KALINDI COLLEGE

UNIVERSITY OF DELHI

NAAC Accredited Grade 'A+'

BOTANY NEWSLETTER

"THE AMARANTH TIMES"

VOLUME 1 ISSUE 1

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Message from the Principal's desk

It gives me immense pleasure that Department of Botany is coming up with their next issue of newsletter, *"Amaranth Times"* for the academic session, 2022-23. The newsletter helps in bringing out creative and artistic side of students. I am sure that readers will benefit from the informative articles as well as and other updates in biology. I wish them all the very best !

-Prof. (Dr.) Anula Maurya

FACULTY EDITORIAL BOARD

MESSAGE FROM EDITOR & TEACHER IN-CHARGE

It gives me immense pleasure that we are releasing our first volume and issue of the newsletter *"Amaranth Times"* for the academic session, 2022-23.

We have dedicated this issue to the loving memory of Dr. Sudesh Bhardwaj whom we lost in September, 2022. Dr. Sudesh Bhardwaj joined Department of Botany, Kalindi College in April 2014. She loved teaching, attending seminars, conferences, workshops and travelling to new places. She was a very warm person with always smiling face and simple nature. She remembered everyones birthday and wished them. I had a long association with her. We met for the first time in 2005 during interviews and she specially came to collect some notes from me from Sri Venkateswara College where I was teaching at that time. I have many fond memories associated with her like going to educational trips to Okhla Bird Sanctuary, conference at TERI, South campus, Shivaji College, Hansraj College, CPDHE, travelling in metro and even to Rajouri Garden market for shopping for my children. We used to chat a lot during travelling. We also used to have differences of opinion on several topics. She was loved by whosoever she met because of her simplicity and affectionate nature. The last conversation we had was regarding her health and our long due promotions. I miss her affectionate, simple, genuine and warm nature. May her noble soul rest in peace!

Coming to this volume, it is a special issue compiled by students of both Botany (Hons) and Life Sciences. Editorial board has students of both Life sciences and Botany (Hons). Articles have been contributed by the students of our department, from other departments of our own college as well as other departments and Universities.

The theme of this volume is *"Biofortified Crops"*. Biofortified crops are plants for nutritional enhancement by conventional methods or *via* Genetic engineering. Articles by students will make readers aware of the importance & need of these crops.

I am really thankful to our editorial team, especially the Student Editors, Ms. Kanupriya Chaudhary and Ms. Anubhuti Mathur and their team for their hard work, dedication & sincerity in bringing out this issue. I am also thankful to all the students who have contributed articles for this issue.

I hope readers find this issue interesting and benefit from the variety of articles.

-Dr. Ranjana Roy Mishra

FACULTY EDITORIAL BOARD

Teacher co-editors

It gives me immense pleasure to finally release this issue of "*Amaranth Times*" with our team. This would not have been possible without the contributions of our beloved students, the hard working students of the editorial team and the support of all faculty members. In this edition, the theme revolves around *"Biofortified Crops"* which is enhancing the nutrition quality of crops produced. Read on and learn more about the biofortified crops. This edition of newsletter is really special as it is dedicated to late Dr. Sudesh Bhardwaj, a beloved teacher and wonderful human. Lastly, we truly appreciate the support of our Principal ma'am without whom we would not have come this far.

-Dr. Monika Keisham

FACULTY EDITORIAL BOARD

Teacher co-editors

Abraham Lincoln truly said, "*In the end, it's not the years in your life that count. It's the life in your years.*" Dr. Sudesh Bhardwaj, our beloved teacher who transitioned into heaven in September, 2022, had a charismatic personality to invigorate and instill a sense of belongingness wherever she would go. I had known her for only three years but I never knew that those embellished years would be the only ones to be cherished forever. Symbolizing a tribute to her, "*Amaranth: The Botanical Society of Kalindi College*" has dedicated this current issue of its newsletter in her remembrance. This issue of the newsletter caters to articles, poems, and other creative art works centered around the theme, "*Biofortified Crops.*" Production of this issue would not have been possible without the contributions of student editors, co-editors, and members of the editorial team. I hope readers will find a vivid spectrum of perspective about Biofortified crops from the articles therein.

-Dr. Pawan Kumar

STUDENT EDITORIAL BOARD

Editorial Head

Hello everyone!
I am honored to be the editorial head of our prestigious newsletter *"Amaranth Times"*. I love reading books and writing is my passion. I would like to thank all my teachers who found me capable for this post. I hope you will enjoy reading this edition of newsletter. Joining this team and working with such amazing and talented people has developed my skills tremendously.

This edition of the newsletter is dedicated to our beloved teacher Dr. Sudesh Bhardwaj. The articulate contributions of our compeers will assuredly enhance the comprehension of our readers.

-Kanupriya Chaudhary
B.Sc. (H) Botany, III year

STUDENT EDITORIAL BOARD

Editorial Head

It has been an absolute pleasure and an honour to be the editor of this esteemed newsletter. The dynamic and insightful contributions of our peers have definitely inspired me and I hope will do the same for our readers.

Biofortification being the theme of this edition has absolutely showcased how resourceful humans and scientific knowledge can solve the most colossal of problems.

Working for the newsletter, I have certainly built a great respect for the scientific community looking out for every section in the society.

As for me, I am always looking for new ways to express myself, especially through writing, and research has definitely been a key part of it whether it's scientific papers or social articles. Art and music are my other sources of expression as well as leisure.

Finally, I would like to thank the ever so creative and tenacious editorial board that I have got to learn a lot from.

- Anubhuti Mathur

B.Sc. (Prog.) Life Sciences, III year

Student co-editors

A flowery greeting to the readers! As one of the co-editors for our intriguing and esteemed newsletter, the *'Amaranth Times', I* have had the honor of working with such a talented and supporting team along with our motivating teachers. I am an ardent enthusiast of literature and science alike, so being a poet and a writer, I always try to connect the artistic visualizations of our being with the scientific aspects of nature, and now working for this newsletter has indeed expanded my horizons towards content writing.

In this newsletter, we have covered the essentiality and the awareness about "*Biofortified crops*", which aided not only in nutrition fulfilment but also for their diverse genetic adaptations. Apparently, in the recent economic and agricultural scenario, biofortified crops will be a saviour for many scarce and under-developed regions. These regions, where there is a scarcity of basic resources, biofortification can be used to enhance the essential micronutrient content in the limited resources one can get there.

- Himanshi
B.Sc. (H) Botany, III year

Hello everyone!

It is an honor to be a part of the editorial team. As a co-editor, I am rejoiced to work for our newsletter, the *"Amaranth Times."* I would like to thank my teachers and editorial heads for providing me this opportunity. In this era of change, the introduction of biofortified crops has been a boon to the society.

These crops are primarily concerned with increasing nutrient value through the use of various modern biotechnological techniques, traditional plant breeding, and agronomic practices.

The motive of this edition of the newsletter is to bring this particular advancement more into the limelight while also enriching your knowledge about it.

-Shruti Srivastava
B.Sc. (H) Botany, II year

Student co-editors

Hello readers,

I feel utterly grateful to be a part of this newsletter, the *'Amaranth Times'* as one of the Student Co-editor. I find myself in absolute rapture that the selection committee at the Botany Department found me suitable enough for this position. I'm pleased to put in my creative side to its true use.

The theme for this edition revolves around biofortified crops which I also learned about in my 5th semester and it puts me in complete awe that how evolved we're as species who can manipulate the genetic makeup of it's coexisting species for the betterment of the humanity. As you read this newsletter, you shall unravel about various aspects of biofortified crops. So, explore and enjoy.

-Gunjan Goyal

B.Sc. (Prog.) Life Sciences, III year

Before moving forward, I would like to offer a word of thanks to our readers and the whole team who've worked together to bring out the best of themselves into this issue of the newsletter. It has been a privilege working for the newsletter, this has been an incredible medium for me to explore my competencies in various ways.

I feel both joy and pride as we bring forward to you "The Amaranth Times" 2022-23. This volume of "*The Amaranth Times*" focuses on the field of biofortified crops and their contribution in eradicating various issues like increasing hunger and major mineral deficiencies. I hope our readers will enjoy reading it as much as we enjoyed the process of making it.

-Prachita Mehra

B.Sc. (Prog.) Life Sciences, II year

Student Editorial Board

Student Members

Presenting before you is the latest edition of "*The Amaranth Times*", the venerated newsletter that our team has worked really hard to put together. As honored as I feel to be onboard in the making of this, I owe it to all the teachers and editorial team. It was an amazing journey of learning and growing together. I hope we made it worth your while. Here's wishing you a great read.

-Gayatri Panchal
B.Sc. (Prog.) Life Sciences, III year

I'm proud to present to you this issue of the '*The Amaranth Times*', before working on this project, I never knew exactly how much effort goes into the making of a newsletter. From the writers to the artists all put forward their finest works, us as editors have a tremendous responsibility towards them to present their entries in a manner which showcases them in the best light. Members of the editorial board have worked really hard and we hope you enjoy reading.

-Kavita Chetan Pandya
B.Sc. (H) Botany, II year

Student Editorial Board

Student Members

Hello readers,
I feel grateful to be a part of *"The Amaranth Times"* and being a part of this newsletter, it has made me gain a lot of new skills and experience. I would also like to thank my teachers who chose me to be a part of this team. And lastly for the readers, thankyou for taking out time to read this issue of the newsletter. This time, the newsletter focuses on the topic of *'Biofortified Crops'* and I hope, you people will learn and take away something new from this newsletter.

-Harmanpreet Kaur
B.Sc. (H) Botany, II year

Hello everyone,
I am a person with a happy vibe who loves to pass on the energy and my hobbies include reading. writing, and learning, which gave me the reason to be here, in the team of editorial board of *"The Amaranth Times"*. Working and learning goes hand in hand. This year's theme revolves around biofortified crops as they will be the future of agriculture, providing more nutrition at the same cost.

-Lovely Yadav
B.Sc. (Prog.) Life Sciences, II year

Dear Readers,
I am glad to have the opportunity of being a member of the newsletter team. It was an amazing experience to work with all the members of the team who helped in developing my skills tremendously. I hope you all will enjoy this edition of *"The Amaranth times'* with a theme of *'Biofortified Crops'*, which at the world level is an important aspect of food security. Moreover, general articles, poetry, facts, etc. make this newsletter unique and interesting.

-Varsha
B.Sc. (Prog.) Life Sciences, II year

In loving memory

Dr. Sudesh Bhardwaj (30.12.1963 - 14.09.2022)

Faculty Remembrance

Dr. Sudesh Bhardwaj (30 December 1963–14 September 2022) was a dedicated teacher, born on 30 December 1963 in Delhi. After completing her college education at Ramjas College, she joined the Department of Botany, University of Delhi, to work on her doctoral degree. She investigated the histochemical and ultrastructural details of *Psophocarpus tetragonolobus*. She was awarded her Ph.D. in 1993. Dr. Sudesh Bhardwaj started her teaching career in 2002 as an Assistant Professor at Gargi College, University of Delhi. She joined Kalindi College in 2014. She was the convenor and co-convenor of various committees and worked for the college till the very end.

The first time I saw Sudesh ma'am at the Department of Botany, University of Delhi in 2018 while she was visiting my supervisor's office. I was a Ph.D. student at that time. A year and a few months later, after the submission of my thesis in 2019, I joined Kalindi College as a guest faculty in September 2019 and started my short but precious association with dearest Sudesh ma'am. She was the teacher-in-charge (TIC) of our department and I still remember how I met her in the main staff room of Kalindi College with other guest faculties for our joining. From the first interaction to the very last, she was very kind, understanding, supportive, and affectionate. She left a very deep impression on all those who came in contact with her. Her legacy will forever be ingrained into all her students and colleagues. She was a teacher who used to teach with passion; loved the students like her own children; did something more than only teaching in the classrooms; and who used to provide academic and emotional support to the students. She loved traveling and when she was the TIC, she took our students on educational trips to Mussoorie, Dehradun, and Rishikesh. To her younger colleagues, she was a motherly figure and had taken good care of everyone. Once I went to Maitreyi College for a paper evaluation in December 2019. She was there that day. She had completed her evaluation well before me. But she would not leave, even if I insisted, and waited for me to complete it as it was dark and cold outside. For my safety, she then dropped me at the nearest metro station. She was very supportive even when my sister fell ill and would regularly ask about her well-being. Sometimes, she would bring chocolates for me and my sister. I want to add here that I was a new teacher who had just started her teaching career and she was immensely helpful every time I approached her in the college, be it regarding understanding an experiment for a practical class to extracting data for academic work. Off the college, she was only one call away.

