equally to this work.

Megha Karki

Post Doctoral Fellow, The Scripps Research Institute, La Jolla, CA

B.Sc(Hons) Chemistry 2005 -2008

To hear you...

What would I do if I couldn't hear?
I'd suppose I'd sense that nothing is near..
It's not just about being blessed to be able to sense,
But to listen to someone's heart, in times happy or tense..

It is not the decibel that counts,
But the sense that comes with the sound,
Of variant emotion, low and upbeat,
Making kindled spirits, hearts and loved ones meet..

Undoubtedly emotion is beyond expression,
Timeless in its very form or version,
But then when none is near, what else would please,
But the thoughts and sounds in your head that release..

At this when I am melancholy away from loved ones, home,
This is one way for me to be shown...
Through the sense of sound that your joy gleams,
Nearness and timeless does it seem....

To hear you say all the things we do,
For the surreal thoughts or fretting true..
For all the ones at the receiving end,
Every emotion for my heart does lend..

And even if you were right in sight, in view..
Your voice would have stirred these very few
Laughs, vent and tears that trickle anew..
The sense of life when I hear you...

A special thanks to Alexander Graham Bell for inventing the Telephone!!! And all my phone buddies!!!

Divya Subramanian

B.Sc. (H) Chemistry 2002-2005

Solar hydrogen: An alternative clean fuel

Abstract: A country's economy and development depends on availability of cost effective and environmentally benign energy sources. In the current scenario, fossil fuels, which fulfill most of our fuel requirements, are depleting. Combustion of carbon rich fuel releases greenhouse gases (GHG) which are responsible for global warming. A future energy economy needs to replace oil and reduce greenhouse gas emissions for climate protection. The worldwide interest in hydrogen as a clean fuel has led to comprehensive research, development and demonstration activities whose main objective is the transition from a fossil based to a "CO₂lean" energy structure. In the present article the thrust for the development of renewable and clean fuels and adverse effects of conventional non-renewable energy sources, different ways to utilize solar energy (the most abundant source of energy on earth) and conversion of solar energy into carbon free fuel such as hydrogen is emphasized. The different methods for hydrogen generation by using solar energy are mentioned. Photocatalytic water splitting is one of the potential approaches for hydrogen production and is described here. The role of heterogeneous catalyst in the water splitting reaction, problems encountered during the reaction and the overview of research done till date on water splitting reaction is also revealed here. A gist of photocatalysts developed by us at Chemistry Division, BARC is also mentioned here.

Generation of green house gases and scarcity of fossil fuel are the major concerns in near future. Hence, there is a need to replace fossil fuels with sustainable, renewable and environment friendly fuel to overcome this issues. Sunlight is freely available in abundance as a primary source of renewable energy on the earth and it can be converted to thermal and electrical energy using clean technology to minimize the GHG emission. Utilization of all solar energy falling on earth surface can satisfy World's annual energy demand. India receives 200 MW/km² average intensity of solar light and its proper use can satisfy India's growing energy demand. However, sunlight is intermittent in nature and its availability depends on time, season and geographical position. Photosynthesis is a natural process by which plants harvest sunlight and convert it into chemical energy such as carbohydrates. Similarly, solar energy can be converted into chemical energy like hydrogen which has a high calorific value (141.8 kJ/g) compared to other fuels such as gasoline (40 kJ/g) and is an attractive and clean fuel as its combustion product is only water. In hydrogen economy, it was envisaged that hydrogen can be a prospective candidate to replace fossil fuels. Fig. 1 shows the overall hydrogen technology emphasizing its production, storage and application.

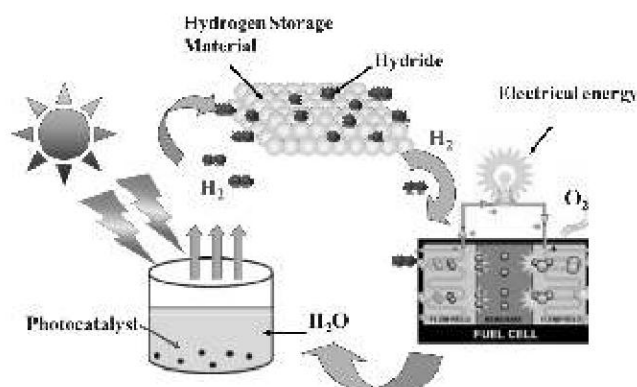


Fig.1 Harvesting solar energy by photocatalytic water splitting for H₂ production, storage and fuel cell application.

H₂ can be produced by using solar energy and water and stored in a hydrogen storage material. This stored hydrogen can be taken to the required site for its utilization or feed into fuel cell to produce electricity. The product water is recycled back to give hydrogen by employing solar energy. This is a clean way of conversion of solar energy into chemical form.

