Anthesis

Volume 9: 2013-2014

Special Focus: Recent Advances in Plant Sciences

Annual Publication of Gargi College Botanical Society

Department of Botany
Gargi College, Siri Fort Road
New Delhi-110049

Anthesis

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Cover: Cyathia of *Euphorbia milii var. splendens*
Photo: Dr. Gita Mathur

From the Principal's Desk

Dr. Shashi Tyagi

I am happy to note that Gargi College Botanical Society named **Taru** is bringing out next issue of its annual publication called **Anthesis**.

The theme this year is '**Recent advances in plant sciences'**. So much has happened in the last few years in the field of biotechnology, bioinformatics and other related fields that to spread awareness about it is very important. Magazine provides a forum where students can express themselves.

I am very much attached to my Botany students and believe me, nothing gives me more happiness and joy than my delighted students. I have read all the issues of Anthesis and keenly looking forward for the next issue.

I congratulate all teachers, students and contributors for their efforts.

All the best.

Dr. Shashi Tyagi
Principal (Officiating)

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From the Editor's Desk

Aakanksh Sharma

Plants are the most delightful creations of God. Like a Human is hidden with so many enigmas inside, plants likewise store some beautiful and astounding surprises within them. As Botanists, it is our duty to unravel these fascinating mysteries to the world and let their magic spread.

Yes, it is 2014, and once again Anthesis, the annual publication of the Gargi College Botanical Society (Taru) has superbly accomplished the impression of completing 8 wonderful years with its 9th volume being brought forth now. The meaning of the word 'Anthesis" is opening of a flower, true to this we bring forth informative and interesting articles to open up to new advancements in plant science. Keeping in our minds, as botanists, over how to conserve Mother Nature and its priceless resources we have sustained the norm of making this publication in electronic form which is easily distributed and accessed by everyone.

Special focus of Anthesis 9 is "Recent Advances in Plant Sciences'. The response has been overwhelming and the topics covered in this volume show how brilliantly computers have proved to be a boon to our flora and to discover and procure some vital phenomenon never heard or thought of before. The beautiful marriage between DNA and computers has opened so many doors towards new areas in plant sciences which can be read through articles like DNA Barcoding, Glowing Plants, Bioinformatics and Eco-informatics. Further, articles such as Biotechnology, Tissue Culture and *Agrobacterium* throw light upon the creative use of genetic engineering and other important techniques like somatic hybridization and micropropagation in hovering better disease resistant, improved quality, high yielding plants of interest.

Algae and their contribution to different sectors of economy and agriculture in the world ranging from a simple source of food and fodder since ancient times to now even turning a car that emits oxygen instead of carbon are of interest. Other articles include Botanical details about banana, *Musa textilis* and Khus, *Vetiveria* under the

section “Famous Plants” and their influence on industries like textile, perfumery and various other innovative ways even in making art pieces and handicrafts.

There is a section that accompanies the other events that took place in the college like Inauguration of the new batch of Taru, Scintillations (The Science Fest), Reverie (College Fest), visit to Botanical field Trip and Excursion along with updated departmental news with newly joined teachers and lab staff. Achievements and Awards also won by the Taru members have been added to the affair with prominent pictures and information.

The number of alumni who have contributed to this volume is more than previous years, this is an indication that Anthesis being an e-publication is reaching our alumni and rekindling their bonds to our Botany Department.

The very popular section “Botanical Fun Pages” has a new crossword based on Techniques in Biology, interesting poems and Botanical riddles. The basic purpose of this publication is to encourage students to learn to write good, informative articles as well as to enjoy what we learn. In current times we need to understand issues like copyright violation and plagiarism. Anthesis is an effort towards reaching this goal.

Value addition to many articles has been done as “Editor’s additional information” at the end of the articles. Many articles have been illustrated by self-clicked photographs contributed by Dr. Gita Mathur. For both these I would like to acknowledge her efforts. As the teacher advisor on the editorial board of Anthesis she has been our guiding force; motivating and inspiring us to put in our best towards this volume of Anthesis.

On behalf of the whole editorial team I would like to thank our Principal, Dr. Shashi Tyagi for her encouragement and all other faculty members of Botany department for their help in various ways. Last but not the least, my editorial team members need my special thanks in making this volume become a reality.

Aakanksha Sharma

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DNA Barcoding – The Barcode of Life

Pranati Gogoi

Botany (Hons) III Year

Introduction

DNA barcoding is a taxonomic system that uses a short stretch of a core DNA sequence to identify species (fig: 1). This technique was first proposed by Hebert, Stoeckle, Zemlak, et al. and Ward. Identification of species through barcoding is usually achieved by the retrieval of a short DNA sequence from a standard part of the genome of the specimen under investigation. DNA barcoding research has been facilitated by the Barcode of Life Data (BOLD) – an online resource available to the scientific community. The most commonly used barcode region, for animals, is a segment of approximately 648 bp of the mitochondrial gene cytochrome oxidase 1 (COI). DNA barcoding systems are now being established for various groups of organisms, including plants, macroscopic algae, fungi, protists, and bacteria. DNA barcoding has a standardized desirable locus varying from species to species. A set of standardized regions showing desirable locus are:

- The mitochondrial COI gene, in animals and many other eukaryotes.
- The concatenation of the rbcL and matK chloroplast genes in land plants.
- The internal transcribed spacer (ITS) region, in fungi.

FIGURE: 1

Advantages of Barcodes

- Barcoding can identify a species from bits and pieces. DNA barcoding is drastically used in identifying plant leaves even when flowers or fruits are not available, identifying insect larvae, also in identifying the diet of an animal, based on its stomach contents or faeces and identifying products in commerce (for example-herbal supplements or wood). It will help reconstruct food cycles by identifying fragments in stomach.
- Barcoding can identify species at any stage of its life cycle: from eggs and seed, through larvae and seedlings, to adults and flowers.
- A DNA barcode can distinguish among different species that look alike, uncovering dangerous organisms masquerading as harmless ones. It shall also enable a more accurate view of biodiversity.
- DNA barcoding helps in sequencing vouchered specimens (for e.g.: herbarium specimens, cultured cell lines, or sometimes images)

Future of barcoding

A co-ordinated effort is needed in the molecular taxonomic community to fully investigate the variation of barcode targets within a taxon. It shall also be necessary to define the “taxon discrimination ability” of targets and develop new tools for the analysis of burgeoning data sets. The taxonomists preparing new taxa for publication should be welcomed by DNA-savvy biodiversity laboratories, which should be able to provide expertise at minimal cost.