This winter is the first winter after her passing away. She loved basking in the sun on the small balcony of our department in the winter. Every time I go to the small balcony, I remember her and miss her dearly. She is also dearly missed by her friends, students, and colleagues not only from Kalindi College but other DU colleges. Lastly, I want to share one of the quotes that I sent her in the past. It is written by Assata Shakur and it read: *"You died. I cried. And kept on getting up. A little slower. And a lot more deadly."*

Dr. Monika Keisham
Botany Department, Kalindi College

In Loving Memory

In Loving Memory

Student Remembrance

When I was asked to write a remembrance for Dr. Sudesh Bhardwaj, it took me back to our first interaction in an online class. I can recall her kind and loving voice that she used to teach us with or just chat with. She loved to chat. Her classes were never mundane. She'd always share some fun anecdotes or ask us about our varied lives.

Before I began writing I went around and asked people what they cherished the most about her and the response was overwhelming. One said, "She was like a mother to us. Away from our homes, she would always check up on us. Ask us if we ate this morning or did we bring lunch today." Another said she was always worried for our safety and well-being in the new city. "Do you travel safely?" "Do the people you live with treat you nicely?" The thing is, classes with her didn't feel like work at all. She would always make learning fun with her personal touch.

She was an incredibly sweet lady and yes, she would forget our names, and replace them with something she made up herself, but we loved getting nicknames from her. One of our classmate mother's name was also Sudesh and when Dr. Sudesh learned about it, she said that she would love to meet her someday. Oh, now we wish we could still make that happen.

We may have spent very little time with her but she left a great mark on us with her kindness, her compassion, her beautiful smile, and her huge heart that had space for all of us. She was like a nurturing mother goose to all of us and we were and still are her kids. We wish we could always be there for her like she was for us. We are the legacy she left behind. She showed us how cosmic souls always stay alive in people's hearts no matter how short or long they may have been known to them.

-Anubhuti Mathur
B.Sc. (Prog.) Life Sciences, III year

Theme Based Articles

A HANKERING FOR HEALTH

-Anubhuti Mathur

B.Sc. (Prog.) Life Science, III year

Amari, a 10-year-old boy in Africa, suffers from anemia. He belongs to a low-income family that survives only on cheaply available staple grains like wheat, rice, and corn, and due to a lack of a balanced diet, Amari grew up malnourished. But this isn't Amari's story alone. Millions of kids across the globe are born and raised malnourished due to a lack of essential nutrients in their diet. This lack of vital micronutrients in the diet that endangers a person's health and development, in the long run, is known as "hidden hunger". This problem adversely affects women and children, making them vulnerable to detrimental issues like a poor immune system, brain damage in newborns, anemia, impaired cognitive development, blindness, and in many cases, early death. There are numerous factors that contribute to the aggravation of hidden hunger, like poverty, the growing population, climate change, and even gender inequality, but there is a lack of immediate, pragmatic solutions for it. Then in the early 1990s, a scientist asserted that "dietary quality is as important as dietary quantity". This man was Dr. Howarth Bouis. He noticed that if the masses were consuming large amounts of staples every day, we could forge more of the micronutrients they required in the staples themselves, and hence the revolutionary idea of biofortification was born.

Biofortification uses conventional methods of plant breeding to produce crops that are richer in essential micronutrients and produce higher yields when cultivated.

For this process the screening of various varieties of a plant is done to select varieties rich in vital micronutrients like iron, vitamin A and zinc. Then these are crossed with high yielding varieties. This can also be achieved by altering gene expression using genetic engineering technology like in rice by activating genes that function only on a very low level of iron but in this case, it is active throughout the plant growth increasing the level of iron uptake in the plant. Some of these varieties are Golden rice, Orange sweet potato, Zinc rice and Zinc beans, etc.

These improved seed varieties have presented a bright new beacon of hope for local farmers in regions like Africa, Asia, Latin America and the Caribbean where they are desperately needed. To add to it there are numerous advantages to biofortification besides the increased nutrition. The crops have beneficial attributes like early maturity, resistance to diseases and pests, higher yields and their cost effectiveness and sustainability.

Biofortification is definitely a symbolic amalgamation of human creativity and science for the purpose of changing the lives of billions. Today biofortification has helped farmers in around 60 countries to give their families and local communities a chance at a better standard of nutrition and living.

With the growing rate of climate change, more and more people can't afford proper health and nutrition. Ultimately dietary diversification is the best way to attain victory over hidden hunger but considering people belong to all sorts of socio-economic background and its implementation is directly linked to their income it would not be fruitful till decades. Until then biofortification strives to curb the hankering for health of every individual like Amari.

BIOFORTIFIED CROPS

-Rani
B.Sc. (H) Botany, I year

Biofortified crops are crops that have been genetically modified or bred to have higher levels of vitamins and minerals. This fortification can happen through conventional breeding methods, such as the selection for desired traits, or through some more modern genetic engineering techniques. The goal of biofortification is to improve the nutritional value of crops, making them more nutritious and thus more valuable to both farmers and consumers.

There are many different ways to biofortify crops, but the most common method is to increase the level of micronutrients, such as iron, zinc, vitamins A and vitamin C. This can be done by either increasing the level of these nutrients in the plant itself or by adding them to the soil in which the plant is grown. Either way, the goal is to have the plant take up more of these nutrients from the soil so that they are available in the produce for human consumption.

Biofortification is a promising solution to the problem of micronutrient deficiencies, which affect billions of people worldwide. These deficiencies can cause serious health problems, including cognitive impairment, blindness, and even death. By providing more nutritious crops, biofortification can help to improve the health of both individuals and entire population.

Malnutrition is a serious problem in India, where nearly half of all children are underweight and more than a quarter are stunted. This problem is particularly acute in rural areas, where access to nutritious food is often limited. Biofortified crops offer a potential solution to this problem, as they can provide more nutritious food for both children and adults.

The Indian Government has been giving a lot of importance to the issue of nutrition in recent years. Several schemes and initiatives have been launched by the Government to tackle the problem of malnutrition in the country.

The whole concept of biofortification is to solve the malnutrition crisis, and making a healthy and balanced diet easily accessible!

There are various biofortified crops currently in development, and many more have already been released. Some of the most well-known biofortified crops include iron-rich rice, zinc-rich wheat, iron-rich beans, and zinc-rich sweet potato. These are some of the crops that are widely consumed in India and are generally available to the common man.

The Indian Government is supportive of biofortified crops as a means of improving nutrition for the population. They have invested in research and development of these crops, and have also implemented policies to encourage their cultivation and consumption. The government sees biofortification as a key part of its strategy to improve the nutritional status of the population and to address the problem of hidden hunger.

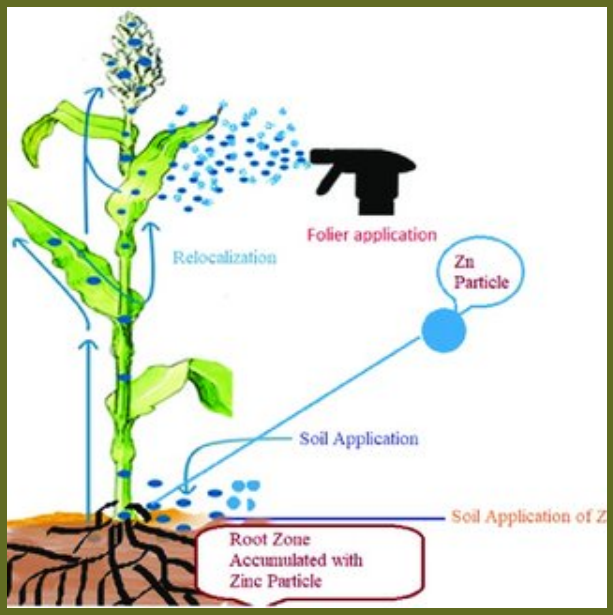
ZINC BIOFORTIFICATION TO OVERCOME ZINC DEFICIENCY

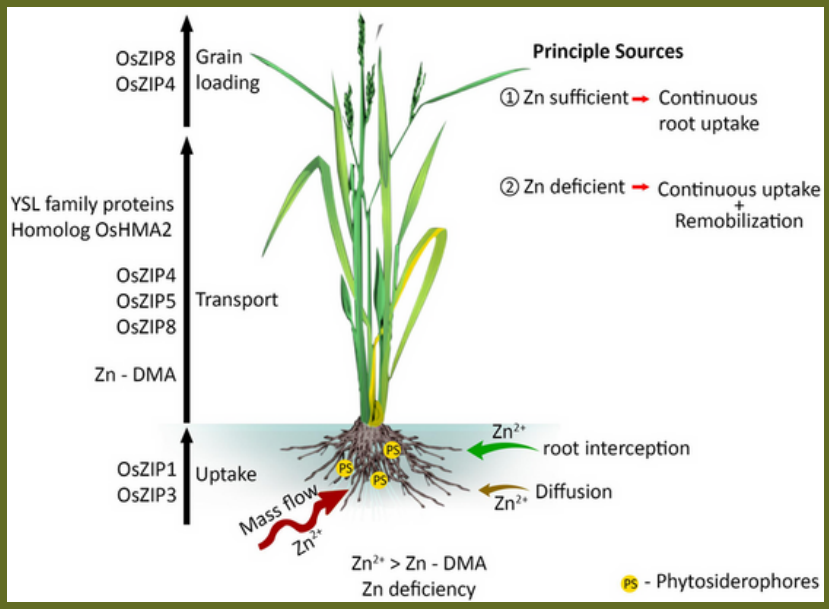
-Prachita Mehra
B.Sc. (Prog.) Life Sciences, II year

The human body requires two kinds of nutrients- micronutrients and macronutrients. Macronutrients being the one required in larger quantities than micronutrients doesn't imply the fact that micronutrients are not as essential. Deficiencies of these micronutrients are a great cause of concern in the field of human healthcare. One such micronutrient is Zinc (Zn). Through an estimation conducted a few years back, it has come to our awareness that one-third of the total world population is suffering from Zn deficiency. The deficiency of Zn can even lead to disorders like stunting, diarrhea, and pneumonia (severe in children, becoming the significant reason for infant immortality).

The deficiency of zinc is studied to be the main reason why land and water productivity of rice and wheat yield has been decreasing in countries like South Asia. Zinc deficiency can be overcome by increasing the amount of Zn in crops by a technique called Biofortification. In simpler terms, Biofortification or *"Biological Fortification"* is the enhancement of crops by increasing their nutritional value through techniques like biotechnology, crop breeding, and fertilization. Biofortification of crops can be achieved by three means: Transgenic, Agronomic, and Conventional methods. Now, intake of zinc in diet can be improved by agronomic as well as by transgenic means.

Agronomically, Zn can be increased by using Zn-based biofertilizers on crops or by increasing phytoavailability of Zn in soil by use of adequate crop rotation patterns, the introduction of appropriate microbes, and enhancement of the alkalinity of the soil. Agronomic biofortification of Zn has been successful in areas where mineral fertilizers are often used to increase nutrient and mineral count in crops. Some commonly used Zinc fertilizers are $ZnSO_4$, ZnO, and synthetic Zn chelates. These biofertilizers are introduced to the crops and are then absorbed by the apoplast of the leaves and finally taken in by the plant cells. Transgenic or Genetic biofortification includes increasing the Zn amount in the edible parts of the plants.





Genetic means can only come into use if there is enough amount of zinc present in the soil for the plants to absorb it.

The introduction of bZIP19 and bZIP23 genes can be used to increase the accumulation of zinc in edible parts of the crops. The specific targets for enhancement of Zinc concentration in roots are the transport proteins of plasma membrane and tonoplast of cells whereas some important targets for shoot enhancement include: enzymes involved in the synthesis of compounds facilitating zinc movements in xylem, tonoplast of shoot cells as well as enzymes catalyzing the synthesis of compounds responsible for detoxification of Zn ions in and out of shoot cells. *A. thaliana* has been experimented to be successful in the genetic biofortification of zinc. Even though zinc biofortification has been helpful in overcoming zinc deficiency to some extent and is also very practical and cost-effective as compared to the fortification of other minerals in crops, it still remains one of the least explored techniques and hasn't been as helpful as it could be if explored more genetically in the study of the appropriate biomarkers required. I believe that in order to advance and take a step further in zinc biofortification, the research should focus on (i) improving agronomic as well as genetic techniques to study targets of phloem-fed tissues and their mineral enhancement, (ii) identification of procedures affecting the Zn homeostasis in plant cells and steps to manage the manipulations of subcellular zinc.