Photocatalytic water splitting

Photocatalytic water splitting is one of the promising methods for production of hydrogen using solar energy and water and photocatalyst. In this process, photocatalyst plays an important role. IUPAC defined photocatalyst as "Catalyst able to produce, upon absorption of light, chemical transformations of the reaction partners. The excited state of the photocatalyst repeatedly interacts with the reaction partners forming reaction intermediates and regenerates itself after each cycle of such interactions". Chlorophyll in plant is an example of natural photocatalyst which absorbs light and converts water and carbon dioxide into O₂ and glucose.

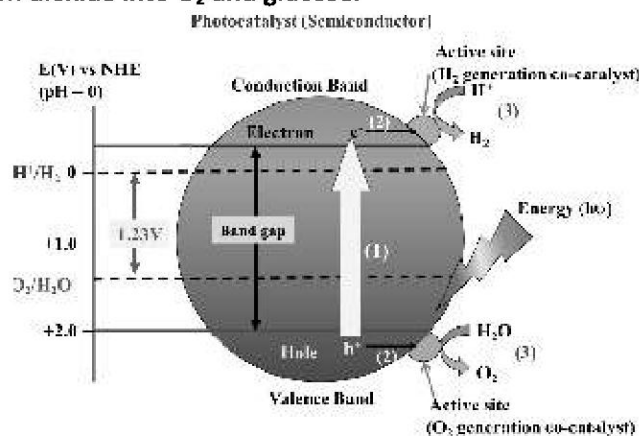


Fig.2 Steps involved during photocatalytic water splitting using semiconductor photocatalyst.

Semiconductors are potential photocatalyst because of their suitable optical and electronic properties. In semiconductors the valence band and conduction band is well separated by the forbidden gap called band gap. Semiconductors are useful for trapping of light/thermal energy. The following processes occur in semiconductor when light shines on it (Fig. 2). The first step is absorption of light by the semiconductor photocatalyst to produce e^-/h^+ pairs. The second step is the separation and migration of photogenerated e^-/h^+ to the surface active sites. The electron and hole should not recombine back to release energy in the form of unproductive heat or photons. The third step is reduction of water by electron to H₂ and oxidation of water by hole to O₂.

Photocatalysts studied

Around 190 phases were tested till date for photocatalytic water splitting reaction. Oxides, sulphides, nitrides, oxynitrides of metals (in d^0 and d^{10} configurations) and metal-free catalysts are promising. Transition metal oxides are stable and are well known for their catalytic and semiconducting properties. In d^0 electronic configuration, the outermost empty d orbitals of the metal cation mainly construct conduction band, some examples of such oxides are TiO₂, ZrO₂, WO₃, Ta₂O₅, Nb₂O₅. In d^{10} electronic configuration, hybridized orbitals of empty s and p orbitals of the metal cation predominantly form the conduction band with large dispersion. Such oxides include In₂O₃, Ga₂O₃, GeO₂, SnO₂, Sb₂O₅ and ZnO. Different kinds of indates, gallates, germanates, antimonates and stannates have been studied for water splitting reaction. Many photocatalysts have been developed till date but the required efficiency for

commercialization of the process has not achieved. Low stability, poor light absorption properties of photocatalyst and higher rate of recombination of electron and hole pair are the major concerns which need to be addressed in order to bring the process in reality.

TiO₂

Among these photocatalyst, extensive research has been carried out throughout the globe on TiO₂. It is an inert, chemically stable, robust, conventional catalyst and is considered as a promising candidate for commercial production of solar H₂. Although having favourable properties for water splitting, it shows poor photocatalytic activity due to limited absorption in visible region and shows fast rate of recombination of photogenerated electron and hole pair. In our laboratory we have adopted different strategies to improve the light absorption properties of TiO₂ towards visible wavelengths and also to limit the rate of recombination reaction.

Here in our laboratory, we undertook studies to improvise the optical and photocatalytic properties of several photocatalysts; conventionally known UV active TiO₂ and novel organic semiconductor, g-C₃N₄. Various strategies such as cationic doping by Cu in TiO₂, composite formation with NiO and CuO inducing *pn* heterojunctions, carbon incorporation in bulk TiO₂ to improve electronic conductivity, surface modification of g-C₃N₄ by dispersing carbon nanodots (CND) and noble metal ions (Pt, Pd, Au, Ag and Cu) were adopted to limit the e⁻/h⁺ recombination reaction and to enhance the photoresponse under visible light illumination. All samples were thoroughly characterized by relevant techniques and their potential for H₂ generation was evaluated under sunlight and UV-visible light in presence of sacrificial reagent. Density functional theory calculations were performed and life time of e⁻/h⁺ from PL decay curves was measured to support the activity trend. Parameters such as illumination area, catalyst concentration, form of catalyst (powder/films) and amount of sacrificial reagents were optimized for maximum H₂ yield. Performance of the screened photocatalysts was also tested in up-scaled photoreactors (vol = 0.5, 1 and 2 L). For more details our published papers can be referred on this subject.

Conclusion: Photocatalytic water splitting holds the promise for future hydrogen economy but the challenge involved is to bring this process into reality. Many photocatalysts were tested for pure water splitting but the low stability and limited absorption of visible light limits its use for practical application. From the above discussion it is concluded that development of a photocatalyst with high efficiency, stable and cost effective is a main concern for bulk production of solar hydrogen.