Despite the obvious drawbacks of using DNA barcoding, the reported success of using the barcoding region in distinguishing species from a range of taxa and to reveal cryptic species is remarkable. However, it is known that species identification based on a single DNA sequence will always produce some erroneous results. Efforts should therefore be made to develop nuclear barcodes to complement the barcoding region currently in use.

Limitations

- . One of the major concerns is the inclusion of molecular information into taxonomic aspects.
- . A major issue that needs to be resolved is how to read the organismal barcode once it is generated.

- . Another shortcoming is that similarity scores often do not give the nearest neighbour as the closest relative.
- . The fourth shortcoming involves the lack of an objective set of criteria to delineate taxa when using distances.

DNA barcoding requires assembling of tissue samples and subsequent isolation and archiving of genomic DNA. These archived samples can act as useful resources for phylogenetic, population genetics, and phyiogeographic studies.

Conclusion

DNA barcoding contributes to taxonomic research, population genetics, and phylogeographic studies. Consequently, the International Nucleotide Sequence Database (INSD), Gene Bank, EMBL, and DDBJ have adopted a unique keyword identifier (BARCODE) to recognize standard barcode sequences specified by the scientific community (CBOL). The introduction of DNA barcoding is a natural addition to the post-genomic era in which the whole genome sequencing has provided a vast amount of sequence information from a limited number of species. DNA barcodes can help expand our knowledge by exploring many more species rapidly and inexpensively. As the advantages and limitations of barcoding become apparent, it is clear that taxonomic approaches integrating DNA sequencing, morphology and ecological studies will achieve maximum efficiency at species identification.

References

- Gupta R and Gupta R (2012) Modern Tools for Identification of Plants. In: Gupta R (Ed), Plants Taxonomy Past, Present, and Future, TERI, pp. 115-128.
- En.wikipedia.org/wiki/DNA barcoding
- www.barcoding.si.edu/dnabarcoding.htm
- www.bing.com/images/search.
- http://earthsky.org/human-world/david-schindel-on-dna-barcodes-for-seafood

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80% Frustration, 20% Illumination-

Why I Love Auxin Research

Joyita Deb
(Batch of 2008)

It all began about a hundred and thirty years ago with a curious observation- plants bend towards light. Well, Charles Darwin found this curious and after studying this phenomenon in coleoptiles, he concluded that the substance(s) causing this was produced in the shoot tip and was acting below the tip causing it to curve. Decades later, Cholodny and Went independently came to conclude that the asymmetric distribution of a plant hormone at the shoot tip results in its unidirectional growth towards light. This hormone was called Auxin- literally meaning 'growth-promoting'. The next question that arose is what causes auxin to be distributed asymmetrically?

For me it began not so long ago, 2007 to be exact was when I was first introduced to auxin in my third year at Gargi studying Plant Physiology. Of course I did find it interesting to study about plant hormones and their discovery, biosynthesis etc. but truth be told, I think I was much more interested in having lunch with my friends at the Nescafe stall in front of the canteen and talking about 'what next after college' with my best friend as we took an auto-ride home. I decided that research was for me and mainly fundamental molecular biology or genetics. Plant hormones didn't figure anywhere in the picture- Watson and Crick type of research did! My Masters' degree exposed my naivety as I later realized that in biological research nothing is mutually exclusive and if you have a couple of topics you like chances are you can always find a project that bridges them. My Masters project, for instance, looked at how plants sense high temperatures and allowed me to study the fundamentals of gene expression regulation, but in a plant model system. It had been known for quite some time that at higher temperatures plants, such as *Arabidopsis thaliana,* elongate and that high auxin levels is one of the contributing factors to this [1]. But how do the auxin levels increase at higher temperatures? At the molecular level, the lab I where I did my project found that a transcription factor called PIF4 was involved in this elongation response [2]. My aim was to find the link between PIF4 and auxin. This could occur in two ways: either PIF4 was regulating auxin biosynthesis directly or it was involved in regulating the components of the auxin-signalling pathway.

Auxin biosynthesis occurs via different pathways and a few genes encoding enzymes for these pathways have been identified, however a lot still remains to be uncovered in this area and new pathways are also being found. Knowledge in auxin signalling is advancing more rapidly. Auxin- or its naturally occurring form Indole Acetic Acid -can directly bind directly to a multi-protein complex called the SCF-TIR1

complex. When auxin binds to this complex the TIR1 complex degrades a class of repressor proteins called Aux-IAA proteins. These are always bound to transcription factors called Auxin Response Factors (ARFs). There are 23 ARFs and many have been shown to directly bind DNA and regulate gene expression. Like all transcription factors ARFs bind to their specific recognition sites (5' TGTCTC 3' in this case)[3].So coming back to our problem, PIF4 could either directly regulate the expression of an enzyme involved in one of the auxin biosynthetic pathways, or it could interfere with auxin signalling most likely by regulating an Aux-IAA protein or an ARF. We now know that PIF4 regulates auxin biosynthesis at higher temperatures and its target gene has been found [4]. Unfortunately, I was not involved in this finding. However, what I did find out was that applying what I learnt in college and delving deeper into it was an exhilarating experience!

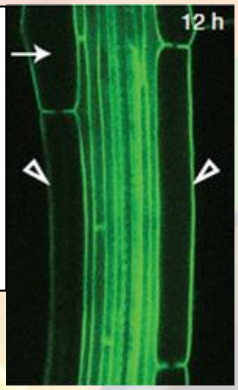

Fig1. PIN protein polarity. The protein has a Green Fluorescent Protein (GFP) tag. The white arrow shows the direction of light. The open arrows show PIN localization in the cell membrane.