Biofortified Crops

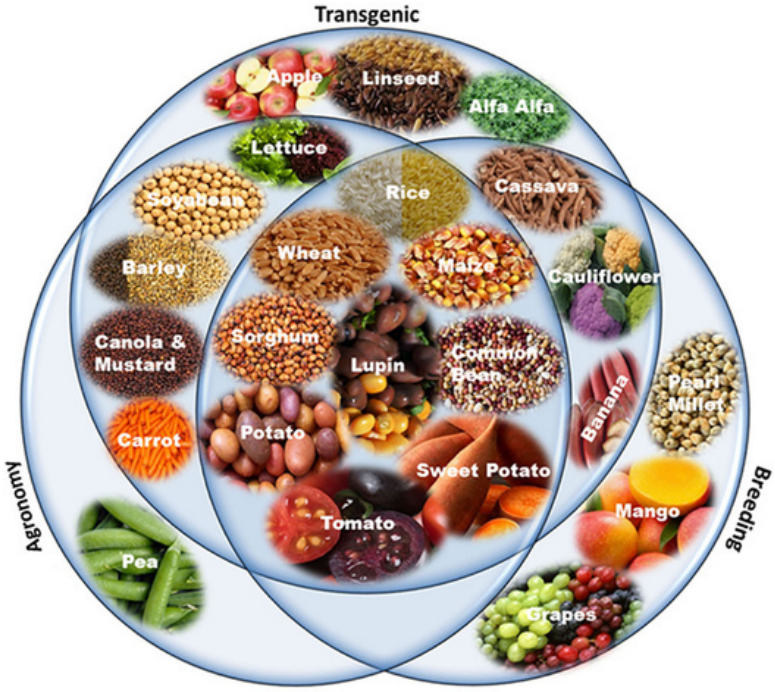
-Sandhya Yadav

B.Sc. (H) Botany, I year

Basically, Biofortification is the process of growing crops in order to increase nutritional value from the seeds. Biofortified crops refers to the nutritionally enhanced food crops with increased bioavailability for the human population.

The ultimate aim of biofortified crops:

- The current focus is on increasing the nutrient content in food intake. Despite having 'enough to eat', many people are not getting enough nutrients in their food intake. This causes the problem of hidden hunger.
- Hidden hunger can be defined as when your diet is sufficient in calories but deficient in the nutrients that are needed for proper growth and development in people.



Challenges of Biofortification:

- Due to the colour changes in the grain, people hesitate to accept biofortified food as in the case of golden rice.
- The initial costs also could be a barrier for people to implement this.

Benefits of Biofortification:

- Biofortification helps in achieving overall health improvement in the people.
- It offers a food based, sustainable and low dose alternative to iron supplements.
- It has the potential to reach the poorest section of our society and will also benefit farmers.
- Biofortification is a sustainable and cost-effective method that resolves many challenges like malnutrition and anemia.

Techniques of Biofortified crops:

- **CONVENTIONAL PRACTICE**: It involves a traditional method with an ultimate aim to yield high nutrient content.
- **BREEDING PRACTICE:** It involves the insertion of DNA into the genome to introduce new or different characteristics.
- **AGRONOMIC PRACTICE**: It involves the application of fertilizers to a quantity of micronutrients.

Some of the examples of transgenic crops are given below:

Transgenic rice *(Oryza sativa):*

- Rice has been targeted to address the global challenge of iron deficiency and anaemia .
- Vitamin deficiency is one of the major challenges that affects the underprivileged population due to poor affordability.
- Golden rice was an important breakthrough as an effective source of Provitamin A (beta carotene) with a significant potential to reduce diseases.

Transgenic Wheat *(Triticum aestivum):*

- Wheat is one of the most widely grown staple food crops in the world.
- Researchers have tried to address the challenges of most deficient nutrients like vitamin A, iron, and essential amino acids while also improving antioxidant activity.
- To address the challenge of overnutrition and obesity.

Transgenic Potato *(Solanum tuberosum):*

- Potatoes are the world's fourth most important source of calories.
- Potatoes have been targeted for enhancement of Vitamin C (ascorbic acid) by overexpressing strawberry GaIUR gene.
- Transgenic potato varieties that limit the formation of the reducing sugars.

Transgenic Mustard *(Brassica juncea):*

- Mustard is an economically significant crop and extensively cultivated for oil throughout the world.
- It has been targeted for improving the nutritionally important unsaturated fatty acids.

2023: FIRST INTERNATIONAL YEAR OF MILLETS

-Varsha

B.Sc. (Prog.) Life sciences, II year

The first food grain that was domesticated for the consumption purpose by human beings was millets. Approximately 4000 years ago, in Asia millets was the crop that was cultivated with human interference for the consumption purpose as fodder for animals and eventually for human use. We can easily find millets popping up in literature, sculptures, paintings, folk songs, and even in religious compositions from different times and geography. For example, Hindu Vedic scriptures make references to the millet in 'Sathapatha Brahmana'. There is evidence of Millet dating to the Indus valley civilization.

A number of small seeded annual grasses primarily used as grain crops grown in a variety of climates like dry, subtropical and tropical are called millets. Many countries of Asia and Africa grow it but India is the largest producer of millet. A variety of millets are popular in India, for example, *Eleusine coracana* (Ragi), *Sorghum vulgare* (Jowar), *Pennisetum glaucum* (Bajra), *Panicum sumatrense* (Samai) and *Panicum miliaceum* (Chena or Barri).

In 2021, the government approved the mid day meal scheme to include millets in the menu to overcome the nutritional deficiency that was found in the surveys of National Health. Millets were included in the mid day meal scheme due to its high nutritional value, being less expensive and because it can be easily grown in a much faster way than wheat and rice. At the international level up, a proposal was brought forward by India for the consumption of millets and it was endorsed by the United Nations Food and Agriculture Organization in the 75^{th} session of the United Nation general assembly and finally, year 2023 was declared as the International year of millets.

After attaining G-20 presidency in December 2022 government has said millets will hold an integral part in G-20 meetings and for a year activities will be held to promote and spread awareness about the benefits of millets for the 'cultivator, consumer and climate'.

This will be a great step towards achieving adequate nutrition at the world level in a sustainable manner.

General Articles

BIOPIRACY

-Astha Tiwari and Ruvedita
B.Sc. (Prog.) Life Sciences, III year

Biopiracy is the use of genetic or natural products of plants based on their traditional uses without the consent of the local authorities and using this knowledge for industrial purposes by patenting it under the name of an industry, person or a company.

In simple words, it is the stealing of knowledge possessed by locals on their endemic plant species and then selling it without giving any recognition to the origin of the knowledge.

A person can use a product, genes or local knowledge for exploitation of the plant. Pat Mooney in the early 1990s coined the term "biopiracy". He was the founder of an organization that protects people who are unable to protect themselves from the advancement in technology and from people who might steal their traditional gifts to make profit. The group was called the ETC group.

Biopiracy is often done to:

- Produce medicines and have full control on them
- Make varieties that might have few changes than the original plant
- Have control on several genes of pirated plants
- To have full control on a valuable piece of knowledge

Biopiracy affects:

- Mainly small farmers and tribal communities
- Traditional knowledge
- Endemic gene pool of a plant
- Economy of developing countries

Case studies :

1.Enola beans (*Phaseolus vulgaris*)

- Larry Proctor, a Colorado executive of the American bean industry, travelled to Mexico and bought a bag of yellow beans.
- As he returned to Colorado, he bred the beans for several generations and segregated the yellow beans in several generations.
- After 2 years of breeding, Proctor filed a monopoly patent on 13th April, 1999.
- The patent claimed a range of yellow colored seed coats.
- In Mexico, farmers have grown yellow colored beans since the Aztecs Empire.
- Then he stated that Mexican farmers are illegally cultivating Enola beans and selling them in the US market.
- The yearly sales of Mexican beans in the US were $50 million before the patent application, but afterward, they fell by almost 90%, driving the Mexican farmers into bankruptcy.
- CIAT filed a request for re-examination.
- The United States Court of Appeals for the Federal Circuit revoked and rejected Proctor's patent on the 'Enola' bean variety on July 10, 2009.

2. African super sweet berries (*Pentadiplandra brazzein*)

- In South Africa's western part grows an indigenous plant called *Pentadiplandra brazzein* which is also known as sweet berry.

- It was found 2000 times sweeter than normal sugars.
- In African population, it is an important source of Brazzein protein and local people use it as a low calorie sugar to sweeten food and beverages.

- Researchers in 1997 reported the success of genetically engineered yeast cells which were secreting sweet protein monellin.

3. Basmati Rice (*Oryza sativa*)

- Texas based company RiceTec patented the Basmati Rice lines and grains on September 2, 1997.
- The US patent and trademarks office granted the patent.
- The patent gave the company many rights on breeding of basmati rice and property rights on the seeds and grains and using the term 'Basmati ' for rice grown outside India.

- This patent affected the Indian and Pakistani basmati production and exports.
- Company claimed the production of "novel rice lines and grains" (Basmati 867) by breeding Pakistani varieties with American
- But it has a resemblance with the traditional basmati rice.
- CSIR challenged the patent.
- On August 14, 2001, the US Patent Office ordered that the title of the patent be changed to “Rice Lines Bas867, RT 1117 and RT1121”.
- But RiceTec still has a patent and can still call it basmati.

4. Rosy Periwinkle (*Catharanthus roseus*)

- *Catharanthus roseus* is commonly called Madagascar periwinkle.
- It helps in combating blood cancer (Leukemia) as it sharply reduces the amount of white blood cells.

- It has anti-diabetic properties and also treats malaria.
- It has been used as a medicine in Africa. Indigenous groups in the Philippines use it as an appetite suppressant.
- In 1954, Eli Lilly's researchers extracted vinblastine from rosy periwinkle. Eli Lilly was awarded patents for alkaloid extraction, which were anti cancerous in property.
- During patent courses many drugs derived from Periwinkle & Eli Lilly made millions of dollars.
- Madagascar people were never offered compensation.

5. Tamarind (*Tamarindus indica*)

- India is the largest producer of tamarind.
- Annually India produces half of the world's total tamarind.

- Pulp of tamarind has been part of the traditional Ayurveda medicine in India for many centuries.
- Its herbal formulations are used as antioxidants, improves heart health and lowers cholesterol. It is antimicrobial in nature and may have anti-diabetic effects.
- From 1978 to 1997 there were about 30 US and Japanese patents granted for medicinal and pharmaceutical formulations.
- Most of the patents are on the use of seeds, which can be used in the textile dyeing industry.

- At the present 60 non-Indian patents are there which are based on traditional Indian Ayurvedic knowledge.

6. Turmeric (*Curcuma longa*)

- It is not hidden that Indians have been using turmeric for thousands of years in their kitchens. It gives an umami flavor to most of the Indian dishes. It is also used in Indian weddings. The bride and groom are covered with turmeric paste at their haldi ceremony. It treats various skin diseases and also gives a golden glow.

- But in 1995, two emigrant Indians, Suman K. Das and Hari Har P. Cohly, working in the University of Mississippi Medical Center patented turmeric as a wound healing agent.
- When the Indian Council of Scientific and Industrial Research came to know about this they filed a re-examination case with the USPTO challenging the patent on the rationale of the prior art.
- They used many ancient literature and past papers to prove the wound healing traits of turmeric was actually not discovered by the patent holders but are a well known and performed practice in India.
- The US patent office revoked the patent in 1997.
- **This was the first milestone case where a developing country challenged an international patent holder successfully.**

7. Neem (*Azadirachta indica*)

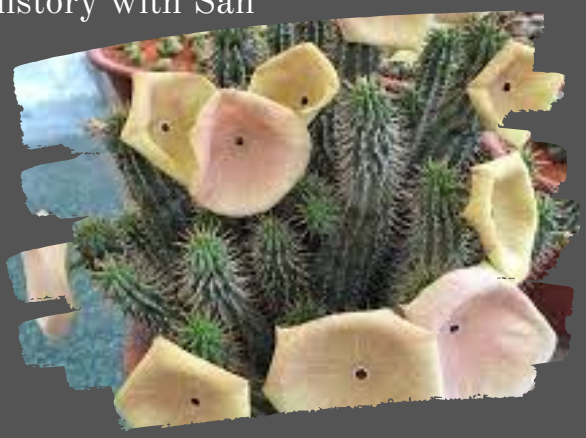
- Neem is called nature's pharmacy as all of its parts have some or the other medicinal properties. Neem leaves are used in villages to keep pests and fungi away from harvested crops. Its oil is used to treat skin diseases and also to cure colds and flu. Neem is also used in dental hygiene.

- In 1994, European Patent Office (EPO) gave a patent (EPO patent No.436257) to the US company W.R. Grace and the Department of Agriculture on the use of neem oil to manage plant fungi.
- A group of international NGOs and representatives of Indian farmers filed legal opposition to this patent in 1995.

- They submitted evidence that the fungicidal effect of extracts of neem seeds had been known and used for centuries in Indian agriculture to protect crops and was therefore unpatentable.
- In May 2000, the patent was lifted as the arguments revealed that this property of neem is already known to the public and may have anti-diabetic effects.

8. *Hoodia* (*Hoodia gordonii*)

- *Hoodia gordonii* is a cactus-like succulent plant that grows abundantly in the Kalahari desert and has a history with San Bushmen people of South Africa. These people used the cactus as a hunger suppressant and to fight thirst on long trips.



- The African CSIR studied this property of the plant and found oxy pregnane steroidal glycoside, code-named P57AS3 (P57), as the sole active compound for this activity.