Acknowledgement: I thank all my co-authors and students (Ms. S. A. Rawool, Ph.D student) involved in this work. I am grateful to all my senior colleagues for providing encouragement. I hereby take this opportunity to thank my alma mater, Gargi College particularly Dr. Sushmita Chowdhury, for providing me an opportunity to share exciting aspects about the production of alternate clean fuel hydrogen and highlights of our contributions in this field with all readers. I joined the college as the first batch of students of Chemistry honours and thank all my teachers who contributed immensely in my growth and development.

(The article is based on published work by the author and others. Interested readers may contact the author or members of the editorial board for detailed references)

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B.Sc (Hons) Chemistry 1991 - 1994

Strolling down the memory lane.....

Dr. Prem Khullar It has been my privilege to be associated with Gargi College for 43 years from 1969 to 2012. It has been a long journey full of experience which developed me to a confident person. When I joined college in July 1969, it was housed in a school building in Lajpat



Nagar behind Lady Shri Ram College (LSR). People did not know this college, it had no identity of its own, the only reputation it enjoyed was the college behind LSR. There was one course in science, the pre medical course. After a few years, when the pre medical course

ceased to exist, B.Sc. (General) Group B (known now as B.Sc. Programme Life Science) was introduced. From that reputation Gargi College has grown to a full-fledged college with a "Potential for excellence and star status, this is due to the contribution and hard work of teachers. It is now one of the most sought after colleges in south Delhi.

The first principal of the college, under whom I joined, was Smt. Indira Thakurdas who treated the staff members as a family and had the knack of recognizing the potential in a person. It was under her leadership that the college developed in leaps and bounds. There were only two teachers in the department Dr. C.K Khurana and Ms. Pratibha Sharma. The former was the senior most teacher in the department, she trusted us completely and under her guidance we set up the chemistry labs. We visited different colleges in north campus to get an idea, new balances and equipment were purchased. Weight boxes were standardized in the chemistry department of Delhi University. We visited book shops in Kashmiri Gate and selected books for the college library. We took a lot of care to see that our students should not suffer in any way by joining a new college. We did not look into our specialization and prepared schemes for Inorganic and

Organic analyses. These schemes were subsequently improved by the younger teachers but the seed was sown by us.

When we shifted to the present building we were faced with the uphill task to get the plan of the laboratory approved, to get the civil, wood work and electrical work done and set up the new lab and make it functional. The preparation room and store room had to be developed, stock registers for purchase and consumption of chemicals and equipments were to be maintained. All teachers were united and put their best foot forward in establishing the laboratory and maintaining records.

After a few years BSc (General) Group A (known now as B.Sc. Programme Physical Science) was introduced, this was followed by honours courses in botany and zoology, chemistry was their subsidiary subject. With much efforts chemistry (Honours) was granted to us in 1991. No extra grant was given to set up the honours laboratory. With great difficulty and much later a new lab was set up on the second floor of the building. New experiments were introduced and we performed them ourselves before asking our students to do, new equipment, instruments and books were purchased. It was a great learning experience.

I had the privilege of teaching Quantum Mechanics, my favourite subject, later on I taught chemicals kinetics as well. My aim was to introduce the concepts in such a way that they would understand the subject and not memorize. The Chemical Society, "Rasgandhyan" was formed. This name was given by the late Dr. Santosh Luthra of the Hindi department. Various competitions like poster making, rangoli, science quiz, dumb charade, paper presentation and seminars were organized by this society. The inter college chemistry festival was named 'Chemaroma'; however now we have a science festival "Scintillations". The Chemistry department was the first one to have an alumnae meet and holds a degree distribution function for the honours students. A

magazine of the chemistry department "Amalgam" was later introduced.

I congratulate the chemistry department on successfully completing 25 years in this course. Our students have performed brilliantly. Some students got admission in IIT, some went abroad and managed to have lucrative jobs. It was a very satisfying experience when you see your students perform well in life and having great careers. In 2006 I introduced silver medal for the best student in physical chemistry in III (hons). Later on in 2012, it was converted to a cash award for the best student in chemistry (hons). I have been loyal to the department and tried to shoulder responsibilities and think about improving the department from time to time.

I would like to appeal to the young teachers of the department to raise the standard of teaching and take a lot of interest in the administrative functions of the department. They should focus on developing students beyond their curriculum. Students' research needs to be developed and they should encourage students to take up projects.

My best wishes for the science department for a great future.

**** * * * * * * * * * * * * * * * * * *

Dr Indu Sidhwani —The joy of teaching in Gargi then and now— The wonderful journey of the Chemistry Department began in a school building behind



LSR in 1967, and I joined the college on 4th September 1973. The best part about the old college was that there were only three labs of 20 students each, and it was the responsibility of each teacher to mentor all experiments irrespective of their

specialisation. This set-up was a great learning experience for us, as we got trained to handle a variety of

experiments. In 1976, we moved to the current building. With time, the number of courses and students increased, to where we are today.