But I have digressed. We were questioning the mechanism behind the asymmetric distribution of auxin to facilitate phototropism. Remarkably, this was only solved as recently as 2011! [5] The unique and fascinating aspect of auxin is that its distribution in the plant can be channeled via auxin efflux transporters called PIN proteins. These proteins are localized at the plasma membrane of a cell and show a polarity in their localization i.e. they preferentially cluster to one side of a cell depending on the direction auxin flow has to be channeled. In this manner auxin can be transported from a source like the shoot tip to a sink to trigger the required response. In the case of phototropism, PIN proteins become aligned in the cells in such a manner that they ensure that auxin accumulates to the shaded side of the shoot tip. This results in more growth occurring on the shaded side, causing the shoot tip to bend towards light (Fig 1). The complexity of how this hormone functions keeps scientists guessing and digging ever-more deeper to understand how plants coordinate their growth and development.

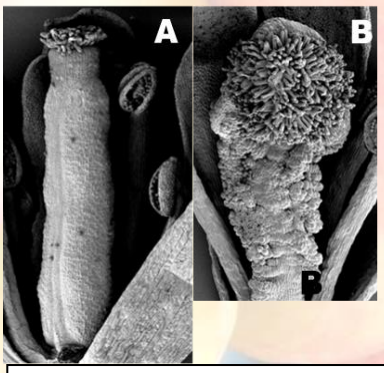

Fig2. A: Normal *Arabidopsis* carpel. B: Carpel with mutation in the ARF

My current project is for looking at the role of both aspects of auxin- the signalling and the transport via PIN proteins- in developing the carpel (this is where my taxonomy and embryology classes at Gargi helped loads!). I am studying the role of an ARF and another transcription factor in auxin signalling. Both these transcription factors play a role in carpel development (Fig 2) and are also involved in auxin signalling and regulating the PIN proteins [6]. During my studies we found that these two transcription factors function in auxin signalling in a manner different from the one I described previously. At present, we are trying to figure out how these two transcription factors work together with auxin. My work often leaves my brain in knots and when experiments don't work as you expect them to, maddening is perhaps the best word that describes how you feel at that point! But when things do go the way you'd like, and a hypothesis you

had turns out to be true, you are left in awe of the little glimpse you have in the inner-most workings of nature- and THAT is what makes it all worthwhile.

References:
[1]Gray, W.M., Östin, A., Sandberg, G., Romano, C.P. and Estelle, M., 1998. High temperature promotes auxin-mediated hypocotyl elongation in Arabidopsis. Proceedings of the National Academy of Sciences of the United States of America, 95, 7197-7202.

[2]Koini, M.A., Alvey, L., Allen, T., Tilley, C.A., Harberd, N.P., Whitelam, G.C. and Franklin, K.A., 2009. High Temperature Mediated Adaptations in Plant Architecture require the bHLH transcription factor PIF4. Current Biology, 19, 1-6.

[3]Guilfoyle, T.J. and G. Hagen, Auxin response factors. Curr Opin Plant Biol, 2007. 10(5): p. 453-60

[4]Franklin KA, Lee SH, Patel D, Kumar SV, Spartz AK, Gu C, Ye S, Yu P, Breen G, Cohen JD, Wigge PA, Gray WM,1998. Phytochrome-interacting factor 4 (PIF4) regulates auxin biosynthesis at high temperature Proceedings of the National Academy of Sciences of the United States of America., 13; 108(50)

[5]Ding Z, Galván-Ampudia CS, Demarsy E, Łangowski Ł, Kleine-Vehn J, Fan Y, Morita MT, Tasaka M, Fankhauser C, Offringa R, Friml J., 2011. Light-mediated polarization of the PIN3 auxin transporter for the phototropic response in Arabidopsis. Nature Cell Biology. 2011 Apr; 13(4):447-52

[6]Girin, T., et al., INDEHISCENT and SPATULA interact to specify carpel and valve margin tissue and thus promote seed dispersal in Arabidopsis. Plant Cell, 2011. 23(10): p. 3641-53

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Glowing Plants: Not a Dream Any More

Shreya Tripathi and T. Ramya
Botany (Hons) I Year

Yes!! You read it right. Glowing plants are not a dream anymore...read through this article to know more about glowing plants and the technique used to create them. Synthetic biology has made glowing plants a reality.

SYNTHETIC BIOLOGY
Synthetic biology is the design and construction of new biological parts, devices and

systems. It is also the redesign of existing, natural biological systems for useful purposes. Recently scientists have discovered how to make new sequences of DNA. By combining these techniques with the principles of genetic engineering and by the use of computers, scientists are designing organisms that do new things. Synthetic Biology can be used to produce cheaper and efficient bio fuels as well as to create naturally glowing plants.

WHAT IS THE NEED OF NATURALLY GLOWING PLANTS?

Today, there is a need of sustainable development which means the judicious use of available resources keeping in mind the needs of future generations. As we all know fossil fuels are non-renewable sources of energy. Combustion of fossil fuels also creates a lot of pollution. It has been found that lighting creates as much carbon dioxide as cars which cause global warming. So, there is an urgent need for finding alternatives. Glowing plants are one such alternative.

RESEARCH INTRODUCTION

This ambitious project of designing glowing plants is funded through the Kickstarter campaign. The core team of this project comprises of Antony Evans (project manager), Omri Amirav-Drory (vision and tech lead) and Kyle Taylor (plant science guru). The members were inspired by the University of Cambridge team's progress with bacterial bioluminescence by recycling of Luciferase. This project was funded on June 7, 2013.

PROCEDURE

The project encompasses three steps:

1. DESIGNING OF GENOME

Genome Compiler is a software which is used to design DNA sequences according to the user. It consists of a database of genetic constituents which can be combined as per user's choice. It allows researchers to manipulate and design everything from single genes to entire genomes.