- In 1997, a patent was filed by the CSIR to take control over this cactus which outraged the local San Bushmen people and latent law critics and in 2002 the issue was settled by the two parties. CSIR promised royalties to San Bushmen people whenever a product with the properties of this plant was launched in the market.

9. Ylang-ylang (*Cananga odorata*)
   - A very famous French brand called Yves St. Laurent or YSL has a perfume that has a formula based on the smell of a plant native to the Phillipines called ylang ylang *(Cananga odorata)*.

   - The company used to import the high quality flowers of this plant from the Philippines for 20 years directly for perfume production but recently it started growing the filipino native plant species in Africa and has patented its perfume formula.
   - This is another case of biopiracy where the natives didn't get any benefit from the company while the company makes profit out of their resources.

10. Bitter gourd (*Momordica spp.*)
    - A Thai variety of bitter gourd (*Momordica spp.*) called the Bird Dropping Gourd was found to be helpful in Thailand's most problematic disease, HIV, by the nation's leading scientists.

    - They found that the bitter gourd can be used to make effective medicines against the disease. However they found a US patent already registered for the active Map-30 protein from this native strain of Thai bitter gourd.

HIDDEN HUNGER

-Faailah Khursheed

B.Sc. (Prog.) Life Sciences, II year

We all are familiar with the feeling of an empty stomach or craving which is typically called hunger. Hunger can affect us physically and directly affects our mood. Surprisingly it is not just a feeling but just like most things there is science behind it. Dropping in glucose levels is directly associated with the release of hormones like cortisol and adrenaline explaining the mental aspect of hunger which we as humans would react to much faster than the physical aspects of hunger. Unfortunately, our brain does not have a similar mechanism to react to hidden hunger. “Hidden hunger is a micronutrient deficiency which occurs when the quality of food does not meet the nutritional requirements and the body is not provided with sufficient essential vitamins and minerals required for growth and development." A diet based on crops that are usually energy-rich like the staple crops: maize, rice, and barley usually fall under such a category. The essential nutrients sufficed by them in comparison to the energy is significantly lower than the daily requirement of an individual. The primary cause for such deficiency is presumed to be poverty; the inability to afford nutrition-rich food products usually animal-based products like meat, fish, and eggs which are not accepted sources of food in some cultures. The lack of alternatives thereof in economically weaker countries is the main cause of hidden hunger, apart from the socioeconomic factor. Hidden hunger is prevalent due to unawareness to these deficiencies and the symptoms taking a longer period of time to be reflected on the body, which becomes a major concern. Iodine, iron, vitamin A, and zinc are major contributors to micronutrient deficiency

concerning policymakers globally due to their developmental consequences. Half of the world's population's hidden hunger is contributed by India.

Nearly one million people in India are experiencing hidden hunger. The best way to eliminate hidden hunger would be to diversify the food we eat. Diversification of food would lead to the consumption of different micronutrients and help to recover from hidden hunger. Other than food diversification, biofortification of crops has proven to be a successful way to incorporate micronutrients in the major food categories that are commonly consumed. Biofortification involves the breeding of food crops in a transgenic way to increase the micronutrients, quality, yield, and resistance of the crops. To help with the deficiencies, crops like vitamin A cassava, zinc rice, and zinc wheat have already been introduced in countries that have been proven to be safe.

Consciousness towards balanced consumption of meals with the development of science and their application and betterment of policies can further help to eradicate such issues globally to lead a sustainable and healthy life.

SCIENTIST SECTION

EK Janaki Ammal

November 4, 1897 - February 7, 1984

The 'nomad' flower scientist India forgot

Credits- BBC News

(from the excerpts of BBC news dated November 14, 2022)

In March, the magnolias begin blooming at Wisley. For the next few weeks, rows of pink flowers dot the small town in Surrey in the UK, beckoning passers-by to stop and smell them. Few know, however, that many of these blooms have Indian roots.They were planted by EK Janaki Ammal, a scientist who was born in the southern Indian state of Kerala in the 19th Century.

In a career spanning almost 60 years, Janaki studied a wide range of flowering plants and reworked the scientific classification of several families of plants."Janaki was not just a cytogeneticist - she was a field biologist, a plant geographer, a palaeobotanist, an experimental breeder and an ethno-botanist and not in the least, an explorer." says Dr Savithri Preetha Nair, a historian who has researched the scientist's life for years. It's difficult, Dr Nair says, to name even one Indian male geneticist from that time who adopted such cross-disciplinary methodology in their research."She talked about biodiversity as early as the 1930s."

Janaki lived an inspiring life, but for decades, her work went largely unappreciated and her contribution to science was barely acknowledged. But this year - which also marks Janaki's 125th birth anniversary - Dr Nair hopes to change that with an in-depth biography. The book, titled "**Chromosome Woman, Nomad Scientist: E.K. Janaki Ammal. A Life 1897-1984**" was released earlier in November and is the product of 16 years of research spread cross three continents.

It also marks, Dr. Nair says, the beginning of "a grand project" of recovering stories about Indian women in science. "Until now, published sources on women scientists have focused on Europe and North America," she says, adding that women from Asia and other regions "hardly figure anywhere".

Why India forgot this freedom hero from the south ?

While Janaki's professional achievements were numerous, her family members say the way she lived her life was also inspiring. "She thrived on human possibility," says Geeta Doctor, a writer and Janaki's grand-niece. "She was passionate about everything, completely liberated and always fixated on her work. "Janaki was born in Tellichery (now Thalassery) in Kerala in 1897. Her father, EK Krishnan, was a high court sub-judge in the Madras Presidency, an administrative subdivision in British India. She grew up in a privileged and large family that lived in a house called Edam, which Ms. Doctor says was "the centre of Janaki's life".

The two-storey house had a grand piano, a sprawling library and spacious halls, its large windows overlooking a carefully-tended garden. Janaki belonged to Kerala's Thiyya community, which is regarded as socially backward under the Hindu caste system. But at Edam house, Janaki's life was far removed from any prejudices, Ms. Doctor says. That didn't mean she did not face caste discrimination in her life, she adds - but she never allowed it to stop her. "If somebody displeased her, she would just move on." After she finished school, Janaki moved to Madras (now Chennai) for higher education. In 1924, she was teaching at a women's college when she received a prestigious scholarship from the University of Michigan in the US.

Eight years later, she became the first Indian woman to be awarded a doctorate in botanical science. She returned to India shortly after, and taught botany in her home state before joining the Sugarcane Breeding Station at Coimbatore. It was here that Janaki worked on cross-breeding sugarcane and with other plants to create a high-yielding variety of the crop that could flourish in India. She was the first person to successfully cross sugarcane and maize, which helped in understanding the origin and evolution of sugarcane, Dr Nair says. A particular hybrid she created, the historian adds, went on to produce many commercial crosses for the institute but she didn't receive credit for it. In 1940 - just after World War II had started - Janaki moved to London and joined the John Innes Horticultural Institution to continue her research. The next few years were the most formative ones of her career. Five years later, she became the first woman scientist to be employed at the Royal Horticultural Society Garden at Wisley. It was also a time of hardships and hard work - Britain was facing the brunt of the war and food supplies were heavily rationed. "But Janaki was unfazed," Ms. Doctor says. "When the bombs fell, she would just dive under the table or sleep under the bed - all in a day's work. "This attitude extended to her personal life, she says. "[The children of her family] were her equals and she expected us to keep up with her strict ways. "But there was a sweeter side to her as well.

A ***Rhododendron*** specimen made by Janaki at RHS

Ms. Doctor recalls that her grand-aunt gave them amazing books and took them on delightful picnics. And she was always brimming with stories - about Kapok, the small black-striped palm squirrel that she had smuggled in her sari to keep her company in London; and her doll Timothy, who fascinated everyone at Edam. Ms. Doctor does not put dates to these memories - the past is simply the past - but she vividly remembers Janaki's strident personality and commanding presence; her vibrant yellow saris; and her "energetic yet subtle" ways. "She enjoyed life in its minutiae and also the grand scheme of things, but with a rigorous scientific mind. "Dr Nair says that this was also evident in her work, which was not about one seminal revelation, but a series of small-scale discoveries which contributed "to the grand history of human evolution".

In 1951, India's prime minister Jawaharlal Nehru asked Janaki to return to the country and help restructure the Botanical Survey of India (BSI).Janaki, who was greatly inspired by the teachings of Mahatma Gandhi, went immediately. "But her male colleagues refused to take commands from a woman and her attempts to re-organise BSI were turned down," Dr Nair says, adding that Janaki was never entirely accepted at the institute. This caused her great pain and she could never entirely recover from it. So she took refuge in exploring the country in search of new plants. In 1948, Janaki became the first woman to go on a plant-hunting expedition to Nepal which, according to her, was the most unique part of Asia botanically, says Dr Nair. When she was 80, the Indian government awarded her a Padma Shri, one of the country's highest civilian honours. She died seven years later, in 1984.Ms Doctor says that even though Janaki did not receive the recognition she deserved, she never lost her passion for studying life. "She would always say 'my work will survive' - and it did." Dr Nair agrees. "Janaki's life continues to be a blazing testament to intellectual integrity."

Botanical Updates

Rice breeding breakthrough to feed billions

Date: January 10, 2023.
Source: University of California - Davis
https://www.sciencedaily.com/releases/2023/01/230110160152.htm

Summary: An international team has succeeded in propagating a commercial hybrid rice strain as a clone through seeds with 95 percent efficiency. This could lower the cost of hybrid rice seed, making high-yielding, disease resistant rice strains available to low-income farmers worldwide.

The single-step process involves modifying three genes called MiMe which cause the plant to switch from meioisis, the process that plants use to form egg cells, to mitosis, in which a cell divides into two copies of itself. Another gene modification induces apomixis. The result is a seed that can grow into a plant genetically identical to its parent.

The method would allow seed companies to produce hybrid seeds more rapidly and at larger scale, as well as providing seed that farmers could save and replant from season to season, said Gurudev Khush, adjunct professor emeritus in the Department of Plant Sciences at University of California, Davis.

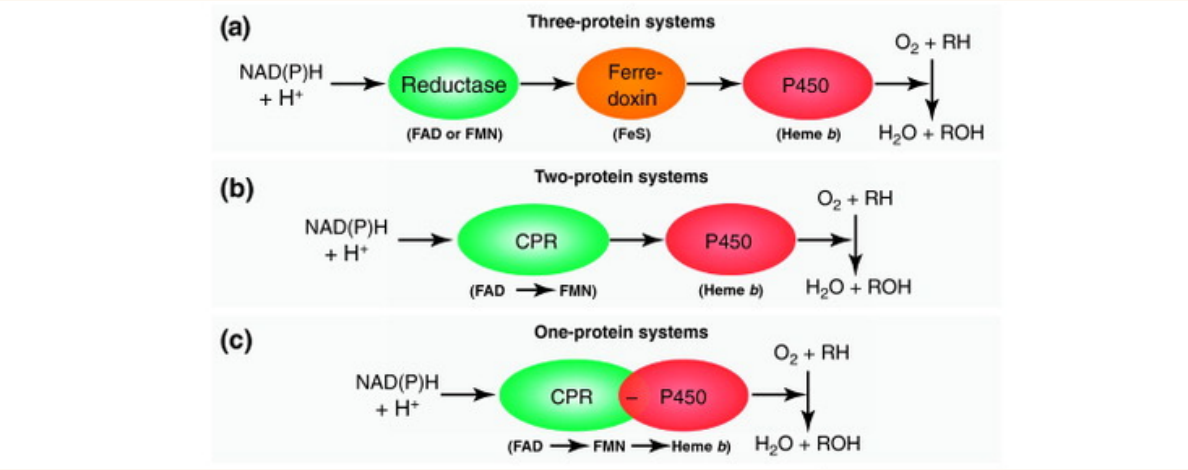
Commercial hybrid rice strain with 95% efficiency

New levers for controlling plant biochemistry

Date: January 11, 2023
Source: DOE/Brookhaven National Laboratory
https://www.sciencedaily.com/releases/2023/01/230111150805.htm

Summary: Plant biochemists have discovered a new level of regulation in the biochemical 'machinery' that plants use to convert organic carbon derived from photosynthesis into a range of ring-shaped aromatic molecules. The research suggests new strategies for controlling plant biochemistry for agricultural and industrial applications.

"Our study reveals the long-overlooked complexity and versatility of a key set of enzymes known as cytochrome P450 monooxygenases," said study lead author Chang-Jun Liu of Brookhaven Lab's biology department. "These enzymes operate as a synthetic machine to produce a wide range of aromatic compounds in plants - including compounds that build plants' waterproof skeleton and vasculature, and others that provide defense from insect invasions and ultraviolet (UV) radiation."



