





UGC RECOGNIZED

The Newsletter of Department of Chemistry

CHEMSTREET

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TABLE OF CONTENTS

S. No.	Title	Page No.
1.	From Editors' Desk	3
2.	Message from Director (School of Technology)	4
3.	Message from Head of the Department	5
4.	Vision & Mission of the Department	6
5.	The Dialogue with the Director General	7
6.	Antibiotic Resistance: A Complex Issue that can Jeopardize the Global Economic Growth by Dr. Prakash Chandra	10
7.	Artificial Life through Artificial Cell by Dr. Balanagulu Busupalli	12
8.	Science Communication: Simultaneous Learning and Teaching by Ms. Bhooma	14
9.	Teachers Day Special by Mr. Rushik Ragadiya	16
10.	Crossword by Dr. Prakash Chandra	17
11.	Chemistry Facts by Ms. Shikha Shah	18
12.	Departmental Events & Activities	19
13.	Student Corner	22



From Editors' Desk

Dear Reader,

Greetings from the editorial team! We hope that you are in good health and spirit! You are about to begin your journey across 3rd Ed. of the CHEMSTREET, on a presumably pleasant day (or night) of autumn, since you are looking at the September Issue of our departmental newsletter!

This edition is focused on Medicinal Chemistry, the branch which essentially brings chemists, biologists, doctors together, and also recognizes the contribution from physicists, and engineers. Medicine is an integral part of our life, no matter how much we try to avoid it by choosing a nutritious diet, exercise, and overall healthy lifestyle, and it has been so since ancient times. Ancient Egyptian, Chinese, Greek, and Indian civilizations have documented the use of many herbs and plant products as medicine. Often these were suggested to be applied to/consumed with simultaneous chanting of mantras, dancing, or some other folk ritual. Doctors were considered to be the sorcerers! Diseases were thought to be caused by demons or supernatural beings and medicines thereof as elixirs/magic potions. We have come a long way since then. The culprits behind many diseases, especially those caused by microbes have been recognized to be a part of the 'natural world'. The cause of most diseases is now known to us. Diagnosis and treatment of the same have become systematic, and backed by the scientific evidences. This has also lead to the birth of the 'Medicinal Chemistry'. This branch is heavily dependent on the chemistry of natural products, synthetic organic chemistry, spectral and analytical techniques, bioorganic/bioinorganic chemistry, preclinical, and clinical studies along with the computational studies to find 'hits' as drugs or drug targets. It's also complemented by fundamental biological research, device, and pharma-formulation development. The development of medicines, supplements, vaccines, and other antimicrobials is a long process involving years of dedicated work of scientists from various fields. At the core of the drug development process is chemistry, which incorporates design, optimization, synthesis of drug molecules (not only through trial and error or accidental findings, but using computer-aided drug design methods), and then studying drug molecule interaction within our body.

This edition brings to you the glimpses of that world, starting from antimicrobial resistance to creating an artificial life in the lab, from our Director General's research experience in this field to the interesting facts about medicinal chemistry curated by our students. Therefore, we wish you a good time reading this issue. Before concluding, we would like to thank all the contributors of the newsletter for their constant support.



Message from Director (SOT)

Dear Colleagues and Students,

Chemicals have played and will continue to play a central role in drug research. Progress in chemistry, cell biology, genetics, molecular, and systems pharmacology is the driving force



behind the paradigm shift towards **systems therapeutics** which target biological networks rather than single transduction pathways, and affect disease processes rather than physiological processes and has far reaching important implications for the future of drug research. The deeper interplay between specialists from pharmaceutical sciences, the biological sciences & engineering, **computational sciences** and **robotics** is now the driving force behind this

paradigm shift in drug research. The integration of **deep learning** in molecular systems engineering and design as a transformative catalyst towards the next chemical revolution offers opportunities for rapid and exciting developments in the design of new chemical molecules, products and processes.

Thus systems therapeutics and deep learning encapsulates the future development trends to achieve more intelligent medicinal research. As we @ PDEU (formerly PDPU) embark on this journey towards systems therapeutics and deep learning, I am Happy to Introduce this issue of the CHEMSTREET which not only share with all its readers the latest news and developments in the Department of Chemistry but would also be sensitizing all of us on the latest trends and developments in the medicinal chemistry.

The limitless power of digital transformation technology to do good and the conviction of my faculty colleagues and students that the golden age is ahead of us - and not behind us – brings about the best in all of us which is reflected in their achievements.

Compliments to the editorial team for their passion for perfection and unbound creativity which makes me always look forward to the next edition of the Newsletter.

Prof. Sunil Khanna, Director, School of Technology, PDEU



Message from Head of the Department

Dear Readers,

Greetings! It gives me an immense pleasure to share the 3rd issue of our departmental newsletter



CHEMSTREET. I would also like to appreciate the consistent hard work of the newsletter team to bring forth the wonderful issue. The current theme "Medicinal Chemistry" of the newsletter is very apt and relevant to the current times. The recent experience of COVID and Post COVID era has made us realize the importance of health. Past two years brought into light the importance of medicine in our life. Especially the fast track development of vaccines has been quite

phenomenal on the part of scientists involved. The role of biologist, chemist, engineers and doctors in the world of medicine is very vital. My message for the young readers is to be active in their research field and to work towards development of solutions to the problems they see around. As a Chemist we can contribute in many ways possible not only to medicinal chemistry but to the energy sector as well which again is very crucial for any field to run.