2. PRINTING OF DNA

The designed DNA sequences would then be printed on large scale at Cambrian Genomics, a company headed by CEO Austen Heinz. This company does 3D printing of DNA by a DNA laser printer.

3. TRANSFORMATION

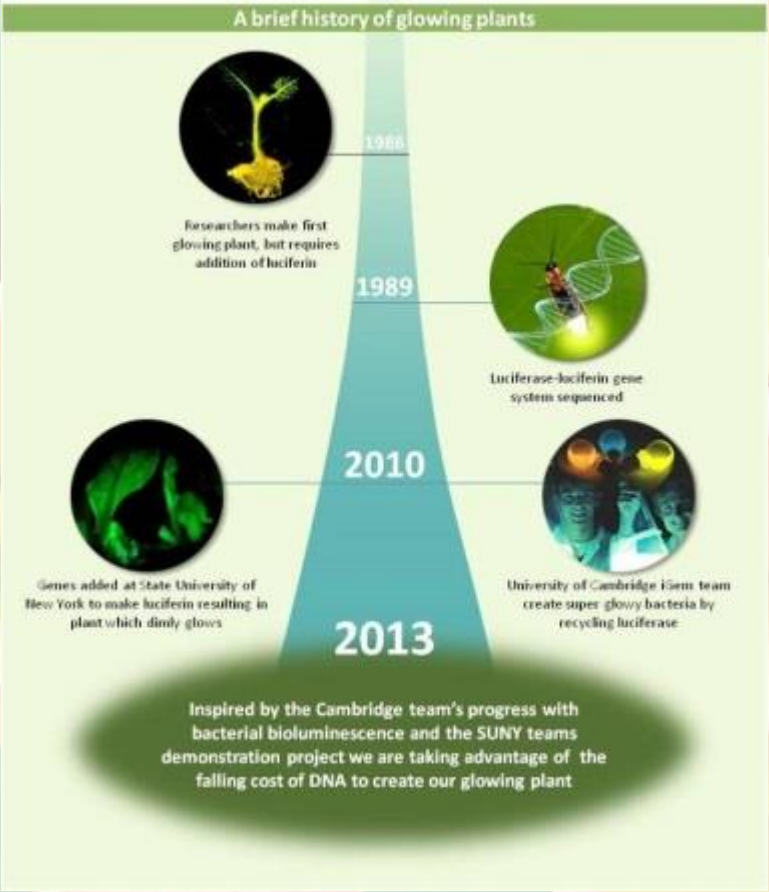
The DNA would be transferred in the cells of the target plants in the lab which would result in the uptake, incorporation and expression of the DNA giving rise to glowing plants.

References: -

- www.Kickstarter.com,
- www.lasefocusworld.com

Additional information by editors (Dr. Gita Mathur)

The first auto growing plant was created by biotechnology company Bioglow and named Starlight Avatar. http://www.goweirdfacts.com/first-glowing-plant.html



Read more at the following links:

- http://pando.com/2013/08/02/why-did-kickstarter-ban-gmos/
- https://www.kickstarter.com/projects/antonyevans/glowing-plants-natural-lighting-with-no-electricit

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Biotechnology - A Glimpse and Future Prospects

Saumya Srivastava
Botany (Hons) I Year

With the coming up of new technologies and development in the agriculture sector, scientists have been using various techniques such as genetic modification, genetic engineering, mutagenesis, micropropagation, use of bioreactors in micropropagation, tissue culture, somatic hybridisation, etc to improve the quality and yield of the crops, to reduce harmful traits in crops, to produce crops which are tolerant to adverse conditions and to develop insect resistant crops. In modern times, plant breeders have been able to introduce desired traits in plants by transferring genes from one organism to another using variety of techniques commonly known today as plant biotechnology.

Biotechnology includes a number of processes, the most important ones are:-

1. Genetic Modification – Existing genes are modified, not necessarily inserted from another organism.
2. Genetic Engineering – It is a laboratory based method. In this method, a known gene for a desired trait is inserted into the plant cell. The cell is grown in tissue culture to develop a full plant. The genetically engineered plant expresses the new trait such as added nutritional value or resistance to pests.
3. Mutagenesis – In this process, the genes of an organism are altered. This process occurs in nature but plant genes can be altered experimentally by the use of chemicals and radiations.

In the last few decades, plant biotechnology has led to the development of crops that help farmers control weeds, insects and diseases, increase yield and allow them to use environmental friendly farming practices.

Around 70 – 80% of people worldwide depend chiefly on traditional herbals medicine to meet the primary healthcare needs. Biotechnology tools are being improved for the multiplication and genetic enhancement of the medicinal plants by adopting techniques such as in vitro regeneration and genetic transformation. Biotechnology can also be harnessed for the production of secondary metabolites of plants using bioreactors. Advances in tissue culture combined with improvement in genetic engineering techniques specifically transformation techniques, have opened new avenues for high volume production of pharmaceuticals, neutraceuticals and other beneficial substances.

Applications of plant biotechnology through various means are as follows-
First technique is DNA manipulation which is used in the production of large amounts of desired compounds by plants, by infecting them with an engineered virus.

Transgenic plants maintain constant levels of production of proteins without additional interventions.

Plant tissue culture refers to growing and multiplication of cells, tissues or onset of plants on defined solid or liquid media and aseptic environment. Example of tissue culture is that of *Cichorium intyber.* Second technique is Micropropagation which is presently used as an advanced method required for the production of identical pathogen-free plants for agriculture and forestry. Examples are - *Catharanthus roseus* (Apocynaceae), *Chlorophytum borividianum* (Liliaceae), *Datura metel (*Solanaceae), etc. Also, *in vitro* flowering, *in vitro* fruiting and effective propagation protocols are studied in *Withania somnifera* (an antitumor medicinal plant using axillary buds implant).