Cytochrome P450 monooxygenases

Molecular mechanism behind nutrient element-induced plant disease resistance discovered

Date: January 10, 2023
Source: American Phytopathological Society
https://www.sciencedaily.com/releases/2023/01/230110150941.htm

Summary: In one of the few studies to directly investigate the mechanism underlying the effect of essential elements on plant disease resistance, scientists demonstrate that nutrient elements activate immune responses in tomato plants through different defense signaling pathways. The paper was recently published in Phytopathology by Gupta *et al.*, (2023) and outlines the molecular mode of action that potassium, calcium, magnesium, and sodium take to minimize both fungal and bacterial plant diseases. Using straightforward laboratory methods, the authors demonstrate that essential element spray treatment sufficiently activates immune responses in tomato - including defense gene expression, cellular leakage, reactive oxygen species production, and ethylene production - leading to disease resistance. Their results suggest that different defense signaling pathways are required for induction of immunity in response to different elements.

Essential spray treatment used to activate immune responses in *Solanum lycopersicum*

Ancient hybridization and genome doubling explain the origin of the apple tribe

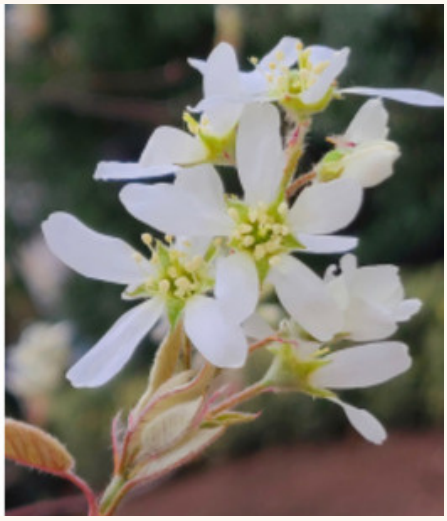
Date: April, 2022
Source: Plant Press, Vol. 25
https://nmnh.typepad.com/the_plant_press/2022/05/ancient-hybridization-and-genome-doubling-explain-the-origin-of-the-apple-tribe.html

In the 1930s, biologists studying chromosomes in the rose family (Rosaceae) noticed that species in the apple tribe (Maleae) had approximately twice as many chromosomes (base chromosome number = 17) as every other species in the rose family (base chromosome number = 7, 8, or 9). Over the ensuing decades, researchers proposed hypotheses of hybridization and/or genome doubling to explain the evolutionary origin of the apple tribe and the unusually high chromosome counts in the apple tribe.

There were two competing hypotheses explaining the evolutionary origin of the apple tribe, but it was difficult to test them rigorously with the data available at the time. For many years, botanists tested these hypotheses using morphological characters, chromosome count data, and more recently, single-locus genetic data. Until a few years ago, researchers did not have access to genome-scale genetic data to test hypotheses of ancient hybridization and/or genome doubling.

Sweet crabapple
(*Malus coronaria*)

Callery pear
(*Pyrus calleryana*)



Canadian serviceberry
(*Amelanchier canadensis*)

An ancient hybridization event gave rise to the apple tribe (Maleae) in the rose family, Rosaceae. Maleae taxa include (from left) sweet crabapple (*Malus coronaria*), Callery pear (*Pyrus calleryana*), and Canadian serviceberry (*Amelanchier canadensis*).

Discovery of anti-cancer chemistry makes skullcap fit for modern medicine

Date: January 19, 2023
Source: John Innes Centre
https://www.sciencedaily.com/releases/2023/01/230119133341.htm

Summary: The evolutionary secrets that enable the medicinal herb known as barbed skullcap to produce cancer fighting compounds have been unlocked. The CEPAMS collaboration used DNA sequencing technology to assemble the genomic sequence of skullcap (*Scutellaria barbata*)known in China as Banzhilian.
This gave researchers the genetic information - a microevolutionary history - required to identify how the plant produces the compound Scutebarbatine A, which acts against a range of cancer cells.
Professor Cathie Martin, Group Leader at the John Innes Centre, and one of the authors of the study said, "We have found that the primary metabolite has activity against cancer cells but not non cancer cells which is especially important for an anti-cancer metabolite. Now we are looking to develop synthetic methods for producing more of the lead compound."

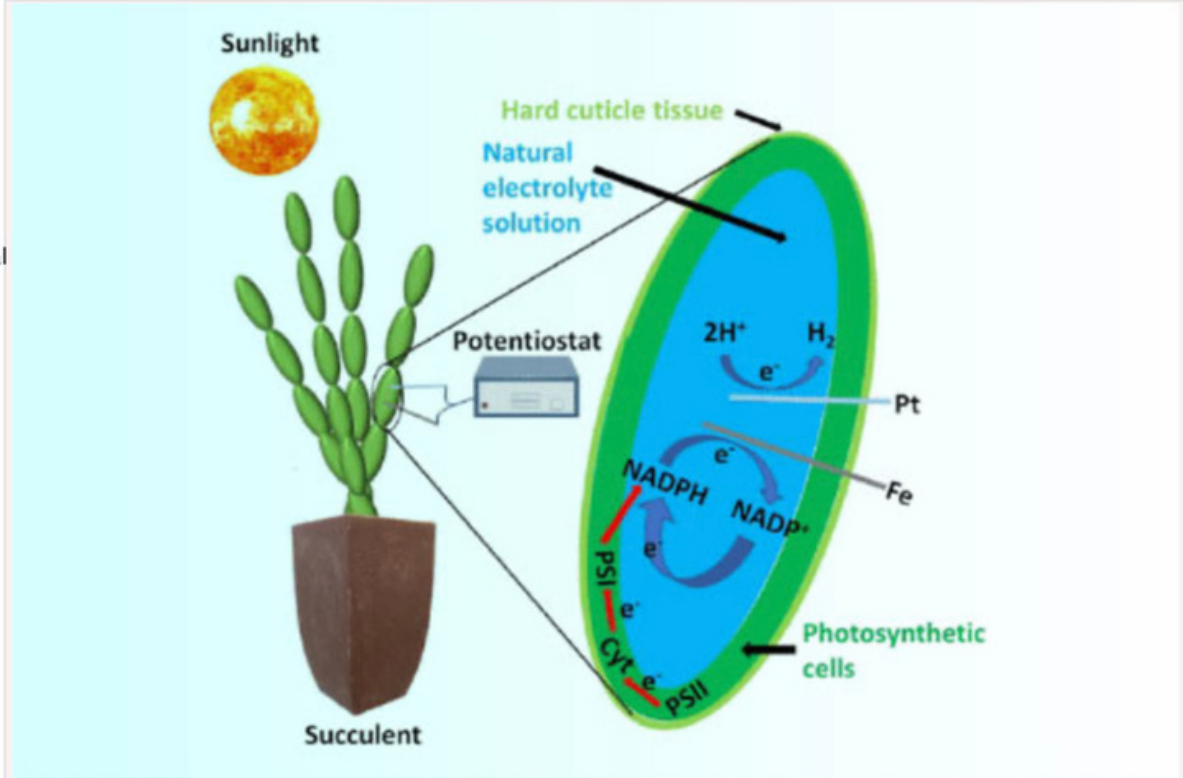
Scutellaria barbata

Biological Updates

Researchers turn succulent plant into living 'Bio-Solar Cell'

Date: 14 December, 2023
Source: News Staff
Link: https://www.sci.news/biology/living-bio-solar-cell-11479.html

Harvesting an electrical current from biological photosynthetic systems, such as live cells, is typically achieved by immersion of the system into an electrolyte solution. In new research, scientists at Technion in Israel show that the aqueous solution found in the tissues of succulent plants can be used directly as a natural bio-photo electrochemical cell.



Shlosberg et al. present a method to simultaneously absorb carbon dioxide while producing an electrical current with minimal engineering requirements. Image credit: Shlosberg et al., doi: 10.1021/acsami.2c15123.

New research shows how humans lost their body hair

Date: January 6, 2023
Source: News Staff
Link: https://www.sci.news/genetics/mammalian-hairlessness-11547.html

Humans, whales, elephants, and naked mole-rats all share a somewhat rare trait for mammals: their bodies are covered with little to no hair. The common ancestors of each of these species are considerably hairier which must mean that hairlessness evolved multiple times independently. To identify genomic regions that appear to have evolved at a faster or slower evolutionary rate along hairless lineages, researchers from the University of Pittsburgh and the University of Utah scanned the genomes of multiple mammalian species. They identified a number of protein-coding genes as well as noncoding regions that might explain how hairlessness evolved in mammals.

The picture shows a Neanderthal man. Image credit: Mauro Cutrona.

Explosive fossil fruit found buried beneath ancient Indian lava flows

Date: April, 2022
Source: Plant Press
Link:https://www.floridamuseum.ufl.edu/science/explosive-fossil-fruit-found-buried-beneath-ancient-indian-lava-flows/

Adapted from Jerald Pinson (The Florida Museum of Natural History).
Just before the closing scenes of the Cretaceous Period, India was a rogue subcontinent on a collision course with Asia. Before the two landmasses merged, however, India rafted over a "hot spot" within the Earth's crust, triggering one of the largest volcanic eruptions in Earth's history, which likely contributed to the extinction of the dinosaurs.
Rachel *et al.*, (2022) in study published in the International Journal of Plant Sciences, reported that the fossilized remains of plant material wedged between layers of volcanic rock describe a new plant species based on the presence of distinctive fruit capsules that likely exploded to disperse their seeds. The fossils may be the oldest fruit discovered to date of the spurge family (*Euphorbiaceae*), a group of plants with more than 7,000 species, with well-known representatives that include poinsettia, castor oil plant, rubber trees, and crotons.

(photo by Kristen Grace, Florida Museum of Natural History)

The fruit of *Euphorbiotheca deccanensis* is potentially the oldest ever discovered of the Spurge family. Based on the preserved fibers within the fossilized fruit, it likely exploded to disperse its seeds.

Poetry Section

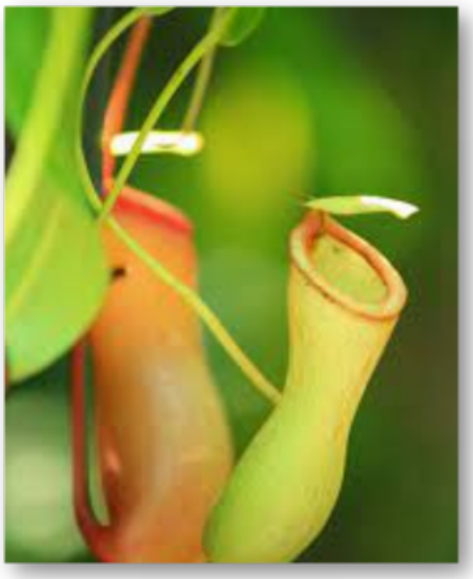
TALE OF CARNIVOROUS PLANTS

-Aastha Mehta
B.Sc. (H) Botany, II year

100 million years ago, when dinosaurs were ruling the earth,
The evolution of the most skillful green hunters was taking birth.
Nutrient - poor soil made them shift towards carnivory,
And the nutrient- rich prey started tasting savoury.

It all started when the ancestor generated a second copy of its genome,
What a surreptitious move to lure victims with sweetness.
What was meant for diversification of genes led to initiation of a three step process, repurposing genes meant for leaves into genes for traps,
And nutrition seeking soil genes into genes for carnivorous nutrition.

Hungry plants receiving nitrogen and phosphorous from their prey,
Got convinced that optimum nutrition can be obtained only this way.
This marked the second step of their journey to carnivory,
And announced that receiving nutrition from prey is a glory,
Even if it meant having reduced roots and leaves, it wasn't a worry.



Third step of their journey was unique to their surroundings,
With leaves and roots genes being trap specific.
Genes once used to secrete nectar,
Now took over the role to make enzymes to attract prey within the hectare.

Most plants are capable of becoming carnivores,
But the question is if there were ever a worldwide nutrient poor soil,
All the plants will turn to carnivory
Or evolution will weave another story?

"THE VIEW"

-Gunjan Goyal

B.Sc. (Prog.) Life Sciences, III year

Walking through the road
all hazy, covered with fog
As the sun rises and marks dawn
And after a long night in the dim moon light, the sky finally sees the first glimpse of sunlight.
Amidst the silence I hear the pleasant melody of chirping birds, coming out from their nests.
As I look up the sky, crystal clear but the soft vibrance of orange fills my eyes. This mesmerizing scene elates my soul
And as I hold the magnificence of this scenic view in my eyes,
I somewhere in my mind realize how beautiful it is to breathe in this nature full of artistic surprises but alas, it's getting lost with time.
But I continue
Walking through the road
all hazy, covered with fog.