Since Chemistry is a nexus between all branches of science, we have continually interacted with all other science courses such as Botany, Physics, Maths, Microbiology and Zoology. I would like to thank the innumerable students of various disciplines and various different courses whom I have taught. It had always been a pleasure learning from your curiosity and questioning power, which has made me a better teacher. I always felt young in your company. Your smiling faces lighten up our day, and your academic and other achievements make us feel very proud.

During the last couple of years, the department has been bubbling with various activities, like lectures by eminent scientists, oral and poster presentations, ozone day celebrations, science quizzes and much more. We are the first and only college in our University to have a lecture on Nobel prize centenary celebrations. Students have been intellectually stimulated and publishing their own department magazine. We have received a number of grants, including CPE and star college grants, which have allowed the students to work towards socially relevant projects. Importantly, we have developed a number of innovative interdisciplinary projects, which has fostered a more collaborative undergraduate environment. Through these projects, our students have gotten the unique opportunity to publish and present their work in national and international conferences. It has truly been a fulfilling time for our department. With great pride, I want to say that the Chemistry department is one of the best in the University of Delhi. It is rightly said that the team work is essential for success, and I think we saw it in the NAAC accreditation when we were awarded an A grade.

As for the next steps, I think it is important for us to inculcate collaborations with the industry and develop state-of-the-art chemistry labs for our students. Students will benefit by doing some projects using wastes generated

in the lab. By doing so, we will be teaching our future generations about sustainable development, while also working towards waste management. Micro-techniques should also be used for safer chemistry, reduced time and cost, waste minimization and lab skill development. We have very experienced young academic faculty-- their potential will ensure the success of these endeavors while also helping to retain the best practices of our department. To our students, I would like to request you to attend your classes and practicals regularly for continuity. A lot of hard work, energy and resources go into preparing for labs and theory classes. We do it for you, so it is encouraging when we see you work equally hard towards your own future.

I would like to end by saying that there is so much to do in life-- if you do not achieve what you wanted to, a new path will always open up. Just always yearn to achieve the highest.

As quoted by Richard Bach, "You are never given a dream without also being able to make it true."

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Dr. Keya Banerjee As I try to recollect the past 33 years with the department, many events flash through my mind. The years have been memorable. I have been very fortunate to have been associated with Gargi



College and the chemistry department; it has helped me to grow as an individual. I have seen the department and the college both blossoming from into a flower and bearing fruits and which has been a wonderful experience. Introducing the B.Sc honors Chemistry course in

1991 was a challenge for all of us. The chemistry honours has always been a sought after course due to its diversified and intensive nature. In the beginning, it was not easy to persuade the authorities at the college and University level and also the UGC to give sanction for introducing the

course. Somehow, after the approval, authorities in the college had reservations due to constraints of space and infrastructure. The contributions of all my colleagues, both academic and non-academic have been tremendous in shaping up the Department of Chemistry to what it is today. I would like to have a special mention of all the senior colleagues who have built up the department brick by brick. They have always been the guiding and motivating factors behind all our endeavors. Dr. (Mrs.) Khurana deserves a special mention here who has been the founder member of the Department and also the driving force behind getting Chemistry (Hons.). At this point I would also like to remember Dr. Minakshi Sharma who is no longer with us today.

Since the college was an out of Campus College, distantly located with poor connectivity, we had our apprehension regarding the quality of students we would be getting. To our surprise, we found the first batch of honors students who come were very sincere and committed. We were fortunate enough to have bright and dedicated students all through. They have been making us proud. Many of them are placed in very good positions.

With start of Chemistry Honors course, we started the Chemical Society 'RASGANDHAYAN', prior to which existed a Science Association combining all Science Departments.

The Chemical Society activities increased students' participation in presentations and debates. Eminent personalities took part in deliberation and this gave students a chance to interact with them and know about the opportunities that lay ahead. The Chemical Society apart from intellectual activities have been organizing some other fun loving activities like crossword, quizzes etc. It also started the wall magazine where one finds students actively participating updating their friends time to time. 'Amalgam' the Chemical Society Magazine also finds enormous involvement of students and faculty who work

tirelessly to express their views and opinions in the form of articles, riddles, fine arts etc.

The Chemistry Department has the distinction of offering the M.Sc. course for nearly a decade now. The library has been regularly upgraded so that the students at both UG and PG level have updated knowledge.

In all these years, from time to time, seminars, symposiums and workshops have been arranged where students and faculties have participated. In the recent past, add on courses have also been offered by the department along with openings for projects in various fields supervised by faculty members.

I am sure, in the future, the Department will sustain all these efforts and would be able to improve and improvise the curriculum with cooperation from younger faculty members who have expertise in various branches of Chemistry.

Signing off with all my best wishes.