Prof. Rajib Bandyopadhyay Head, Department of Chemistry, SOT, PDEU



INTRODUCTION TO CHEMISTRY DEPARTMENT

The Chemistry department works under the School of Technology, which focuses on technological education, research, and service that anticipates and meets the need of tomorrow's world. Initially, the Department of Science was established in the year 2010, comprising Chemistry and Physics disciplines. The departments were bifurcated into an individual department in the year 2020 and were named department of Chemistry and Department of Physics, respectively. The department of chemistry is progressing overtime, indulging in various research activities, symposiums, conferences, etc., to create its impact in academia and industrial areas.

The programs offered by the department are Bachelors of Science (Hons.), Masters of Science, and Ph.D.

OUR VISION

"The Department has a vision to graduate admitted students as life-long learners and leaders in the diverse Chemistry programs."

OUR MISSION

The Department of Chemistry of the School of Technology offers well-designed program curricula to provide in-depth knowledge related to the application of Chemical Sciences and inculcate scientific temper to students interested in Engineering and Technology.

In order to contribute and to provide assistance to PDEU to achieve its mission of academic excellence, the program integrates a judiciously-designed comprehensive curriculum and a research module for the sound academic, professional, and personal development of students.



The Dialogue with the Director General

-by Team Newsletter

"Everyone need not be a lighthouse scattering light to long distances, but all of us can be candles. Everyday is an opportunity to illuminate our immediate surroundings, closed neighbours and thus the distant ones. A thankful, purposeful spirit will keep you alive." That's the essence of his life philosophy. Check out the dialogue with our prestigious leader Prof. Sundar Manoharan, Director General of PDEU.

- Sir, since the COVID has hit us hard, we have been reflecting on the importance of medicinal chemistry and thus we wanted to pay a homage to the same in the September issue of CHEMSTREET. We would like to know your view points on medicinal chemistry.
- I am very happy to know that. I don't traditionally come from a medicinal chemistry background. I worked mostly on the electronic structure of semiconductors, superconductors and metallic systems. However, in the last ten years, I have shifted quite a bit of my focus into the medicinal aspects including biotechnology, biomedicine, and biomedical engineering. This is where I see the potential. Importance of medicinal chemistry is now apparent to all in post-COVID era.
- What are your views on how significantly the research in medicinal chemistry has helped us in such hard times like COVID?

- Medicinal chemistry is not a blockbuster area in chemistry where you can easily commercialize anything because it has its own life cycle. A single molecule that has to be integrated to clinical practice as a medicinal therapeutic easily takes 7-10 years of time. It's a hard fought game!

To make a medicinal molecule suitable for human consumption, it undergoes 3 stages of verificationfirst and foremost is the drug design whether it is herbal, allopathic, natural or synthesized. For instance, if it's a natural product like an alkaloid, its isolation, extraction and proper characterization constitute one part of the game.

Once you know that the medicine holds potential, then the immediate next is the preclinical study where in you identify an animal model (mice, poultry, pigs) to study its efficacy. The preclinical stage itself involves huge investment. Patency of an efficacious



molecule is extremely important to even take it forward for human application.

Now when it comes to human trial or clinical trial, it's absolutely a great wall to cross. Getting approval for the study itself is a challenge. Often a molecule that is perfectly suiting in animal trial may get knocked out in the first phase of human trial. Hence it takes a lot of investment & patience.

The important question is 'why medicinal chemistry is important during COVID times?' So far, we don't have any medicine conceptually designed to combat COVID! We have just re-appropriated some of the medicines corresponding to HIV or tuberculosis or some which fights bacteria.

But the appropriation of the existing antibiotics or antifungal or antimalarial or antivirulent compounds have been implemented for COVID medication. This highlights how sensitive it is to engage in medicinal chemistry, but at the same time quite rewarding. The entire human population raises its hope just because one medicinal molecule like Remdesivir is there. That's the power of a single molecule.

You have been in the field of research for almost 4 decades, and have more than 125 publications. How do you relate yourself to research in medicinal chemistry and what is your contribution to this field?

- In fact, I wanted to be an organic chemist, but I ended up as a physical chemist, then into materials science and more toward nanotechnology now. But I still remember my first research project during M.Sc. was on an antibacterial drug molecule **linezolid.** It was produced by Ranbaxy but was phased out due to



development of drug resistance around 2011. We have developed nano-formulations of linezolid and demonstrated through preclinical studies that it can again be implemented for next generation patients who need not develop drug resistance. It also shows anticancer activity.

So, you may say broadly I work on **oxazolidinone**based antibiotics and our aim is to develop antibiotics more specific to gram-negative bacteria, which is quite challenging.

I have 4 patents related to molecules which are broad spectrum antibiotics.

I have 2 ICMR projects and 1 MHRD project on medicinal chemistry, and I am a co-investigator in a DST-funded project where we are developing Gadolinium-based compounds as contrast agents in medical imaging. So technically I have 4 running projects related to medicinal chemistry.

PDEU has grown a lot over the recent years. How do you envision PDEU in the coming 2 years?

Medicine takes first priority and energy takes second in any sector as of now. So PDEU should be actively involved in medicinal chemistry and in fact we are trying to start a new centre for biotechnology and biomedical engineering. It might become a course or a degree by itself within next 5 years. One of the biggest contribution we (PDEU) have made is making an indigenous ventilator that has served more than 800 patients across India, and completely subscribing to 'Atmanirbhar Bharat'.

We have also taken care of our faculty and staff by increasing health insurance coverage, mental and financial support during the tough time. So PDEU is not only subscribing to energy as energy materials, but the (soul) energy of a person, each stakeholder of the university. I envision sustainability of energy in all the 4 important quadrants of the society (food, water, health and energy). PDEU is excelling in energy and gradually moving ahead in capitalizing over the three quadrants too.

In fact, we are hosting a 4 million euro project on desalination of water through solar thermal power.