Micropropagation is a labour-intensive technique. The use of bioreactors for micropropagation was first reported in 1981 for *Begonia.* Since then, it has provided applications to many reproductive parts including - shoot, bulbs, tubers, corns and somatic embryos. Bioreactors provide more precise control of the plant growth, gaseous exchange, illumination, medium agitation, temperature and pH than the conventional cultural vessel. Bioreactors help increase the rate of growth of culture and reduce the space, energy and labour requirements in commercial micropropagation.
Another application of biotechnology is in the production of transgenic plants by introducing the desired genes in the plant using a soil plant pathogenic bacterium namely *Agrobacterium tumefacians*, *Bacillus thuringiensis* or Ti vectors. The advancement in technology and change in time has made population more prone towards biotechnologically produced products such as Bt brinjal, Bt cotton, Bt cereals, etc. These days, transgenic cotton or Bt cotton varieties are now being grown commercially in China, South Africa, Mexico, Argentina, Indonesia etc. The adoption of Bt cotton in China began in 1997. Also, China has commercialized the production of transgenically produced cotton in Vietnam, Cambodia, etc. In South Africa, Bt cotton is grown by both large as well as small scale farmers. Another transgenically produced product is Bt cereals. Bt maize is being grown commercially in Argentina, South Africa, North America and Europe. Also, Bt maize has been tested and is nearly approved in various countries including China, Brazil, Egypt and many other countries.

References:

- Kirakosyan, Ara, and Peter B. Kaufman (2009) *Recent advances in plant biotechnology*. Berlin: Springer.
- Applications of plant biotechnology
- www.sciencedirect.com (Plant biotechnology in agriculture)
- http://www.tjpr.freehosting.net (Role of biotechnology in medicinal plants)

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Tissue Culture: A Miracle Creator

Pranati Gogoi

Botany (Hons) III Year

The discovery of the cell and subsequent propounding of the cell theory led to the development of the science of tissue culture. The science of the plant cell and tissue culture really come into existence since five decades when it was conceived and enunciated by Haberlandt in 1902. He is a German Botanist, Father of Plant Tissue Culture. He was the first to culture the cells aseptically in nutrient media. However, the evolutionary history of cell culture was difficult to trace in the early years because of all attempts that were obtained from continuous culture of cells and organs ended in failure. This is due to the lack of nutritional and hormonal factors in cell growth and the media were deficient. Haberlandt visualized the idea of growing plant cells in artificial media in the hope of rejuvenating a quiescent cell and triggering it into division and growth, to form a tissue and eventually, regenerate a whole new plant.

A significant contribution was made by the Department of Botany, University of Delhi, in the use of tissue culture methodologies for morphogenetic studies on a wide variety of test subjects. The objectives of the experiments were: isolation and culture of reproductive organs; intra-ovarian pollination, test tube fertilization, etc. and developments of plantlets from vegetative tissues derived from herbaceous or arboreal species. In-vitro culture of gran legumes, arboreal forms of Gramineae and of several conifers are also being pursued at the Department of Botany, University of Delhi, India. A fascinating outcome of tissue culture studies initiated at the University of Delhi, has been the spectacular demonstration for the first time of the development of pollen embryoids and plantlets from another culture of *Datura innoxia* by Guha and Maheshwari (1964, 1967) who, so to say, stumped into a

discovery, which was to revolutionize plant breeding programmes of the future the world over and it was a distinct landmark in the history of plant tissue culture.

Research Scholar: Ms. Monika

Advantages:

The technique of micro-propagation, an alternative to conventional methods of vegetative propagation, is applied with the objective of enhancing the rate of multiplication.

a. Through tissue culture over a million plants can be grown from a small, even microscopic piece of plant tissue within a few months.
b. Further the advantages in propagation through tissue culture is that shoot multiplication usually has a short cycle (2-6 weeks) and each cycle results in logarithmic increase in the number of shoots.
c. Additionally, tissue culture gives propagules such as mini-tubers or mini-corms for plant multiplication throughout the year irrespective of the season.
d. Using these methods, stocks of germplasm can be maintained for many years.
e. A major advantage of micro-propagation happens to be the minimum growing space required, in commercial nurseries. Several thousand million plants can be maintained inside the culture on a shelf space built into a room of about 3 meters x3 meters x5 meters.

Tissue Culture Applications:

a. Cybrids
b. Micro-propagation
c. Androgenesis
d. Virus elimination
e. Secondary metabolite production
f. Crop improvement
g. Cryopreservation
h. Germplasm conservation

Conclusion:

Several institutions and universities in India and elsewhere have introduced the subject as part of the curricula and tissue culture laboratories are mushrooming all over the country, what with the astonishing progress that has been made over the years inspired by the pioneering efforts of Gautheret, White, La Rue, Steward, Street, Nitsch, Murashige and others. Gautheret (1983) has elegantly traced the history of plant tissue culture in its entire ramification.

References:

Photo clicked by Pranati at Delhi University annual fest, Antardhvani 2014

- Recent advances in botany: Prof. PN Mehra commemorative volume. Bishen Singh Mahendra Pal Singh, 1976.
- Razdan, M. K. (2003). Introduction to plant tissue culture. Science Publishers.
- Narayanaswamy, S. (1994). Plant cell and tissue culture. Tata McGraw-Hill Education.

Additional information by editors (Dr. Gita Mathur)

A Tissue Culture Laboratory has been established in Gargi College where students and teachers carry out experiments. Here is a glimpse through my clicked photos.

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Agrobacterium: Natural Genetic Engineer

Umama Khan

Botany (Hons) III year

Agrobacterium is a genus of Gram negative bacteria(rod shaped) which was established by H.J Conn. *Agrobacterium tumefaciens*, a soil plant pathogenic bacterium, is the most studied species in the *Agrobacterium* genus. It has a very unique ability to transfer DNA between itself and different plants and thus is considered an important tool for genetic engineering. *Agrobacterium* has now become the most used method for the introduction of foreign genes into plant cells and subsequent regeneration of transgenic plants (a plant with a foreign gene (genes) from another plant /animal that is incorporated into its chromosome).

Transformation is basically a process of obtaining transgenic plants. Transformation was the first horizontal gene transfer mechanism discovered in bacteria. It is the uptake of naked DNA molecule or fragment from a cell and then incorporation of this molecule into the chromosome of the recipient.