**** *

Dr Rita Bhatla As I begin to write this piece, my memory rushes back to September 13, 1991. This was the



day I first came to Gargi College for my interview as a part time lecturer in the Chemistry Department. I was extremely lucky to be interviewed by the Founder Member of the department, Dr. (Mrs.) C.K. Khurana. Gargi

College was sanctioned the B.Sc. (Honours) Chemistry course in the same year. All the faculty members took it as a challenge to make this course a great success amidst competition from other reputed colleges of Delhi University where the course was already well established. I fondly remember the time when we visited several book shops on Bungalow Road, Kamla Nagar to look for new titles and the latest editions of textbooks in order to

adequately equip the college library for the benefit of the students. Our students also played their part in this exciting journey and brought several laurels to the department by securing good academic positions in the South Campus as well as the University.

We started our Department Society, 'Rasgandhayan' and our highly successful annual festival 'Chemaroma' in the forthcoming years. This inter-college cultural festival gave the students an opportunity to showcase their talents outside the classroom as well. At the same time all of us worked hard to generate funds for the growth and development of the department and conducted IGNOU practical classes on weekends as well as during the vacations. The Gargi College centre was extremely popular because of the hard work and dedication of the teachers. Consequently, it was possible to have our second chemistry lab for Honours students and also an independent instrument lab. Apart from excelling in academics, the department has been organising industrial trips, add-on courses, conferences, symposia and picnics for the holistic development of students.

The last few years have seen a continuous change in systems from annual to semester mode as well as the introduction of FYUP and CBCS. The superannuation of senior teachers and an increase in workload has led to appointments of young teachers in the department. I have had the great privilege to work with the both the founding members and also the present generation of teachers which is completely tech savvy. I am sure that they will take the department to greater heights in the future while building on the status that has already been achieved by their predecessors.

Nevertheless, the students' hard work, sincerity, enthusiasm and passion for the subject will remain an extremely important ingredient in the flourishing of the department.

**** *

Dr Renu Agarwal My journey in Gargi College started in July, 1993 when I joined the Chemistry Department almost 25 years before. That was the 3rd year of inception of Chemistry (Hons.). I was given 1st year(H) to teach which was the first batch of integrated chemistry (H) course. In our department, all were very enthusiastic for Hons. classes, we all used to discuss the theory and



practicals before taking the class. We carried out all practicals ourselves before doing in the class. I really appreciate the efforts taken by my senior colleagues. They collected the writeups

from other colleges and then discussed in the college so that we all can do justification towards Hons. course. At that time the practical classes for Hons. classes were held in ground floor small lab which is now known as instrumentation lab. Later on it was shifted on second floor. We all teachers at Gargi worked towards greening of chemistry by making changes in the processes and using small quantities of starting materials in practicals. Due to the sincere efforts of all teachers, non teaching staff and our beloved students, Gargi college is now one of the best college for chemistry (H) course in D.U.

I believe in future also with the valuable experience of our seniors and innovative ideas of our young brigade of teachers, we will reach new heights.

Dr Renu Agarwal, Associate Professor, Department of Chemistry, Gargi College, has received the Award for college lecturer by Government of NCT of Delhi for the

Chemical Society Song Composed by Dr. S. Bhanumati

God grant us today
The strength of thy upholding hands
Lead us to light, make us upright
Keep us away from wars and fights

Help us, create a World of our choice
Devoid of pollution and nuclear wars
Guide us to open new vistas in chemistry
To change the cosmos and human history
Banning the use of all chemical weapons
Abating the arms race and mighty cannons

Free us from poverty, hunger and drought
Fill us with love, care and righteous thoughts
And above all
Give us wisdom
To pursue science
With conscience