"Every day is an opportunity to dispense or share your energy" For e.g., we need to plan how much water will be left 70 years down the line. We should ensure that we are creating a good community right now as present stake holders. These issues should drive home the Hence, we would like to bring the goodness of our technology in all the quadrants. So PDEU will be everywhere!

What is the most humane aspect of energy? How has it helped you?

- The energy in the form of light can come from a candle or a lighthouse. But sometimes all are not called to be lighthouse but everybody is a candle. We can always be a candle.

- As mature adults and with the diversity present in PDEU we can learn so much from each other. Being open to learn and respect other cultures and faithseverything is a big stake in terms of energy. That's why PDEU has attracted nearly 34 countries and 20 states to different degree programs. Hence we have a very holistic approach to education, and in that energy is an important perception. At the end what I give is more important than what I receive. If we influence a small group, one fine day we will be influencing the entire nation and world at large.

"Every day is an opportunity to dispense or share

"I am very grateful to the version 2 (COVID) of my life. I will always remain humble that I am alive and there is a purpose for me to live"

your energy." We need to leave a powerful legacy to the future generations. For e.g., we need to plan how much water will be left 70 years down the line. We should ensure that we are creating a good community right now as present stake holders. These issues should drive home the energy concept in PDEU, energy is not only electricity or solar, it's actually about everything.

Weight of the second second

I am a thankful spirit who is appreciative of the life God has entrusted to us. We have more reasons to be thankful than to complain. Hence enjoying and growing with the companionship of our professional community is what will keep us motivated. And what keeps the charge in me is whether I am giving more than what I am entrusted with. Hence this is the compulsion that drives me. To give more and to find joy in it will keep you young and motivated.

Since COVID has hit, how has pandemic been for you?

- I feel we have been brought back to focus on our homes and to stay with family. I think that we see each other as more humans now and have a restored relationship. We started eating together.



For me specifically it has been a very rejuvenating experience. At the same time I have questioned myself too, is my profession really catering to world issue?? Is what I do on daily basis helping fight COVID? If no then what am I doing, what am I learning?? That in fact drove me to jump into developing the ventilator during the crisis.

Hence we need to become more contextual in research and be willing to change and implement several things that we learnt in the past to the present disastrous situation and see how can we help to the society.

So I am very grateful to the version 2 (COVID) of my life. I will always remain humble that I am alive and there is a purpose for me to live. We have been able to keep the students, faculties and staff safe during COVID. I am very humbled that we are all safe and secured and look forward to have you all in the campus very soon.

@ How do you keep in touch with your hobbies and interests??

- That's a good question! I do play music and sing but that has become a part of my family life. Reading books other than the journals or subject matters, walking, and jogging all to catch up with the family life. :)

@ Your closing note to the young leaders?

When I did my graduation at Loyola College, I saw a solution of oxine (8-hydroxyquinoline) which nobody bothered about then. But today that small molecule has revolutionized the entire display world be it the laptops, TVs, phone and LED screens, etc.

Why I am saying this is because it didn't mean anything to me then, but today I hold more than 4 international patents on that molecule. Hence you never know when you would stumble upon a serendipity. So today's experience in the classroom/labs/corridors of PDEU can bring a big change to your life in future. Never despise anything as little things can bring a big change in our life and the society.

Thank you Sir for your time, for sharing your experience with us and the wise words!



Antibiotic Resistance: A Complex Issue that can Jeopardize the Global Economic Growth

-Dr. Prakash Chandra talks about the horror of antibiotic resistance and how the world is gearing up to fight it! A very important read!



What is antibiotic resistance?

Antibiotic resistance (AR) occurs when microbes like bacteria, viruses and fungi develop resistance to the antibiotic drugs for treating infectious drugs. The AR has recently emerged as a global health and development threat. Therefore, for Sustainable Development Goals (SDGs) AR needs to be addressed by various sectors of the society.

Origin of antimicrobial resistance

https://theconversation.com/antibiotic-resistance-is-not-new-itexisted-long-before-people-used-drugs-to-kill-bacteria-115836 The misuse and overuse of the antibiotics can be considered as the prime force behind the generation of the drug resistant pathogen. The antimicrobial resistant organisms are quite prevalent in the animal, plants, humans, food and in the environment. These antimicrobial resistance can be easily transmitted from one organism to another, including the food consumed by humans and animals. Inadequate access to the clean water, sanitation and hygiene (WASH) facilities are responsible for spreading microbes, and building tolerance to the antimicrobial agents. Poor infection and disease prevention and control measures are significantly enhancing the antimicrobial resistance property. Poor access to the good quality medicines, vaccines and other diagnostic too are also the significant contributor towards antimicrobial resistance.

Consequences of the antimicrobial resistance

World Health Organization (WHO) considers the AR amongst top ten global public health problems faced by the humanity. The resistance against antibiotics has become a cornerstone to modern medicine system because the major chunks of the medical procedures in human and animal health are directly related to consumption and the functioning of the antibiotics. According to the survey conducted by Washington-based Centre for Disease Dynamics, Economics and Policy (CDEEP) an increase in antibiotic consumption by 40.40% between 2010- 2020. China and India are the biggest hotspots globally to develop the antibiotic resistance globally followed by Brazil and Kenya. According the CDEEP the global consumption of antimicrobials in food was 131,109 tonnes, and will reach 200,235 tonnes by 2030. Antimicrobial resistants are consumed three times by animals than humans, leading to the accumulation of these antibiotics in the animal proteins. According to Ramanan Laxminarayan (director of CDDEP) "The main concern is that antibiotic consumption, particularly in the animal sector, is rising. This increases the risk of zoonotic infections that could cause epidemics in hospitals". Antibiotic resistance amongst the veterinary health care system is observed in both the national and global scenario. These animal proteins are consumed by humans globally which can further