USES IN BIOTECHNOLOGY

Marc Van Montagu and Jozef Schell discovered the gene transfer mechanism between *Agrobacterium* and plants .This further lead to developmental methods to use *Agrobacterium* as an efficient delivery system for genetic engineering in plants . This unique or exceptional ability of *Agrobacterium* is used in biotechnology and genetic engineering for plant improvement and transformation and is now also called as plant transformation tool.

Forty-four independent transformed tobacco plants were obtained from a cultivation experiment with *Agrobacterium tumefaciens* strains carrying modified Ti-plasmids *Agrobacterium* induces on cogenesis through gene transfer in infected tissues. Ti-Plasmid is a part of circular DNA found in almost all *Agrobacterium*. It is able to introduce and integrate a part of its endogenous Ti-plasmid (tumor inducing), the T-DNA i.e. transferred DNA into the plants genome. As a result of expression of T-DNA in host plant cells, formation of tumor is therefore seen in the plant (host). In addition to tumor of cells, production of new metabolic products called opines is also observed which in turn is used by the bacterium as substrate for its growth. The Ti-plasmids (modified) are being used as vectors for genetic engineering of plants for

past several years .Transformed plants have been regenerated from tumors and co cultivation experiments with Ti-plasmids.

HOW NEW PLANTS ARE PRODUCED BY *Agrobacterium tumefaciens* MEDIATED GENE TRANSFER

Examples are Bt Cotton, Bt brinjal, etc.

Agrobacterium a phyto-pathogenic bacterium has the capability to incorporate its Ti-plasmid and T-DNA into the host plant cell and is thus used in plant transformation techniques to produce transgenic plants or genetically modified organisms (GMO) . Such modified or biotech crops are grown mostly to produce plants having herbicide resistance genes, insecticide resistance genes ,virulence –resistance(coat protein) genes etc. *Agrobacterium* mediated plant transformation is a biological method of plant transformation. A vast majority of approved genetically engineered or biotech (GMO) crops are obtained by means of *Agrobacterium tumefaciens* Mediated Gene Transfer.

References:

- www.academia.edu/4902838/**Agrobacteruim** mediated gene transfer
- en.wikipedia.org/wiki/Agrobacterium
- Bhojwani, S. S., & Razdan, M. K. (1986). *Plant tissue culture: theory and practice*. Elsevier.

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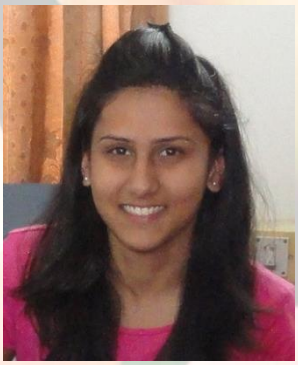
Algae: Food to Fuel

Nikita Dalal M.Sc. Botany (Department of Botany, DU)

GCBS President, 2012-13



Many of us have slipped over a green mucilaginous mass very commonly found growing everywhere during monsoon. Some of you might have also thought why is it here and why does it appear every monsoon! To some of you it might be nuisance! That's algae which happily flourish during monsoon. Some of you might have even wondered why it even occurs in nature. Simply because nature knew that humans will create problems in future, problems like carbon dioxide emission which triggers a cascade of other problems. Nature provides us with solutions too. Algae ranging from unicellular organisms to the giant kelps maintain ecological balance in a number of ways some of which are yet to be discovered. Algae have been used as food and fodder long back indicated by fossil evidences. But recently algal biotechnology has come up as a booming industry and research area. The use of algae as biofuel and sewage treatment, as a source of unsaturated fatty acids, it serves as a component in many products, be it toothpastes, face masks, anti-aging cosmetics, Frozen foods, Pastry fillings, Syrups, Bakery icings , Cooked/ instant puddings, Dessert gels, Candies, Fruit juices, Jams & Jellies, Sauces and gravies, Salad dressings, Ice Cream ,Paper sizing / coatings, Adhesives, Textile printing / dyeing Air freshener gels, Polishes Antifoaming agents, Capsules and tablets, Lotions and creams. The world is on the verge of global food crisis because of the booming population that pressurises the society for higher food production. Algae have proved to be a boon in such a situation.

Algae as food have been used since ages. The ancient Polynesians, whose villages were generally situated near sea, cultivated sea 'gardens' where various edible seaweeds were kept in culture. *Porphyra* 'Nori'; 'Kombu' *Laminaria, Alaria, Arthrothamnus;* 'Hijiki' from *Hijikia fusiforme;* 'Miru' from *Codium;* 'Wakame' from *Undaria pinnatifida*; Irish moss/ Carageenan/ *Chondrus crispus* can be cooked with milk, seasoned with vanilla or fruit or made into a highly palatable dish called blancmanges. It can be used as a gelling agent because of ethereal sulphate in its cell walls which is now the basis of a considerable phycocolloid industry.

Seaweeds generally are not of very high nutritive value, for some of the carbohydrates are not easily digested by human beings because we lack certain enzymes. Their food values lies more in the way they stimulate appetite, provide necessary salts in available organic form, and furnish a number of important vitamins and trace elements. Even if we don't directly consume algae, we indirectly nourish ourselves when we eat fish.

Iodine is manufactured from kelps in Japan. Seaweeds are used because of the iodine content they are rich in; because they grow in sea, so thalli contain a relatively high proportion of this element.

Algae as fodder for animals, certain species are used as a fodder for animals like *Rhodymenia palmate* and *Alaria esculenta* on which goats, cows and sheep feed in Ireland and Scotland.

Medicinal uses: *Sargassum* and laminariales for goitre and glandular trouble*. Gelidium* for stomach disorders and for heat-induced illness. The gentle swelling of dried *Laminaria* stipes upon exposure to moisture gave them use as a surgical tool in the opening of wounds. Agar-Agar: Malay origin means jelly. Agarphytes : *Gelidium, Pterocladia* and *Gracilaria*.