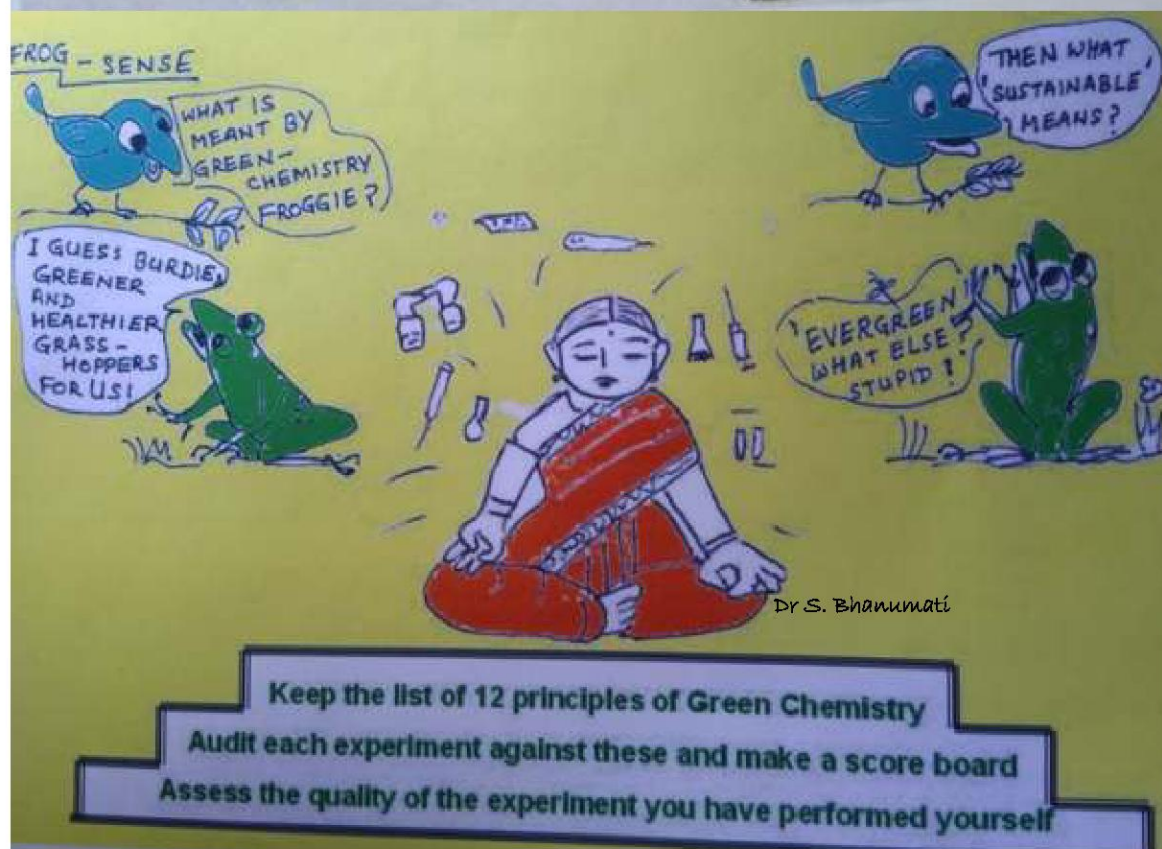
Pursue science with conscience
Pursue science with conscience...



Strolling down the memory lane.....



From L to R clockwise: Dr Renu Agarwal, Dr Keya Banerjee, Dr Manju Avinashi, Dr Prakash Dabbas, Dr Indu Sidhwani, Dr B. Vaijyanthi, Late Dr Minakshi Sharma, Dr Uttara Dutta, Dr Rita Bhatla, Dr Prem Khullar, Dr Manju Kapoor, Dr Sushma Bhan, Dr Sushmita Chowdhury, Dr Anita Chugh, Dr Chandana Mukherjee



Toppers of academic year 2016-2017 of Chemistry Department



Vaishnavi
I year (CGPA-9.91)



Nandana
II year (CGPA-9.68)



Chahat Chhabra
III year (1st South Campus)

Achievements by students of Chemistry Department in 2017-2018



SAPNA
B.Sc. (H) Chemistry II year
First position in Basket Ball tournament at Institute of management, New Delhi.



PRIYANKA KANDPAL
B.Sc. (H) Chemistry III year
First position in following tournaments: Lady shree ram for women, NDIM, Sharda University, JIIT, Noida & GLA, Mathura.



SWATI MITTAL
B.Sc. (H) Chemistry III year
Group Folk Dance: 1st prize in Deshbandhu College, Kamla Nehru College, Daulat Ram College & SGTB Khalsa College



SHIVALI
B.Sc. (H) Chemistry III year
• G old Medal in Matasundri Judo Inter College
• G old Medal in LSR Judo Inter College

Glimpses 2017-18



Chemistry
Department
secured 3rd
position in
March Past on
Sports Day



List of the Alumni 1992 to 2003 (first ten years)

All our alumnae are dear to us and achievers in their own right. However, we are not in touch with everybody. From the present issue onwards we will feature the profiles of some alumni to give the current students an idea of the field in which they excel. Here are the details of alumni of first 10 years.