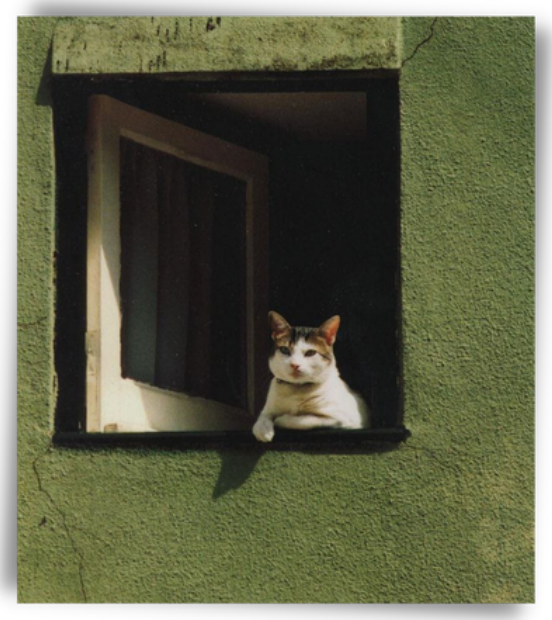
ESCAPE

-Himanshi

B.Sc. (H) Botany, III year

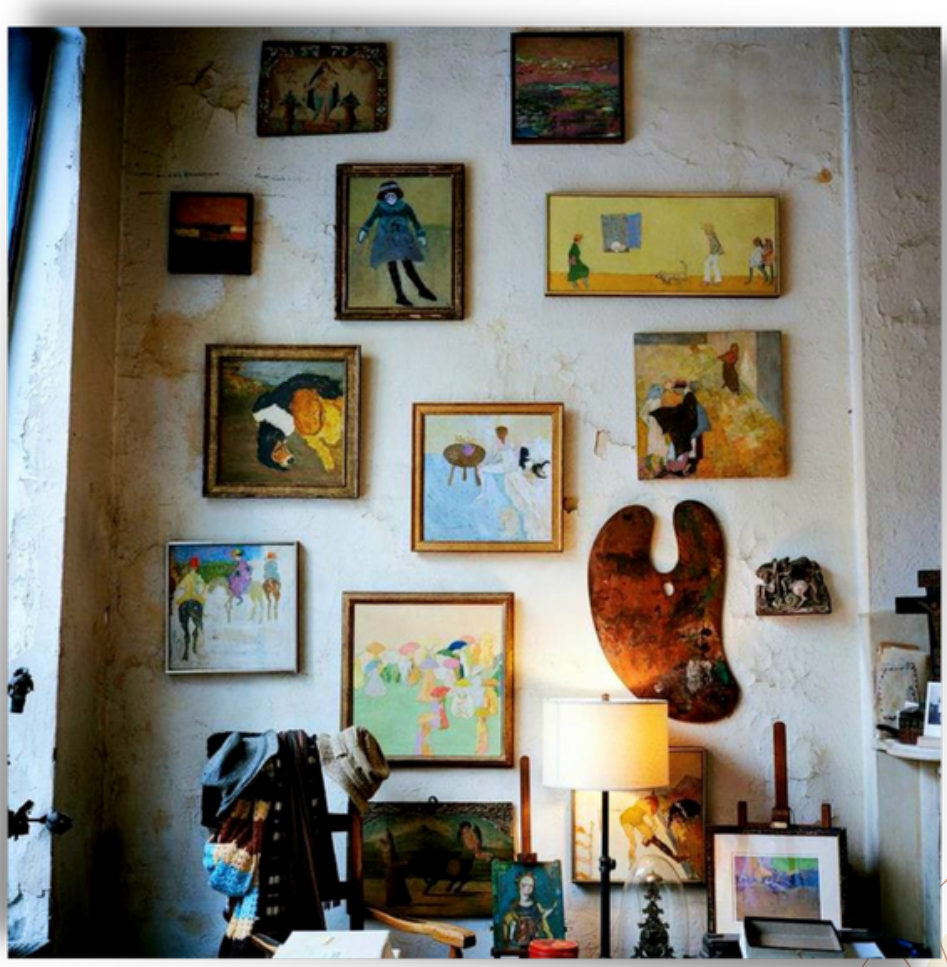
I draw transverse lines
on the canvas here,
my walls, up high
yellow and painted red,
with the lines that cut sharp
in a design ancient on the wall.

I draw our strings,
threadlike passion flows on the wall
like the gush of blood in my cheeks
when the balls of my existence
catch a glimpse of yours.



i travel, create a circle on the wall
for all the loops I run into,
hoping they'd stop now
and become a triangle, or a portal,
to nothingness, with nothing's
surrounded by all colours
dancing in sync with an unholy
benediction that
only my head creates,

rupturing a foot, an artery, and
a snail's tail, few blocks from my own
find me an escape, under the rug
behind the medulla, sitting in a corner
of a wall, that scrapes to reveal
endlessness, innovation, creativity,
that scatters inside a cupboard
filled with coffee beans,
kept to churn when a guest arrives
entertaining me a boost,
cheering, happy, jolly, lively,
Live.



"THE SKY"

-Lovely Yadav

B.Sc. (Prog.) Life Sciences, II year

Lighting awakes the spirit like it never has
Understanding the rage of sky which never been truly less
Yes, yes I'm looking at the sky
Gazing it's beauty by eyes
The stars and their absence, but
But I am waiting for them to twinkle and mark their presence
The darker it grows
The more beauty it holds
The loneliness with sky is not a beast
It's such a living peace
The more I turn around
The more I want to be on this ground
Waiting to be found
But still I am bound
Sky's limitlessness
My recklessness
Matches the level
Clearer it gets
Clear the mind
Even it's dew and hue
Still gives the ideas maybe a lot or a few
What more a writer needs
Leaving the world's greed
Grateful to survive
Grateful to strive
And to thrive
Under this sky which makes me insignificant
But so significant!

SHE IS A SEPARATE WORLD

-Anshika Mishra

B.Sc. (H) Botany, III year

She was always the girl,
with that smile that spark.
Everyone liked her,
but no one knew her dark.

The scars that she took,
the battle that she fought.
She survived that hell,
that can make any soul rot.

She's a queen with no king,
no tiara she has a sword.
They ganged up against her,
but God was in her squad.

I will fly one day,
She used to tell mirror and smile.
Now she has got her wings,
though it took her a while.

HER SMILE AND THE WORLD

-Lovely Yadav
B.Sc. (Prog.) Life Sciences, II year

When you're smiling whole heartedly,
Looking for him,
Looking for him to see you smiling,
But you forgot that this world,
This world doesn't love the smiles,
But it does love the tears.
It loves the fading rejoice,
The fading rejoice, your charming eyes hold.

But you still smile, forgetting everything,
Forgetting that he's also a part of this brutal world,
Who may not like you smiling
But you smile anyways.
You be loud and happy anyways
Just forget him also, just forget the world.
And smile!

“PERCEPTION OF HER”

-Lovely Yadav

B.Sc. (Prog.) Life Sciences, II year

An unsettled mind, finds beauty in lies,
Trust this world which ends with goodbyes
Curiosity is always in mind
Unexplained mysteries to get revealed in the line
Hate the silence, hate the talks,
Still don’t know how to hate and how the hate’s unlocks
Just try to defy with spirits high
Get a smile which fades in a while
Get it again with new hopes in eyes
Confusion is all there in the life
But I am still trying and trying
Want to explore but also wants being explored
Revel the life in the flow
Want to travel the world in the go
Insecurities explain but the confidence speaks
Is always powerful when there’s a need
Anger issues but after so much of patience
Still there’s something or someone’s absence
Crying along when see someone cry
And smile even when I literally cry
Happiness is the outcome of loved one’s smiles
Real Smile is not as far as miles
Just a song on roof top while seeing the stars, the moon and the sunset are the simplest way to that precious smile
Hope even when there’s no light, that’s what all is in my insight.

THE CROPS NOW GROWN ARE BIOFORTIFIED

-Haspreet Kour

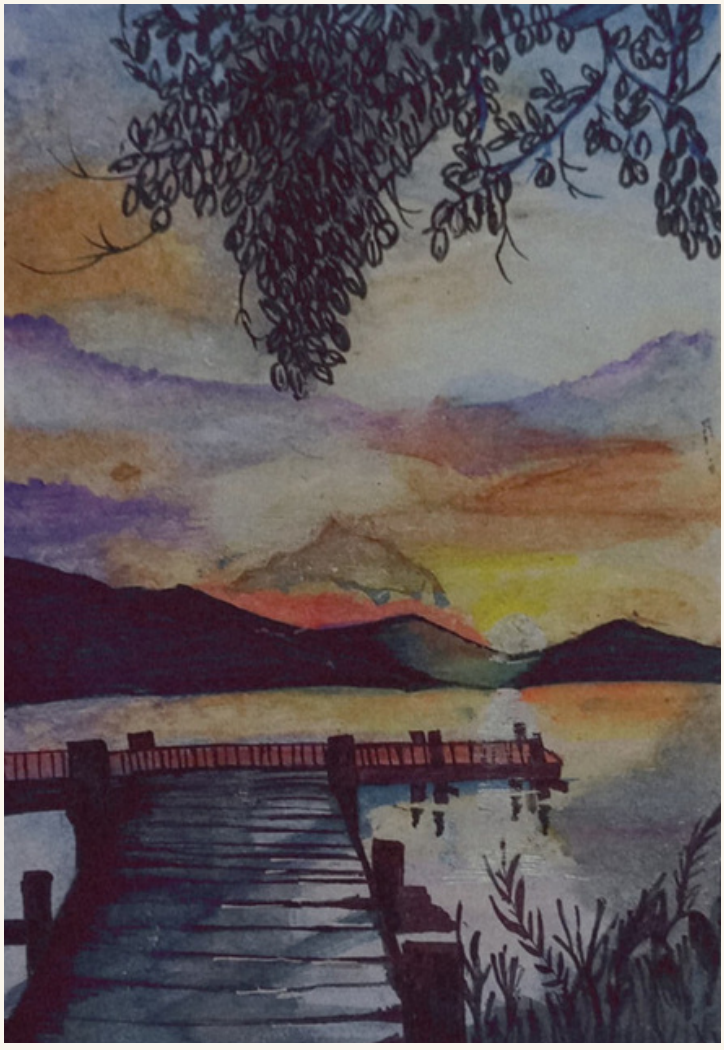
PSPS College for Women Gandhinagar
B.Sc. Medical, II year

With the hard work of the Harvest Plus and wonders of life
A process is derived which is certified to make the crops bright.
The crops now grown are biofortified.
With nutritional quality quite elite
It is when Plant breeding and Biotechnology is applied
The crops now grown ae biofortified..
The fields are filled with the vegetables tied,
One third of global population cannot afford diet, isn't that wright
The crops now grown are biofortified.
Long fingers of human help iron metabolize
Act as a neurotransmitter when *Cassava* is boiled
The crops now grown are biofortified.
My favorite among all is the zinc rice boiled,
With nutrients fully enshrined.
The crops now grown are biofortified.
Colorful pearls brown, black, yellow and white
Through millets the sustenance of poor will be sortified, isn't that wright.
The crops now grown are biofortified.