become hazardous to humans. In India, the resistance to the antibiotics like ampicillin amongst chicken are skyrocketing and have reached to a level of 69.7%. Also, there has been antibiotic resistance for bacterial E. coli and Salmonella has been 16.5%. Furthermore, human beings also consume these antibiotics as the prescribed medicines against the microbial infection. The consumption of these antibiotics has increased significantly in low- and middle-income countries (LMICs). Antibiotic resistance in India has accelerated sharply with a 30% increase in the consumption of antibiotics. In-between 2000-2015 there was a whooping 65% increase in global antibiotic consumption with an estimated increase in antibiotic consumption of 39% in India. The antibiotic consumption rate increased by 39%, 32 from 11.3 to 15.7 defined daily doses (DDDs) per 1,000 people. "If you compare with another large country like China, it is using less antibiotics per capita than India. Consequences of antimicrobial resistance in a country like India will be more detrimental as prescribing second- and third-line antibiotics for India will be more expensive," said Laxminarayan. Recently, Dr. K. N. Ganguly, director general of Indian Council of Medicinal Research (ICMR) considered the indiscriminate use of antibiotics is leading to the increased drug resistance. "Our white paper recommends harmonious actions across human, animal and environmental health paradigms to deal with the impending public health crisis of AMR," he said.

Global action plan against these antimicrobial resistance

Multi-sectoral organizations working on the heath of human, aquatic and land flora-fauna and feed production can work globally to join hands and combat these antimicrobial agents. These organizations can not only work together, but also launch programs, policies and legislations amongst the public regarding the awareness against the antimicrobial resistance to achieve superior public health outcomes. These measures can significantly contribute to our health and economy. Innovation and investment policies for the design and development of the antimicrobial medicines, drugs, vaccines and diagnostic tools targeting the antimicrobial resistance are highly desirable. Foreseeing the severe health risk associated with the antibiotic resistance, Global Action Plan (GAP) was set out in 2015 by World Health Assembly. The world health assembly was committed to implement multisectoral national action plan. The GAP was further endorsed by the Food and Agriculture Organization of the United Nations (FAO) and World Organization on animal health (OIE). In 2016, Interagency Coordination Group (IGAC) in corroboration with United Nations (UN) on antimicrobial resistance brought together multifarious organizations and individual experts in animal, plant and human health and formulated action plan to work together to counter antimicrobial resistance. The outcome of these corroborative action plan led to the advancement of awareness plans and fulfilling the knowledge gap like World Antimicrobial Awareness Week (WAAW), Global Antimicrobial Resistance and use of Surveillance System (GLASS). Furthermore, several research and development plans were launched in 2017 like new antimicrobial, diagnostics and vaccines to fulfil the research gap in the antimicrobial resistance field. Global Antibiotics Research and Development Partnership (GARDP) in corroboration with World Health Organization (WHO) and Drugs for Neglected Disease initiatives (DNDi) committed to develop novel and effective remedies against antimicrobial resistance.



Artificial Life through Artificial Cell

- Dr. Balanagulu Busupalli contemplates on the primitive questions on Life and creation of ityes, you read it right....in the Lab!



Artificial Cell division

How did life originate? Is life present elsewhere in the Universe other than on the Earth? What characteristics define a thing as a living being? These are some of the most prominent questions that are not just relevant philosophically, but are significant scientifically too, and these queries need specific answers. To obtain a holistic insight into the origins of life many scientific fields must be aligned together, for example, collaborations between scientists working in the scientific domains of chemistry and physics in addition to primitive biology and geology could render a thorough understanding of this subject. To answer questions related to the presence of life elsewhere in the Universe, again a conglomeration of scientific disciplines such as chemistry and space science in addition to similar such subjects must occur. In this piece, let us not worry about these two interrogations. We will focus on the third query. Thus, here, I would like to excite you into knowing the basic properties that define life, and then tickle you into knowing how these properties could be instilled in a non-living thing and make it a living being!

The most basic characteristic properties that allow, according to the majority of researchers, anything to be defined as living are four in number. These are self-replication, information transfer, metabolism, and evolution. The minimal entity that could be called living is a natural/biological cell. All these four phenomena are extensively studied in natural/biological cells.

Self-replication is a phenomenon in which one entity divides itself into two. In the case of a natural cell, the cell divides itself into two daughter cells. There are two different processes in which this happens in biological cells viz. mitosis and meiosis. But, we will not discuss these biological processes here. Amoeba and Paramecia and even some bacteria like Escherichia Coli are some of the best examples to visualize the real-time occurrence of self-replication utilizing an optical microscope. Similarly, information transfer is another phenomenon that is observed in cells. Hopefully, you all already know something about this because DNA is the macromolecule that transfers information in living beings. Next up is metabolism, the process via which food that the living organisms consume gets converted to energy. And, energy is essential for everything, including locomotion to



growth in the living organisms. The last but equally important one is evolution. Darwinian evolution comes into our minds when we talk about evolution in living things. As said previously, these properties are well established in living beings.