| Name of Alumni | Year | Qualification | Current status |
|--------------------------|-------------|--|--|
| Aashna Puri | 1994 | M.B.A. (Fore School of Management) | Director of Advisory services, Price Water House Coopers, UAE |
| Anu Jain Khandelwal | 1994 | MS Computer Science(New Jersey Institute of Technology, USA) | Application Development Manager, Rutgers University, New Jersey |
| M. Radhika | 1994 | M.Sc. (DU), MS Computer Science(North Western Polytechnic University, USA) | Technical Expert, Cumulus Networks, San Francisco Bay Area |
| Monika Lahiri (Mittal) | 1994 | MSW (TISS Mumbai) | Formerly, Counsellor, Institute for Psychological Health, Mumbai (Recently relocated to Dubai) |
| Mrinal R. Pai (Agarwal) | 1994 | M.Sc. (IIT Delhi), Ph.D. (BARC, Mumbai) | Scientific Officer, Chemistry Division, BARC, Trombay and Faculty, HomiBhabha National Institute |
| N. R. Ananthalakshmi | 1994 | M.Sc., M.Tech. (IIT Delhi) | Assistant Professor, Sardar Patel Institute of Technology, Mumbai. |
| Preeti Shanbag (shenoy) | 1994 | B.Sc. (Tech) Textile Chemistry, (Mumbai) | Global Manager, DSV, Air & C, Houston, USA |
| Sandhya Ahuja | 1994 | M.Sc. Biotech.(M. S University of Baroda), Ph.D.(Illinois, USA) | Associate Professor, Arizona University, USA |
| Urvashi Jaggi (Wadhwa) | 1994 | M.A. Eco (Annamalai) US teachers' certification | Science Teacher, Houston, USA. |
| Anu K. Moorthy | 1995 | MSc. Biotech (JNU) Ph.D. (IISc Bangalore) | Formerly scientist at San Diego, USA, recently relocated to India |
| Geeti Gangal(Bansal) | 1995 | M.Sc..Ph.D. (DU) | Principal Scientist at Novartis, Boston, USA. |
| Manisha Jain (Gupta) | 1995 | M.Sc. (Gold Medallist), Ph.D. (DU) | Associate Professor in Acharya Narendra Dev College, DU |
| Swati Dumitras (Bhaumik) | 1995 | M.Sc. (DU), Ph.D. (Germany) | Executive Director, Novartis, Switzerland |
| Anjali Dawar (Sharma) | 1996 | M.Sc. IT | Entrepreneur, Bangalore |
| Anjali Sharma (Dhobal) | 1996 | PG, Hospital Administration | Associate Director, Transitions, JLL |
| Joyita Garg | 1996 | PGDBM, Marketing, (Symbiosis Institute of Management Studies), M.B.A. Healthcare Management (Univ of Miami, Florida) | Vice President, Florida PACE Centre, USA |

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|-------------------------------|------|--|---|
| Mandeep Kaur Chawla | 1996 | M.B.A. | Self employed as a strategy and HR consultant |
| Nishma Ojha | 1996 | M.Sc. (IIT Delhi), Ph.D. (Udaipur) | Scientist in Atomic Energy Commission, Bangalore |
| Pratibha Varanandani | 1996 | M.B.A., B.Ed. | TGT Science, Tagore Academy, Faridabad |
| Rachana Bhattacharya | 1996 | Masters, Business information Technology (DePaul Univ, Chicago) | Associate Director, Biosimilars Planning, Pfizer, Illinois, USA |
| Ritu Basra | 1996 | MSc (IIT Delhi), Advanced Diploma in Child Development and Counselling (National Institute of Public Cooperation and Child Development, Delhi) | Counsellor, Heritage School, Gurgaon |
| Shalini Gupta (Vijay) | 1996 | B.Ed. | TGT Science |
| Vaishnavi Iyer (R. Vaishnavi) | 1996 | M.A. Psychology (Tamil Nadu), Certified AML Specialist | Manager, Standard Chartered Bank, Chennai |
| Divya Kumar | 1997 | M.Sc. (IIT Delhi), Ph.D. (Columbia, USA) | Clinical Research Coordinator, Stanford, USA |
| Meghana Rasalkar | 1997 | M.Sc. (DU), Ph.D. (Mumbai) | Assistant Professor, N Wadia College, Pune |
| Minakshi Asnani | 1997 | M.Sc., Ph.D. (IIT Delhi), PG Diploma, Patent Law (NALSAR, Hyderabad), PGDM, (IIM) | Manager, Pfizer chemicals, Mumbai |
| Pooja Kumar | 1997 | M.Sc., Ph.D. (IIT Delhi) | Product Stewardship Chemist at Chevron Houston, USA. |
| Pooja Shah | 1997 | M.Sc., Ph.D. (IIT Delhi) | Lecturer, Dallas County Community College, Texas, USA |
| Saswati Sengupta | 1997 | M.Sc. (DU), Associateship in Information & Documentation Science (NISCAID), PG Diploma in Communication & Management (Madras University) | New Green Fields School, |
| Sonal Bansal (Jain) | 1997 | M.Sc. Ph.D. (IIT Delhi) | Senior Scientist, University of Washington, St. Louis, USA |
| Sukhpreet Kaur | 1997 | M.Sc. (DU), M.Tech. (IIT Delhi) | Computer Professional, CA, USA |
| Kajal Chaudhary | 1998 | M.Sc. (DU), Ph.D. (Canada), MBA (Santa Caroline, USA) | Marketing professional, NIDEK Inc. San Francisco USA |
| Jasneet Bindra | 1998 | M.B.A. | Regional Manager, Bennet & Coleman, Delhi |
| Pallavi Chopra (Grover) | 1998 | M.B.A. | Senior Manager HR, Indigo |
| Ruchika Sharda (Maheshwari) | 1998 | M.Sc. (DU), Ph.D. (CCSU) | Freelancer, Educomp, formerly with Career Launcher |
| Shalini Sharma | 1998 | M.Sc. (IIT Delhi), Ph.D. (Purdue, USA) | Senior Research Engineer, JSR Micro Inc, San Francisco, USA |