Painting Section

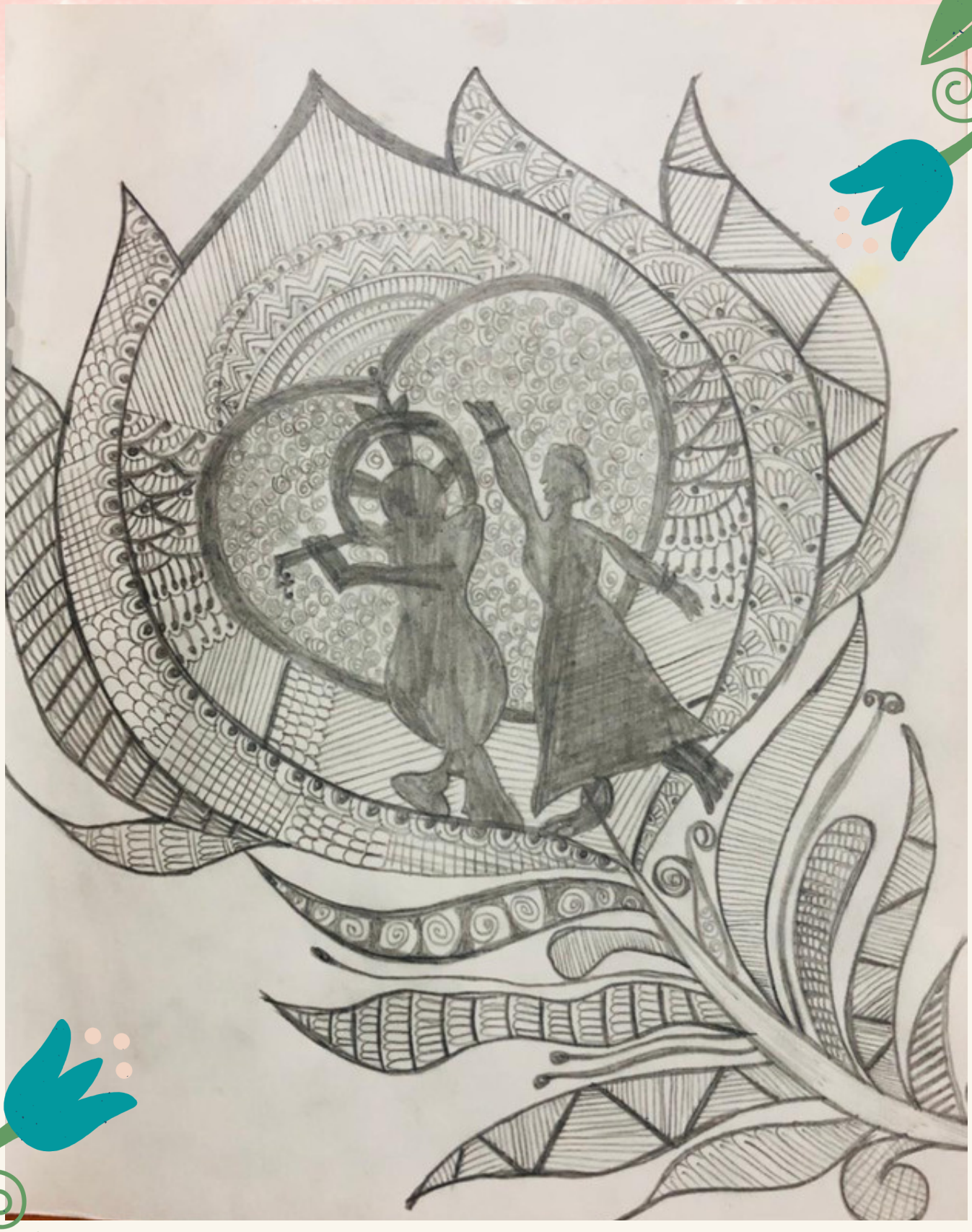
-Vishakha Kaushik

B.Sc. (H) Botany, III year



-Nusrat Nisha

B.Sc. (Prog.) Life Sciences, II year



-Aastha Chauhan

B.Sc. (H) Botany, III year

-Sneha Gupta

Shivaji College

B.Sc. (H) Mathematics, II year

-Sneha Gupta

Shivaji College

B.Sc. (H) Mathematics, II year

-Lavanya Sharma

B.Sc. (H) Botany, II year

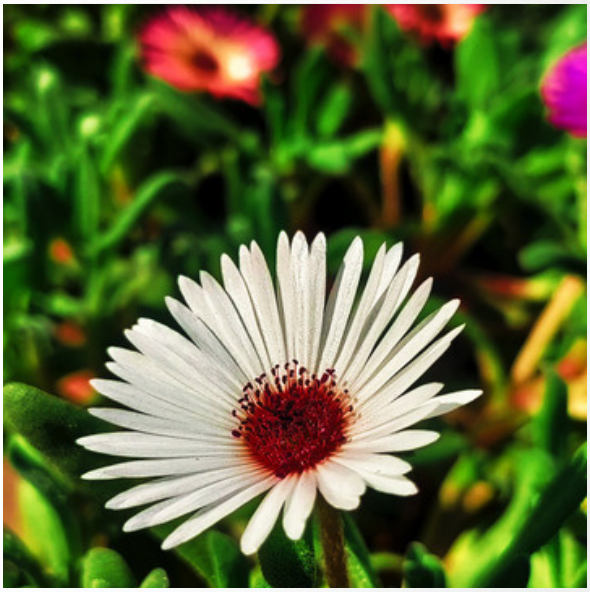
Photography Section

Somya Jain
B.Sc. (H) Botany, III year

Somya Jain
B.Sc. (H) Botany, III year

Somya Jain
B.Sc. (H) Botany, III year

Somya Jain
B.Sc. (H) Botany, III year



Somya Jain
B.Sc. (H) Botany, III year

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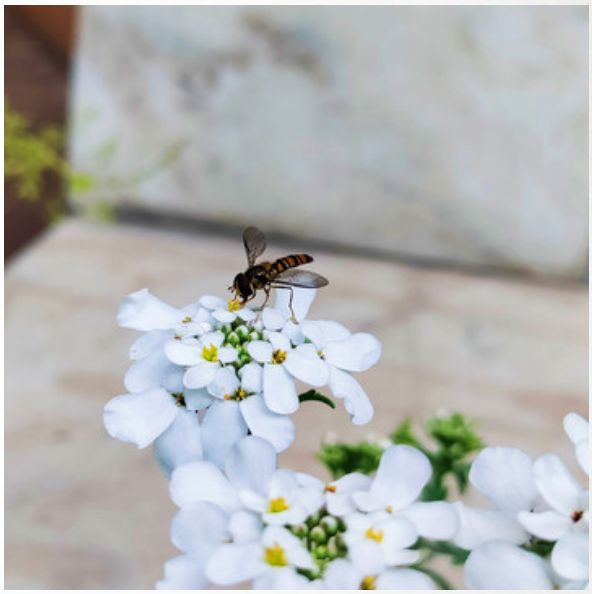

Somya Jain
B.Sc. (H) Botany, III year

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Somya Jain

B.Sc. (H) Botany, III year

Prachita Mehra
B.Sc. (Prog.) Life Sciences, II year

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B.Sc. (Prog.) Life Sciences, II year

Prachita Mehra

B.Sc. (Prog.) Life Sciences, II year

Prachita Mehra

B.Sc. (Prog.) Life Sciences, II year

Lovely Yadav

B.Sc. (Prog.) Life Sciences, II year

Lovely Yadav

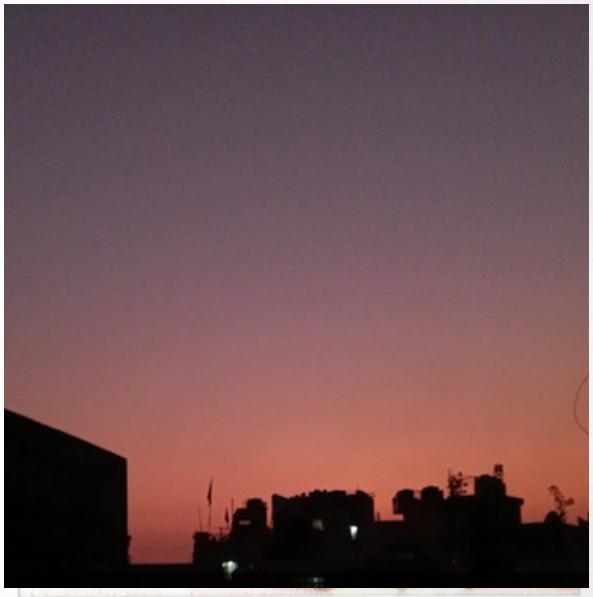
B.Sc. (Prog.) Life Sciences, II year

Vidhi Kasana

B.Sc. (H) Botany, II year

Vidhi Kasana

B.Sc. (H) Botany, II year



Lovely Yadav

B.Sc. (Prog.) Life Sciences, II year

Lovely Yadav

B.Sc. (Prog.) Life Sciences, II year

Kajal Tiwari
B.A. (Prog.), III Year

Lovely Yadav
B.Sc. (Prog.) Life Sciences, II year

Vidhi Kasana

B.Sc. (H) Botany, II year

Vidhi Kasana

B.Sc. (H) Botany, II year

Lovely Yadav

B.Sc. (Prog.) Life Sciences II year

Vidhi Kasana

B.Sc. (H) Botany II year

Salony Kumari

B.Sc. (H) Botany, I year

Kajal Tiwari

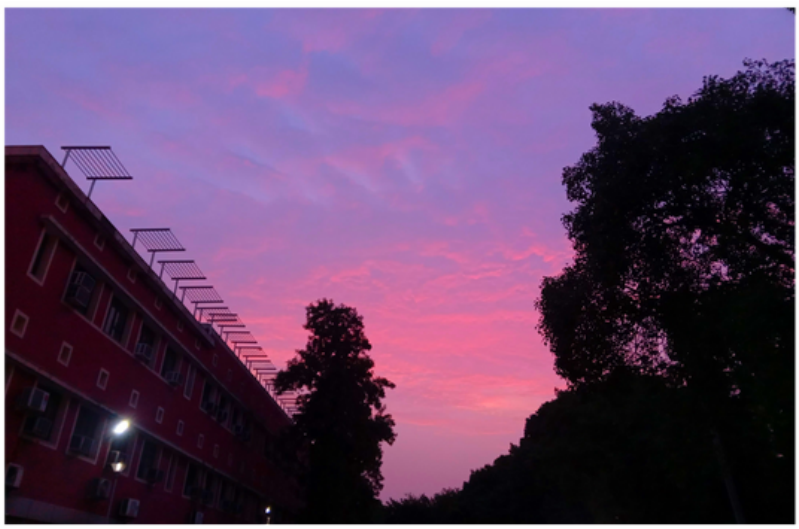
B.A. (Prog.) III year

Lovely Yadav

B.Sc. (Prog.) Life Sciences II year

Prachita Mehra

B.Sc. (Prog.) Life Sciences II year



Prachita Mehra
B.Sc. (Prog.) Life Sciences II year

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B.Sc. (Prog.) Life Sciences II year

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B.Sc. (Prog.) Life Sciences II year

Lovely Yadav
B.Sc. (Prog.) Life Sciences II year

Lovely Yadav
B.Sc. (Prog.) Life Sciences II year

Vidhi Kasana
B.Sc. (H) Botany II year

Vidhi Kasana
B.Sc. (H) Botany, II year

Events section

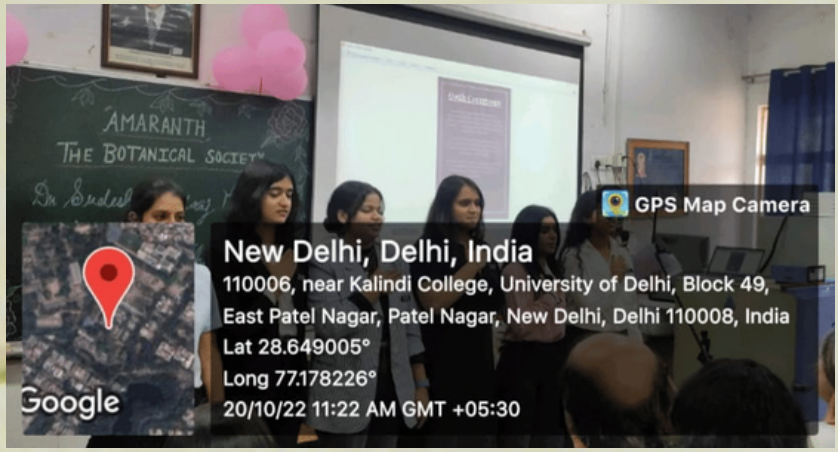
VISIT OF STUDENTS AND FACULTY TO CONFERENCE ON "ACHARYA JAGDISH CHANDRA BOSE A SATYAGRAHI SCIENTIST"

International Conference on the contribution of Acharya Jagdish Chandra Bose: A Satyagrahi Scientist which focused on unheard contributions of Acharya Jagdish Chandra Bose. This event was for two days (November 30, 2022, and December 1, 2022) at IUAC, Delhi. People from every field could join this event and showcase their skills through various competitions like essays (9th to 12th class), posters, oral presentations (Ph.D., post-doctorates, faculty, school teachers), etc. Experiencing this was a great honor for us and we were very lucky to have a plenary lecture from Prof. Gautam Basu, who explained the life of J.C. Bose through comic illusion. He was the greatest scientist of all time and is exclusively known as the "Father of Bengali Science Fiction". After this other plenary talks by Prof. Rajeev Tripathi, Prof. C.M. Nautiyaland and Dr. Manas Pratim Das also discussed fascinating facts about J.C. Bose. There was a hamper of Vibha Material for the slogan poem competition in which Vanshika from B.A. (Hons) History Ist year, Kalindi College won. We also got a chance to engage in activities like night sky watching through a telescope which culminated with a few cultural events. On December 1, 2022, a series of oral presentations from different universities, with enriching new facts were delivered. Prof. Punita Verma and Dr. Remya Krishnan from our college also participated in this. Fun science experiments were also demonstrated by Prof. Y.K. Vijay. The event came to end with valedictory and prize distribution and it was a proud moment for our college as Dr. Remya Krishnan got third prize in the oral presentation. Thus our trip to the Acharya Jagdish Chandra Bose conference came to an end. We enjoyed gaining new knowledge and experience from this event. It is our pleasure that our college provided us with this opportunity and we are thankful to Indraprastha Vigyan Bharati for organizing conferences like this.

QUIZ WINNERS AT DEEN DAYAL UPADHYAYA COLLEGE

Kalpavrisksha- The Botanical Society, in collaboration with Sangyaan, The Quizzing Society, both of Deen Dayal Upadhyay College, University of Delhi, recently organized a quiz based on the theme of "Recent Developments in Science and Technology" on January 27, 2023. Team Amaranth, with Shruti Srivastava, Harmapreet Kaur, and Aastha Mehta of B.Sc. (Hons.) Botany, II year, participated from Kalindi College, along with 5 other teams from DDUC and other colleges. The quiz was divided into four rounds, including a tie-breaker one. The team Amaranth, showing greater wit, took the lead from the very first round, which was an MCQ round with 80 points. However, there was a tie with 130 points with another team, "Ava Orchids," by the buzzer and a rapid-fire round, thus leading to a tie-breaker buzzer round. In the end, Team Amaranth again took the ropes in their hands and won the competition with the most points. The questions revolved around recent scientific developments and included questions based on physics, astrophysics, biology, and common knowledge. The first-place team received a cash prize of Rs. 2500, followed by Rs. 1500 and Rs. 1000 for the second and third-place teams, respectively. As a result, the event was extremely beneficial in gaining new knowledge and experiences.