Algae can also be used for biologically treating the sewage. Biological treatment of sewage is a process of oxidation. The organic matter is broken down by bacteria using atmospheric oxygen. This oxygen is supplied mechanically by spraying the sewage, which is an expensive process. However, another way of providing oxygen is Algae. Algae growing in the water in which the organic matter is suspended, will supply all the oxygen that's needed as their by product for photosynthesis. They'll absorb into their bodies much of the soluble nitrogen, phosphorus and potash that would otherwise run to waste. When the biological oxidation is completed the algae can be harvested. Algae like *Chlorella*, *Scenedesmus*, growing in the sewage supply the oxygen that is required by the bacterial population that breakdown the organic matter in the sewage at the same time destroying harmful substances and making residual liquid safe for disposal.

Recent advancement or the application of phycology has been very well demonstrated by Dr. Sahoo from University of Delhi. He invented a Car that converts the CO2 emitted by the car into O2 and then releases it in the environment. The experimental set up is simple, he used an algal strain in a glass chamber fitted on top of the car which provides algae with sunlight and connected the silencer to the algal tank which makes sure that the emitted CO2 from the silencer goes straight into the algal tank, the algae uses it for photosynthesis and converts it into O2. The algae can then be used for biofuel production.

Bioreactors are being used in industries which emit huge amount of CO2 that works on the similar principle as the algae car. The chimneys are connected to bioreactors filled with particular algal strain which converts it into O2.

Pink Salt: known for its beta carotene content is a result of an alga in Sāmbhar Lake in Rajasthan. And beta carotene is the pre-cursor for vitamin A. A lot of research was lately being carried out on the golden rice regarding beta carotene.

Apart from the other uses Algae can be applied as soil conditioners, fertilizers and green manure in the form of powder, granules or liquid extracts. Seaweed bio fertilizers are found to be superior to farmyard manure due to the presence of high amount of organic matter, which helps in maintaining the moisture, retaining capacity of soil, and enhance the availability of minerals at soil surface. Also seaweeds are eco-friendly, cheaper, convenient, and economic and have environmental benefits.

Biofuel production: Alcohol especially ethanol is used as an alternative fuel to gasoline. Sugars can be directly converted to ethanol while starches and cellulose first have to be hydrolysed to fermentable sugars and then they're converted to ethanol. Ethanol unlike gasoline is an oxygenated fuel that contains 35% oxygen, which reduces particulates and nitrogen oxide emissions. Most important feature of ethanol being the CO2 emitted by ethanol combustion can be fixed by plants. When added to motor fuel bioethanol facilitates in the reduction amount of cancer causing compounds such as benzene, toluene, and xylene and ethyl benzene. Algae have been used to produce biofuel as we are running short of fossil fuels. Particular algal strains are rich in lipid component; this property of algae is used for the production of biofuel.

Bioremediation: *Porphyra (*nori) is utilised as a nutrient scrubber and water purifier due to its absorbance of excessive nutrients in water polluted with human or animal effluents while producing algal biomass and secondary products.

Pigment: *Porphyra* is also the commercial source of the fluorescent pigment r-phycoerythrin which is used as a fluorescent tag for immunofluorescent diagnostics, flow cytometry and antibody labelling.

This article about algae is just tip of the iceberg and most of it is waiting to be explored. Seems as if the sea is full of solutions. Research and development will take us ahead and it is rightly said 'Great things often come in small packets'.

References:

- Levine, I. A., & Sahoo, D. (2010). *Porphyra: Harvesting Gold from the Sea*. IK International Pvt Ltd.
- *.http://science.howstuffworks.com/environmental/green-science/algae-biodiesel3.htm*

Additional information by editors (Dr. Gita Mathur)

Videos to watch on amazing ways in which algae are being used:

https://www.youtube.com/watch?v=XBw9sTrVFNo

https://www.youtube.com/watch?v=BolhY-LgFP4

https://www.youtube.com/watch?v=w9DkArIthSA

https://www.youtube.com/watch?v=ay-cPZZOxxk

https://www.youtube.com/watch?v=wht_PGd0vm0

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Bioinformatics: - The Evolving Field towards New Horizons in Plant Sciences

Aakanksha Sharma

Botany (Hons) III Year

Science is an area of life which keeps on flourishing each day with newer developments and novel progresses diversely. With increase in the number of advances and innovations, the amount of data or in simple linguistic information rises to greater figures. To keep pace with this vast amount of prospering knowledge as well at the same time preserve the present evidences, a fresh arena of science has arose significantly to achieve this goal. This wonderful accomplishment is titled "Bioinformatics". In the coming sections, we will come to know about what is bioinformatics? What are its major aims and its essential constituents? Our chief focus will lie on the various applications of bioinformatics in plant sciences.

Introduction:-

Bioinformatics is a branch of Science that integrates physical, chemical, biological and mathematical data with computational skills to discover answers to large biological queries. The term bioinformatics was given by Pauline Hogwag and Ben Hesper in 1978. The branch of science is required to handle huge and massive volume of data which is accumulated during genomic revolution. The genomic revolution constitutes of DNA and Protein records.

Goals:-

1. **Data Procurement**: - This is primarily concerned with accessing and storing large amounts of data in an appropriate manner to make them proficient of being allied to all the information related to genomic studies as genomic studies are the base to every division of life sciences.

2. **Databases and Tool Development**: - Firstly, Databases are electronic files which are designed to store theses large amounts of data and make them available in future for research and analysis. Tools are the backbones for these databases as they handle the data according to the requirement of the user. As a significant amount of data is offered day to day, it becomes a task or rather a challenge for a bioinformatician to have a strong bond with the

researchers and understand their needs that will be using these databases to interpret, analyze and conclude various biological questions.

3. **Data Investigation**: - The aim follows the principle to use these tools and databases to derive certain conclusions by analyzing the data, for which the database being used should be efficient enough to solve the query of the user and provide the user with all necessary information for analyzing the same. Further using various tools to examine this information. A good Knowledge of various computer programming languages like C++, JAVA and Visual Basic is essential for the database specialist who is designing these programs.