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|------------------------|------|--|---|
| Sumita Sharma (Joshi) | 1998 | MCA (Banasthali) | Senior lead Software Engineer, Adobe. |
| Neetika Rawat | 1999 | M.Sc. (IIT Delhi) Ph.D. (BARC, Mumbai) | Scientist, BARC |
| Ruchi Gaur | 1999 | M.Sc. M.Tech. Ph.D. (IIT Delhi) | Senior Scientific Officer, Indian Oil Corporation |
| Amita Dua | 2000 | M.Sc., Ph.D. (DU) | Assistant Professor Dyal Singh College |
| Arti Pant (Joshi) | 2000 | M.Sc., Ph.D. (IIT Delhi) | Scientist DRDO, Pune |
| Kumkum Jain (Bhushan) | 2000 | M.Sc. Ph.D. (IIT Delhi) | Group Leader, Patents Ester Industries Ltd. |
| Sanghamitra Mitra | 2000 | M.Sc. (IIT Delhi) Ph.D. (Utah, USA), MBA (Boston) | Senior Biomedical Consultant, IQVIA, Boston, USA |
| Sanchita Mukhergi | 2000 | MBA (Fore School of Management) | Co-founder & Private Wealth, Blue Edge, |
| Shweta Dhawan (Kacker) | 2000 | M.Sc. (DU), B.Ed. | PGT Chemistry |
| Sony Soman | 2000 | M.Sc. (IIT Delhi) M.S. (Nebraska, USA) Ph.D. (Kentucky, USA) | Scientist II Cardiovascular Research Centre, University of Kentucky, SA |
| Supriya Punyani | 2001 | M.Sc., Ph.D. (IIT Delhi), | Sr Scientist, Proctor and Gamble. |
| Kavita Masand | 2003 | M.Sc. (D.U.) | Scientific Olympiad Foundation (Publishing team) |
| Komal Masand | 2003 | M.Sc. (D.U.) | Scientific Olympiad Foundation (Publishing team) |
| Ria Nanda Patel | 2003 | M.Sc. (DU), Ph.D. (Udaipur) | Assistant Professor JIMS Engineering and Management Technical Campus, Greater NOIDA |
| Sangeeta Sethi Kakkur | 2003 | M.Sc. (IIT, Delhi) B.Ed. (DU) | PGT Chemistry DPS Faridabad |
| Shikha Mahajan | 2003 | M.Sc. (IIT Delhi), Ph.D. (University of South Florida) | Assistant Professor, University of South Florida, USA |

Pathfinder Research work

Title: From Waste to Essentials: A Green Extraction of Limonene Oil from Waste Fruit Peels and Studying its Larvicidal, Insecticidal and Antimicrobial Properties.

Mentors: Dr. Tripti Kumari and Dr. Ritika Chauhan

Student: Nandana Pal Chowdhury, B.Sc (Hons) Chemistry III year

Title: Smart Fabric: Development of nano silver coated cotton fabric

Mentors: Dr. Geeta Saini and Dr. Divya Ganeswari

Students: Kajal Thakur, B.Sc (Hons) Chemistry III year; Manisha Dagar, B.Sc (Hons) Microbiology II year and Prerna Yadav, B.Sc (Hons) Microbiology 2nd year

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The essence of science is independent thinking, hard work, and not equipment. When I got my Nobel Prize, I had spent hardly 200 rupees on my equipment.

- C.V. Raman

The past, like the future, is indefinite and exists only as a spectrum of possibilities.

- Stephen Hawking

The editorial team



**Nandana Pal Chowdhury
(Editor)**



Babita



Anjana Singh



Parul Sharma



Dhruvika Bisht



Muskan Gill



Khyati Kalra

Editorial address

Magazines play an integral role in representing the essence of an education institution .To infuse in the indomitable, focused yet fun filled spirit of Gargi, we bring to you the annual magazine of chemistry department "AMALGAM 2017-2018." Amalgam gives the young and talented writers an opportunity to feel intently ,observe keenly , think deeply .We strongly believe that young creative minds on being pricked and praised at right time, erupts like a volcano where from flows extraordinary literary work. "AMALGAM 2017-2018" contains the stories of successful execution of several interesting events and competitions held throughout the academic year. Also, packed in the cover pages are mind boggling and insightful articles, both scientific and non-scientific for our enthusiastic readers. This magazine is the result of hardwork of not only the editor and the editorial team members but, also of students and teachers of entire chemistry department. I would also like to express my gratitude to the teacher advisers Dr Beena Negi and Dr Manju K Saroj for their constant guidance. A special vote of thanks to Sushmita Chaudhary ma'am for providing a rock solid support to the team and for providing beautiful nuances to the magazine, without which it would never be transformed into the perfect piece of art.

The Office Bearers of Rasgandhayan



From L to R, Row 1 (Conveners): Dr. Beena Negi and Dr. Manju K Saroj
Row 2: Ankita Mehta (General Secretary), Swati Mittal (Cultural Secretary),
Mayanka Chaudhary (President), V. Vidhya (Vice President) and
Henadri Debbarma (Cultural Secretary)
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Ishika Aggarwal (Not in pic)