Dr. Sudesh Bhardwaj Memorial Lecture and Oath taking ceremony



Amaranth, the Botanical Society of Kalindi College, University of Delhi organized its first, Dr. Sudesh Bhardwaj Memorial Lecture and Oath-Taking Ceremony on October 20, 2022, from 11 am onwards in the Botany lab. The lecture was named in memory of our beloved Sudesh ma'am, who left us for heavenly adobe on September 14, 2022. Our honorable guest speaker for the day was Prof.T.R. Rao, Former Professor and Director of the School of Environmental Studies, University of Delhi. He delivered the lecture on the topic *"How do plants deal with their animal friends and enemies?"* The family of our respected Sudesh ma'am was also invited, her elder sister, sister-in-law, and brother graced the event. The program was initiated by propitious lamp lighting by our esteemed guest Prof. T.R. Rao and family members of Sudesh ma'am along with the senior most teachers of the department. The ceremony was followed by a warm prayer by Kavita. After the prayer, Dr. Ranjana Roy Mishra welcomed our guest of honor by presenting them with a shawl and a planter. Then the program saw the felicitous oath-taking ceremony by the newly appointed office bearers of Amaranth. A short memorial video of Sudesh ma'am was played while remembering her. Further, Dr. Pawan Kumar introduced our esteemed speaker and the students were inspired by listening to the milestones achieved by our esteemed speaker and his contributions to science and research. He invited our esteemed guest to commence the lecture.

The disquisition was full of information about topics related to defense mechanisms used by plants for their protection, pollination, seed dispersal and many more. It was a very joyous and fun filled lecture.

A questionnaire round followed the sermon where students asked some interesting questions and were amazed to know the stories of mindless masters- The Plants. At the last, Dr. Ranjana Roy Mishra presented a vote of thanks to everybody and invited Dr. Kamlesh (elder sister of late Dr. Sudesh Bhardwaj) to say a few words. She shared their memories and thanked the college for initiating this lecture and instituting the prize named "Dr. Sudesh Bhardwaj Memorial Prize" for the highest marks in Plant Physiology as a tribute to her. 10 faculty members from various departments dignified this symposium. More than 40 students from different departments attended the session zealously.

The program was very well coordinated by Dr. Ranjana Roy Mishra (Programme Co-Ordinator), Convenors of the society, Dr. Pawan Kumar & Dr. Monika Keisham and the Co-Convenor Dr. Remya Krishnan. However, this would not have been possible without the support of our Principal, Prof. (Dr.) Anula Maurya.

Elections-Biocenosis

The elections for the Biochemical Society were organized by the Department of Botany, for the selection of the office bearers, for the academic session 2022-2023. The event was held on September 30, 2022, from 12.30 pm onwards in the Botany lab. There was active participation from the students. Eight faculty members along with a total of 82 students were present.

Anubhuti Mathur along with Pihu from the III year contested for the position of President where Anubhuti won with a maximum number of votes (82%). Following suit for the vice president, Deepali Verma and Ayushi Gaur (III year) defeated Gunjan Goyal from III year and Lisha Sharma from III year and grabbed the seat of the Vice Presidents.

Next up, Anjali Soni (III year) and Gayatri Panchal (III year) were named as the cultural secretaries, defeating Yashika Sharma from II year and Varsha from II year.

The candidates-Shivanshi Khurana and Lovely Yadav (II year) were both selected as Content Developers and Media Secretaries.

The next toss was between Kartika Vyas from III year and Yashika Sharma from II year , where Kartika won the race by 81% votes. The next competition was for the class representative for II year where Yashika Sharma won after competing with Anjali Soni.

As for the III year Ayushi Gaur got the chance to be the Class Representative after obstructing Anubhuti Mathur, Pihu, and Gayatri Panchal as her components.

Shehzadi Siddiqui, Anushika Sharma, Priya Kumari, and Shweta Dubey from the II year were named the volunteers for the department unanimously.

The teachers congratulated the newly elected team with heartfelt wishes.

However, this would not have been possible without the support of our esteemed principal Dr.(Mrs.) Anula Maurya

Oath Ceremony-Biocenosis

On November 24, 2022, Biocenosis, the Biochemical Society of Kalindi College, hosted their inaugural ceremony with an oath ceremony followed by a lecture by Dr. S.Naresh Kumar, Principal Scientist, Division of Environment Science ICAR-IARI on the burning topic of *"Climate Change and Indian Agriculture."* Dr. S. Naresh Kumar completed his M.Sc. and Ph.D. from Banaras Hindu University. He specializes in the field of climate change, simulation modeling, and the eco-physiology of crops.

With various publications under his name on climate change, Dr. S. Naresh Kumar also has renowned patents under his name, naming a few like, Infocrop V2.1 a DSS for Tropical Agriculture, Kalpashree- A Tendernut Variety of Coconut, Cocosim- A DSS for Coconut Plantations and many many more. He has also been recognized as World Meteorological Organisation Expert Task Team Member, Expert Member at IPCC for IPCC Reports. Dr. S. Naresh Kumar sir have been awarded with JC Bose Gold Medal, National Environmental Education and Development Award in 2017, Agricultural Leadership Award in 2011, BHU Gold Medal and many more.

The event began with the lamp lighting ceremony by Dr. Ranjana Roy Mishra, the chief guest Dr. S. Naresh Kumar, and all the faculties present at the event. The oath-taking ceremony then commenced for the office bearers for the academic session 2022-2023. Each office bearer was given badges by Dr. Sanawar Soham and Dr. Naghma Parween after which they took the oath as declared by Dr. Monika Keisham .

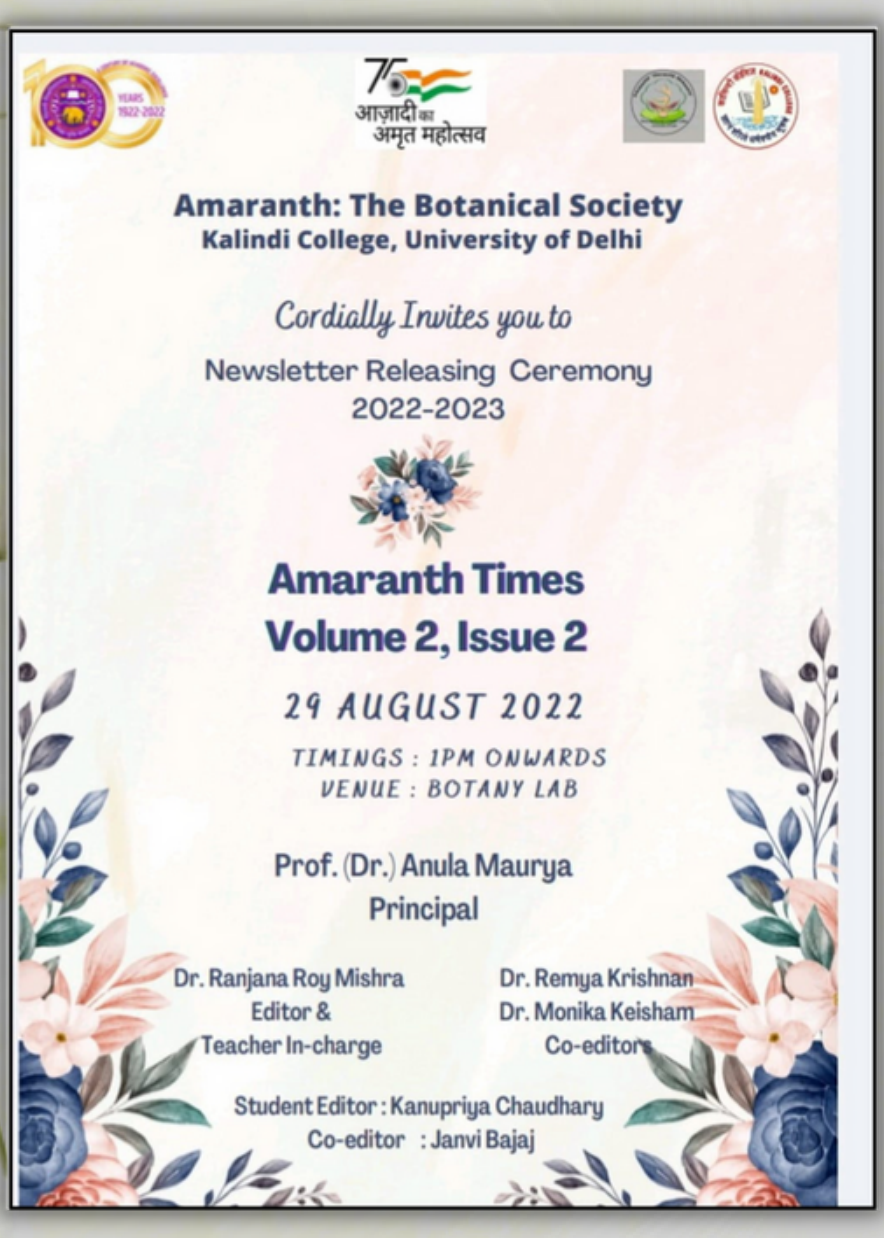
After the oath ceremony, our honorable guest, Dr. S. Naresh Kumar was invited to the podium to give a lecture on Climate Change and Indian Agriculture. The lecture was very insightful as well as interactive. At the end of the lecture, students asked many questions that they pondered upon during the lecture which were effectively answered by Dr. Soora Naresh sir.

The lecture was followed by a formal vote of thanks given by Dr. Ranjana Roy Mishra. Overall it was a very successful event with an enthusiastic audience made possible by the joint efforts of the Convenor, Co-Convenors, office bearers, and volunteers.

Newsletter Release

Amaranth, The Botanical Society of Kalindi College, University of Delhi organized an event to unveil The Amaranth Times (Volume 2, Issue 2), the newsletter for the academic session 2022-2023. The theme of the newsletter was “Heirloom Plants”. The event took place on August 29, 2022, from 1 pm. onwards in the Botany lab. The event was graced by more than 30 students along with 12 faculty members. This program was organized to inculcate healthy habits of reading and writing in the students and to motivate them to express their talents and creativity.

The event commenced with the message of the Editor and TIC: Dr.Ranjana Roy Mishra followed by the Co-Editors: Dr. Remya Krishnan and Dr. Monika Keisham. Later the student editorial team also shared their views and experiences of working with such a wonderful team.



After the disclosure of the newsletter, all the teachers congratulated the entire team and wished them all the best for their further endeavors and projects. This was the first offline release after the pandemic, so it was a joyous event for everybody.

However, this would not have been possible without the support of our Principal Prof.(Dr.) Anula Maurya.

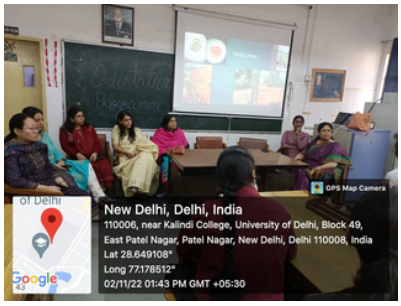
Report on the Orientation Programme of B.Sc. (Hons.) Botany and B.Sc. (Prog.) Life Sciences 1st Semester Students

On November 2nd, 2022, an orientation program was held by the Botany Department for the fresh batch of newcomers in the college. All first year students along with their parents were invited to get a clear picture about the college and its functioning. This orientation was especially addressed to the 1st semester students of B.Sc. (Hons.) Botany and B.Sc. (Prog) Life sciences.

The event began with a warm welcome address to the students by the Teacher-In-Charge, Dr. Ranjana Roy Mishra, on the behalf of the entire Botany Department.

It was then followed by the presentation given by Dr. Remya Krishnan, who enumerated the freshers and their parents participating in the session about the various papers that will be included in their course programmes as well as the multitude of clubs and cultural societies that are established in the college for their holistic development and rich college experience.

Soon after this, the students were introduced to all the faculty members specializing in different areas. This was followed by a very interactive session of doubt-clearing and topics of discussions included information about class schedules, buildings and offices, canteen, library and other resources available at their disposal.



Lastly, college seniors interacted with freshers to discuss about concerns such as, hostel accommodation and modes of commute, to relieve them of any worries related to their safety and well being. The event had approx. 35 attendees among which 9 were faculties and the rest were students and guardians. Overall the event was an imperative initiative to ease the newcomers to settle efficiently and know their way around campus as well as the department.

nature.

JANAUARY 2023