But the fun is in producing artificial life through the inclusion of these properties that define life, into artificial cells (we now know that a simplistic structure that can be called living is a cell). Artificial cells! What are they? Artificial cells are anything cell-like that resemble natural cells and so are meant to mimic natural cells. You may observe that any natural cell, however simplistic it is, is cluttered with umpteen molecules and macromolecules and a few organelles in addition to several active biochemical reactions in its cytoplasm. This makes the study of life's properties very difficult in such natural cells because of the several hindrances from these several constituents inside the cell. So, researchers have approached this challenge in two ways. One way/method is called the top-down approach wherein a natural cell will be taken and its contents withered out one by one such that the cell still could be called as living with the lowest number of contents in it. This makes the study of the cell a bit less obscuring. The other method is called the bottom-up approach where an entirely new structure resembling a natural cell is built out of non-living chemicals like lipids or polymers. This second method is much more interesting as in this method the artificial cell, thus produced will have only a membrane that closes to form almost a spherical structure with lipids/polymers constituting its membrane and there won't be any contents inside the lumen of such an artificial cell except for isotonic solution to maintain its architecture. Such a cell now could be employed to study various phenomena that resemble the processes that occur in a biological cell. The spherical artificial cell is the simplest artificial cell, but that doesn't mean there should be always spherical cells to study such lifelike properties. For example, the natural nerve cells are not spherical but are elongated and almost cylindrical with sheaths. So, sophisticated artificial cells could be prepared by tweaking the preparation method so that the production of artificial cells of any shape or size could be possible. Likewise, if an artificial cell that resembles a natural nerve cell could be produced, the electrical excitation and conduction occurring in a nerve cell could also be mimicked. A plethora of possibilities exists after obtaining a library of such artificial cells with different sizes and shapes. By studying the life-like properties in artificial cells, in the future, it may be possible to realize living artificial cells as a step towards the creation of artificial life in the lab. Ethical concerns might come into the picture once artificial life is created in the lab, as long as such living matter from artificial cell-like structures is utilized for the benefit of humankind, it is alright.

In closing, we acquainted ourselves with inquiries into topics such as what is life and what properties define life and also we appreciated the synthesis of artificial life in the lab through artificial cells.



Science Communication: Simultaneous Learning and Teaching

-Ms. Bhooma Bhagat (Ph.D Scholar) shares her experience in communicating science in easy and interesting ways!

Science communication is a term which comprises awareness regarding science related topics and increasing the fascination about scientific discoveries. The concept of science communication focuses on the AEIOU vowel analogy: awareness, enjoyment, interest, opinion-forming, and understanding. [1]

My overall formal education is in the field of chemistry. This part of science makes the subject more exciting because it is inseparable from nature. As I have progressed with my studies and career, I have realized that simple form of explaining science and its concepts is need of an hour.

My admiration for science awakened when I became curious about the scientific principles present in our surroundings. The questions such as "why does ice float on water", "How far are these stars", etc. ignited in me the tendency to learn science at a very early stage of life. This motivated me to know the field more practically. My first acquaintance towards the field of science communication came in the year 2019 when I started working as a Project Associate at Vikram Sarabhai Community Science Centre, Ahmedabad, Gujarat. The centre aims to develop scientific thinking in young minds by introducing an enjoyable and lasting experience of learnings.

The centre has multi-disciplinary facilities like space science clubs, tinkering labs, physics, biology, and chemistry laboratories where different practical-based learning is provided to both students and teachers. I had a chance to play the role of science communicator in the chemistry lab where we designed fascinating experiments for students to explain them simple chemical reactions and their importance. One such experiment named as "Traffic signal" explained the reaction of redox reaction. The experiment comprised of Potassium Permanganate (KMnO₄), Glucose (C₆H₁₂O₆) and Sodium Hydroxide (NaOH). The three compounds were mixed in proper proportions and they showed varying colours of green, red and yellow on rigorous shaking. This type of activities attracts the observer's attention and makes them learn the science behind it [2]. In the similar way the concept of combustible gases is introduced to the students by showing them the bursting of hydrogen gas balloon. In the experiment the reaction between Zinc (Zn) granules and dilute hydrochloric acid (dil. HCl) produces vapours of hydrogen which is collected in a balloon. The balloon when burst, with the help of candle or matchstick produces a pop sound which shows them the combustible hydrogen. The same is performed with air filled balloon to show them the difference.

Apart from these experiments we had teachers training session sponsored by different government bodies. The objective of these sessions was to educate teachers on newer methods and techniques for certain concepts in science and technology which can be made interesting to teach. The main aim is to reach the maximum number of students who can learn the simple concepts with science communication.

The centre has a bimonthly magazine "Vigyan Drashti", which focuses on the current development in the field of science and mathematics. The magazine aims to provide knowledge to students in villages where use of advanced technologies is somewhat limited.



The articles contributed by me are titled "Science behind colours" and "How to make your own sphericon from paper". I have assisted in reviewing the joy of chemistry publication, a handbook of chemistry experiments which helped me to increase my knowledge in theoretical and practical concepts of chemistry to work as a science communicator. References:

1. Science communication: a contemporary definition T.W. Burns, D.J. O'Connor, S.M. Stocklmayer. Public Understand. Sci. 12 (2003) 183–202.

2. Weeks, M. E. and Leicester, H. M.; Discovery of the Elements, Journal of Chemical Education 1968.



Teachers' Day Special

-Mr. Rushik Radadiya (M.Sc. Chem. Sem. 3) has something to say about each of his teachers in Chemistry department! A fun read (ride)!



Hola! PDEUIN!

Let's have a tour of our Chemistry

department. It would

be quite adventurous, so to avoid accident, please fasten your seat belt, and wear mask, maintain social distancing.

🧕 First of all apologies in advance 🙀

The intention of this tour is to refresh the mood of all the scientific personalities. Please don't be serious! Fun alert!

So let's start with our HOD, Prof. Rajib Bandyopadhyay: very straightforward routine no other talks during the lectures, sticks to the topic only.

Next station is **Dr.** Anirban Das: Salute to his efforts to teach us, though online teaching is not his cup of tea[®], but the way he keeps us engaged during class with his some special phrases (Nahi beta ye to tumhe batana hi padega...) really I enjoy the most.

🥝 🛛 Beep beep ᆇ so much traffic 🖨

Now we have reached to another place.

Dr. Manoj Pandey: Very busy person in the department.

Now, **Dr. Nitin Chaudhary**: I would say he needs to be little strict! Honestly, very liberal nature.

Before going to next Venue, let's have a short break, take your tea, coffee and snacks. Don't finish it, we have a long way to go.

Dr. Syed Shahabuddin: Professionalism!

🮯 📾 Happy Teacher's Day 📾

Next person knows everything about students' thinking, she knows perception of all the students. You can't lie to her, she will catch you definitely, yes, I am talking about Dr. Rama Gaur.

Upcoming is Dr. Nandini Mukherjee: Never scolded anyone...yet!

Who is next, oh yes!! Dr. Megha Balha: Stop Stop first go and revise your basics otherwise you will be scolded by her.

Dr. Anu Manhas: the most amusing lecture that we had when she was trying to learn Gujarati from Saurav seriously!

Dr. Tapan Pal: Sweet nature!

Lunch time A Have a healthy food, because Dr. Prakash Chandra told us to avoid junk food.

Arrived at next junction. Hope we are not running out of the time ©.

Dr. Kalisadhan Mukherjee: The way he has made two teams of students R² and N²M. We felt like we were playing games.

Second last stop 🛛 Have some Spark guys.

Dr. Ranjan Pati: Interesting way of starting the lecture " kese ho beta" feels like homie.

Last but not the least, Dr. Busupalli Balanagulu: Your India to USA journey, really interesting and inspirational as well.

Hope you guys have enjoyed the journey

Thank you to all our educational Rockstars for helping us to grow.





CROSSWORD

- by Dr. Prakash Chandra

Across:

1. Which element makes up only about 0.025 percent of Earth's crust?

2. Which reaction results in breaking of compound into two or more simpler substance?

- 3. Silicon carbide is also known as
- 4. Oxidation reaction occurs at which electrode
- 5. A molecule that binds to enzyme is also known as

Down:

- 1. Blue litmus turns to this colour in acidic solution
- 2. Species formed by loss or gain of electrons
- 3. Are formed by reaction between acid and bases



Find the answers to Crossword on the last page



CHEMISTRY FACTS

- Ms. Shikha Shah (19BSC007)

The drug found in inhalers such as Ventolin and ProAir	Albuterol
A cream containing 1% oxymetazoline and used for the treatment of persistent facial redness in adults due to rosacea	Rhofade
This ergot alkaloid may be combined with caffeine in the management of migraine headaches	Ergotamine
A dry powder inhaler containing vilanterol and umeclidinium bromide used in the treatment of COPD	Anoro-Ellipta
A bicyclic ring system found in the drug brimonidine tartrate (It is the medication used to treat open-angle glaucoma or high fluid pressure in eye)	Quinoxaline
An epinephrine injection system similar to the epipen which contains voice instruction for the patient and which is indicated for anaphylaxis such as bee stings	Auvi-Q
The name for the heterocyclic ring found in Afrin, Visine, Privine and Otrivin	Imidazoline
A term used to describe the action of a drug that relaxes the uterine muscle and and could be used in the management of premature labor contractions	Tocolytic
A term used to describe the action of a drug that relaxes the uterine muscle and and could be used in the management of premature labor contractions A drug occasionally used to treat psychotic disorders such as schizophrenia which is known to cause hyperprolactinemia	Tocolytic Chlorpromazine

Source: https://quizlet.com/288217366/medicinalchemistry/



DEPARTMENTAL EVENTS

(Workshop/webinar/research review symposium/expert talks delivered/ MoUs signed)

WORKSHOP/WEBINAR ORGANIZED

- Admission webinar on "PDEU: A Place for Deep Diving into Science (Counselling Session for Aspiring UG/PG Science Graduates) " (Moderator) was organized by Dr. Nandini Mukherjee on June 20, 2021.
- Webinar series on "Multifarious Applications of Chemical Sciences" was organized by Dr. Manoj Pandey, Dr. Prakash Chandra, Dr. Megha Balha, Dr. Anu Manhas on July 03-24, 2021.
- Webinar on "High Performance Spinsolve NMR: Applications & Recent Advancements" was organized by Dr. Nandini Mukherjee on August 07, 2021.
- National webinar on "Laboratory Safety Practices" was organized by Dr. Nitin Chaudhari on August 14, 2021.
- National webinar on "National webinar on Intellectual Property Rights and Career Opportunities in IPR" was organized by **Dr. Rama Gaur** on September 25, 2021.













PUBLICATIONS

Dr. Anu Manhas

- Ayushi Sethiya, Jay Soni, Anu Manhas, Prakash Chandra Jha & Shikha Agarwal, Research on Chemical Intermediates 2021, DOI:10.1007/s11164-021-04529-0.
- Soni, Jay, Nusrat Sahiba, Ayushi Sethiya, Pankaj Teli, Dinesh Kr Agarwal, Anu Manhas, Prakash Chandra Jha, Deepkumar Joshi, and Shikha Agarwal, Polycyclic Aromatic Compounds 2020, DOI: 10.1080/10406638.2020.1852277.

Dr. Busupalli Balanagulu

Busupalli, B. (2021). Palladium thiolates: a revived class of soluble layered materials. Academia Letters, Article 2969. https://doi.org/10.20935/AL2969.

Dr. Kalisadhan Mukherjee

S. Bera, D. Sengupta, S. Roy, K. Mukherjee* Research on dye sensitized solar cell: A review highlighting the progress in India, J. Phys Energy (2021), 3 032013.

Dr. Megha Balha

Organocatalytic Asymmetric Ene Reactions, Balha, M.; Parida, C.; Pan, S. C. Asian J. Org. Chem. 2021, DOI: 10.1002/ajoc.202100408.

Dr. Prakash Chandra

Modern Trends in the Applications of Perovskites for Selective Organic Transformations, Chandra, P. Chemistry Select, 2021, https://doi.org/10.1002/slct.202101434.

Dr. Syed Shahabuddin

- Ahmad, Muhammad Shakeel, M. M. Shahid, Syed Shahabuddin, Khadija Munawar, Nasrudin Abd Rahim, and Waqar Ahmed. "Effect of concentration of MoS2 on the TCO-Pt free polyaniline nano-rod based counter electrode for dye sensitised solar cell application." Materials Technology (2021): 1-9.
- bt Abd Ghafar, Nurhanis Sofiah, Mahendran Samykano, Syed Shahabuddin, Kumaran Kadirgama, A. K. Pandey, and Muhamad Mat Noor. "A Brief Review on Thermal Behaviour of PANI as Additive in Heat Transfer Fluid." Emerging Advances in Integrated Technology 2, no. 1 (2021): 47-52.
- Rashid, Bushra, Ayaz Anwar, Syed Shahabuddin, Gokula Mohan, Rahman Saidur, Navid Aslfattahi, and Nanthini Sridewi. "A Comparative Study of Cytotoxicity of PPG and PEG Surface-Modified 2-D Ti3C2 MXene Flakes on Human Cancer Cells and Their Photothermal Response." Materials 14, no. 16 (2021): 4370.



BOOK CHAPTERS

Dr. Syed Shahabuddin published the following book chapters:

- Mukheem, Abdul, Syed Shahabuddin, Aleem Ahmed Khan, Md Murad Hossain, Ainil Hawa Jasni, and Nanthini Sridewi. "Bio-plastic Polyhydroxyalkanoate (PHA): Applications in Modern Medicine." In Bioplastics for Sustainable Development, pp. 231-257. Springer, Singapore, 2021.
- Shahabuddin, Syed, Nurul Aqilla Mazlan, Siti Nor Atika Baharin, and Kavirajaa Pandian Sambasevam. "Introduction to Conducting Polymers." In Advances in Hybrid Conducting Polymer Technology, pp. 1-18. Springer, Cham, 2021.

Dr. Tapan Pal published a book chapter entitled "Engineering the Confined Space of MOFs for Heterogeneous Catalysis of Organic Transformations", **Tapan K. Pal**, Dinesh De, Parimal K. Bharadwaj, Wiley doi.org/10.1002/9781119683353.ch17.

HONOURS/AWARDS/RECOGNITION

- Dr. Anu Manhas was a Guest of Honor in the 2nd International Conference on Recent Trends in Computational Cancer Biology and COVID-19 (ICRTCCBC-2021) organized by BIOSHACK India, on July 24-25, 2021.
- Prof. Rajib Bandyopadhyay was selected as a Member for Departmental Academic Integrity Panel (DAIP) of School of Applied Material Sciences, Central University of Gujarat (CUG), Gandhinagar.
- Prof. Rajib Bandyopadhyay was invited to act as an Expert Nominee for the selection of JRF under my GSBTM sanctioned research project entitled, "Rational Design of Photolabile Ruthenium (II) Complexes for Photoinduced Drug Delivery in Breast Cancer Cells", Faculty of Science, The M.S. University of Baroda.
- Prof. Rajib Bandyopadhyay was invited as Board of Studies Member for B.Sc. and M.Sc. course of SRICT Institute of Science & Research under UPL University of Sustainable Technology, Ankleshwar.
- Prof. Rajib Bandyopadhyay was invited as a Review Editor in the Editorial Board of Carbon Capture, Storage, and Utilization (specialty section of Frontiers in Energy Research)
- > Dr. Rama Gaur became an Associate Member of Royal Society of Chemistry (AMRSC).

EXPERT TALK DELIVERED/ORAL PRESENTATION IN CONFERENCE-WEBINAR-SYMPOSIUM



- Dr. Anu Manhas delivered an Invited Lecture in the 2nd International Conference on Recent Trends in Computational Cancer Biology and COVID-19 (ICRTCCBC-2021) organized by BIOSHACK India, on July 24-25, 2021.
- Dr. Megha Balha gave an Oral Presentation on "Organocatalytic Asymmetric Synthesis of Bridged O,O-Ketals with Spirooxindole Motif" at "International Virtual Conference on Frontiers in Chemical Sciences" (IVCFCS - 2021) organized by Department of Chemistry, MLSU, Udaipur, Rajasthan, India on June 25, 2021.
- Prof. Rajib Bandyopadhyay was invited as a Guest Speaker for online Training on 'Challenges and Emerging Trends in Catalysis' Under the banner of the Institution of Engineers India (IEI) on the topic " Porous heterogeneous catalyst for industrial applications, organized by Chemical Engineering Department, Viswakarma Govt. Engineering College (VGEC) Ahmedabad" on July 31, 2021.
- Dr. Rama Gaur delivered an Invited Talk on "Development of low cost clay based adsorbents for environmental Remediation' in International conference Advanced Materials for Better Tomorrow (AMBT-2021) on 17th July 2021 organized by IIT-BHU.

PARTICIPATION IN FDP

- Dr. Nandini Mukherjee has successfully participated in the Webinar entitled "Current and Emerging Career Opportunities in Chemistry" organized by Pandit Deendayal Energy University, on June 05, 2021.
- Dr. Nandini Mukherjee has successfully participated in the Webinar series entitled "Multifarious Applications of Chemical Sciences Series" organized by Pandit Deendayal Energy University, on July 07/14/21/28, 2021.
- Dr. Nandini Mukherjee has successfully participated in the Webinar entitled "Ultrasound Contrast Agents organized by IIT Gandhinagar during July 22-23, 2021.

RESEARCH GRANTS

Dr. Prakash Chandra, Dr. Megha Balha, Versatile transition metal based dichalcogenides for the synthesis of valuable pharmacophores from Industrial waste, ORSP Research Grant (September 2021) by Pandit Deendayal Energy University.

Dr. Syed Shahabuddin, Dr. Rama Gaur, Cost effective approach towards recycling of used lubricant oil using polyaniline based clay composites ORSP Research Grant (September 2021) by Pandit Deendayal Energy University



Dr. Nandini Mukherjee, Dr. Anu Manhas, Synthesis, characterization and DFT-studies of anthracene-based chemosensors for amino acid sensing ORSP Research Grant (September 2021) by Pandit Deendayal Energy University.

Dr. Kalisadhan Mukherjee, Dr. Paawan Sharma, Towards the development of chemically modified conducting polymer based chemiresistive sensorfor the detection of harmful gases at room temperature ORSP Research Grant (September 2021) by Pandit Deendayal Energy University.





2nd International Conference on Recent Trends in Computational Cancer Biology and COVID-19 (ICRTCCBC-2021)

 Fill the google form to complete the registration (Link in the description)

- Registered participant also encouraged to submit Abstract, will be published in conference proceedings with an ISBN
- Separate certificates for participation and oral presentation will be provided

Registration fee:

₹499 INR (For Indian participants) \$20 USD (For International participants)

*Last date of Registration is 20th July 2021

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24-25

VIRTUAL

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Dr. Mithun Rudrapal Dr. Dhruv Kumar



dug Hussain Wan

Dr. Anu Manhas Pandit Deendayal Petroleum University,



Dr. Mugeet Wahid Bahauddin Zakariya University, Pakistan

Dr. Rahul Pal



CERTIFICATE OF APPRECIATION

THIS IS PRESENTED TO

Dr.	Anu	Μ	[an]	has

Assistant Professor Pandit Deendayal Energy University (Former PDPU), Gujarat, India

For Guest of Honor and Speaker

During the 2nd International Conference on Recent Trends in Computational Cancer Biology and COVID-19 (ICRTCCBC-2021) On July 24-25, 2021







ORAL PRESENTATION BY DR. PRAKASH CHANDRA

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ORAL PRESENTATION BY DR. MEGHA BALHA



STUDENT CORNER

AWARDS

1. **Monikaben Patel** received Best Young Research Presentation Award at Young Researcher Meet organised by the Department of Chemistry, Pandit Deendayal Energy University.

POSTER PRESENTATION

- Riti Shrivastava, Syed Shahabuddin, Rama Gaur*, "Use of biosorbents for the treatment of oil spills" at international virtual conference on frontiers in chemical science organised by MLSU, Rajasthan.
- Rushik Radadiya, Rama Gaur & Syed Shahabuddin*, "Acid modification approach for improving surface characteristics of natural clay" at international virtual conference on frontiers in chemical science organised by MLSU, Rajasthan.
- 3. **Krunal Parekh**, Syed Shahabuddin*, and Rama Gaur, "Recent advances in refining of used lubricant oil and their comparative analysis" at international virtual conference on frontiers in chemical science organised by MLSU, Rajasthan.
- 4. Abhishek Rupareliya, Dr. Syed Shahabuddin, Dr. Rama Gaur*, "Development of low-cost clay-based adsorbent for environmental remediation" at international virtual conference on frontiers in chemical science organised by MLSU, Rajasthan.

PARTICIPATIONS

- 1. **Nikunjkumar Vagadiya** from M.Sc. Sem 3 has participated in symposium on artificial intelligent and data-science assisted synthesis by vista.
- 2. **Rushik Radadiya** from M.Sc. Sem 3 has completed the masterclass of science and application on of Raman spectroscopy held by Labbox &Metrohm.
- 3. Jeny D Gosai from M.Sc. Sem 3 has attended the masterclass of science and application of Raman spectroscopy held by Labbox & Metrohm.
- 4. Jeny D Gosai from M.Sc. Sem 3 has contributed as a student coordinator in the National webinar on "Laboratory Safety Practices"
- 5. Jeny D Gosai from M.Sc. Sem 3 has attended SECOND ADVANCE TAEKWONDO TRAINING CAMP-2021 at Nirmala Auditorium, Rawat Public School, Pratapnagar, Jaipur.



STUDENT RESEARCH PROJECTS

Khyati Mistry, Rohit, Nasit Hardik received an ORSP project grant (September 2021) under the supervision of Dr. Prakash Chandra & Dr. Megha Balha for the project titled "Versatile transition metal based dichalcogenides for the synthesis of valuable pharmacophores from Industrial waste", by Pandit Deendayal Energy University.

Krunal Parekh, Rushik Ragadiya, Vivek Jain received an ORSP project grant (September 2021) under the supervision of Dr. Syed Shahabuddin, Dr. Rama Gaur, for the project titled "*Cost effective approach towards recycling of used lubricant oil using polyaniline based clay composites*" by Pandit Deendayal Energy University

Nikunj Vagadiya & Mohil Odedara received an ORSP project grant (September 2021) under the supervision of Dr. Nandini Mukherjee, Dr. Anu Manhas for the project titled "Synthesis, characterization and DFT-studies of anthracene-based chemosensors for amino acid sensing" by Pandit Deendayal Energy University.

Drashti Kamol, Hemendra Raol, Khusbhu Patel, Heena Shekhawat, received an ORSP project grant (September 2021) under the supervision of Dr. Kalisadhan Mukherjee, Dr. Paawan Sharma for the project titled "*Towards the development of chemically modified conducting polymer based chemiresistive sensorfor the detection of harmful gases at room temperature*" by Pandit Deendayal Energy University.







Pandít Deendayal Energy University enters the top 100 universities- NIRF ranking 2021









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