4. **Data Assimilation**: - Subsequently, after the step of analyzing all the queries and approaching towards an inference, it is necessary to match, associate and integrate this result with other key databases. Retaining these outcomes and networking them with other databases requires expert and well-organized practices or methods, for example a scientist running gene expression analysis for a leaf affected by necrosis observes that a particular set of 10 genes express more in the leaf tissue than a normal healthy leaf. The scientist will wonder which of the genes are more related to the infected leaf, for this he or she will have to find out more relevant evidence pertaining particularly to these 10 sets of genes which can only be obtained if information is provided to the user in a well-defined and consolidate fashion.

Databases:-

As mentioned above, databases are electronic cabinets that provide features of storing, handling, analyzing and integrating large volume of data or information together.

The first biological database was a book called the “Atlas of Protein Sequences and Structure. This Book was written by Margaret Day Hoff who is famously known as the “Mother of Bioinformatics”. It confined protein sequences determined at that period of time.

The Sources of data under databases can be majorly grouped into two:

1. Organization of Organisms: including
a) Morphology
b) Anatomy

2. Function of Organisms: including
a) Physiology
b) Biochemistry

Key functions of these databases:-

1. To mass, systemize and organize all the data together obtained from biological experiments.

2. To avoid duplication and deception of data
3. To make the biological data accessible in a computer readable and comprehensible format to the user.

Classification of Databases:

The databases are majorly classified on the basis of primary source where users can directly submit their data and the other source is secondary where the data is curated form a primary database to store them into another database.

Under these, 2 categories fall the types of data which are presented below in the form of a table:-

Type Of Data	Feature	Databases
Sequence Database	Databases include nucleotide and protein sequences	GenBank, UNI-PROT,DDBJ, EMBL, SWISS-PROT
Structural Database	Store structure of nucleic acids and proteins	PDB, MMDB, TOPS, NMR
Genome Database	Consists of whole genome nucleotide sequences of organisms	Entrez Genome, GIB
Literature Database	Contain scientific literature i.e. research papers and articles from various journals	PubMed(NCBI), NLM, Medline
Metabolic Database	Acquire information on biochemical pathways and enzymes	KEGG, Metacyc
Chemical Database	Stores chemical information on various molecules	PubChem (NCBI)
Disease Database	Contains information related to diseases, genetic disorders in mammals and animals	OMIM, OMIA
Enzyme Database	Contains information about various enzyme structure , function and involvement in particular pathway	EC, ExPasy
Microarray Database	Consists of data obtained from microarray experiments	GEO, CGED

BIOLOGICAL DATABASES CONSORTIUM

NCBI (U.S.A)

(http://www.ncbi.nlm.nih.in)

EMBL (Europe)

(http://www.ebi.ac.uk)

DDBJ (Japan)

(http://www.nig.ac.jp)

Database	Data Retrieval Tool	Data Submission Tool
GenBank	Entrez	Bankit, Sequin
EMBL	SRS	Webin , Sequin
DDBJ	Getentry, SRS	Sakura, MSS

Application of Bioinformatics in Plant Sciences and Crop Improvement:

- It is helpful in analyzing gene expression patterns in crops to determine function of genes involved in the resistance of plants to environmental stress such as soya bean, barley and potato.
- To identify the basis of disease resistance and stress tolerance and design methods to make crops harder and much more resilient.
- To plan and project quality type fruits and vegetables against damaging ecological or stressful surroundings. Examples of such crops are Flavr-savr tomatoes, Bt-cotton.
- To improve quality traits of food crops utilized in pharmaceutical and cosmetic industries
- To use the field as a mechanism for rapid gene discovery in finding out the genes involved in fruit ripening and flower vernalisation.
- To figure out sexually compatible plants so that desirable genes can be extracted and then used for hybridizing and tissue culture, from wild relatives to plant of interest.

- To identify an important class of genes called miRNA's that control floral development and growth and further uses them for developing next generation of plants.
- To study gene expression and protein profiles of plants under different environmental conditions through microarrays.
- To study and identify the primary and secondary metabolic pathways and improve the nutritional quality of crop through enzyme and metabolic databases.
- Bioinformatics can be used to design new tools to study gene functions.

Thus Bioinformatics has proved to be a successful and propagative field in the area of plant sciences and will continue to make new and better amendments and discoveries in the biological arena with enhancement and progression in the quantity and quality of plants and crops.

References:

- Zhumar Ghosh & Bibekanand Mallick Bioinformatics: Principles and Applications. Oxford University Press (Jan. 1 2008)
- https://isaaa.org/resources/publications/pocketk/23/default.asp

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Ecoinformatics: From the Gene to the Biosphere

Dr. Samira Chugh

Bioinformatics has now become a very fashionable term as young people today are attracted to terms like computational biology and bioinformatics. Rightly so, because computers and the world wide web have revolutionized the way research, analysis and interpretation is carried out. However when we get down to the basics, bioinformatics is nothing but a tool (though a very handy one!) to organize, store, share and analyze the flood of data created by “Omics” (genomics, proteomics, transcriptomics, lipidomics, metabolomics, glycomics, etc). The surge in data has made computers indispensable to biological research. In short, bioinformatics is a information management system for molecular biology and has many practical applications.

Bioinformatics has three major aims:

1. Organizing and storing biological data
2. Analysing and interpreting it.
3. Predicting, modelling and designing genes in DNA sequence.

Bioinformatics has always been associated with genomics and proteomics. It is taken as an analytical tool for molecular biology data only. However, in the present scenario there is extensive use of computational biology and bioinformatics beyond molecular biology. Interdisciplinary and trans disciplinary approaches have led to new disciplines like cheminformatics, ecoinformatics, toxicoinformatics, pharmacoinformatics, computational evolutionary biology, marine informatics, computational geology, computational weather modelling, computational fluid dynamics etc.

The focus of the present article is Eco informatics. Ecology is the study of interrelationships between organisms and their surroundings. Ecology as a discipline grew out of natural history traditions, with a strong emphasis on observations in the field. By around nineteenth century ecology was becoming a more quantitative

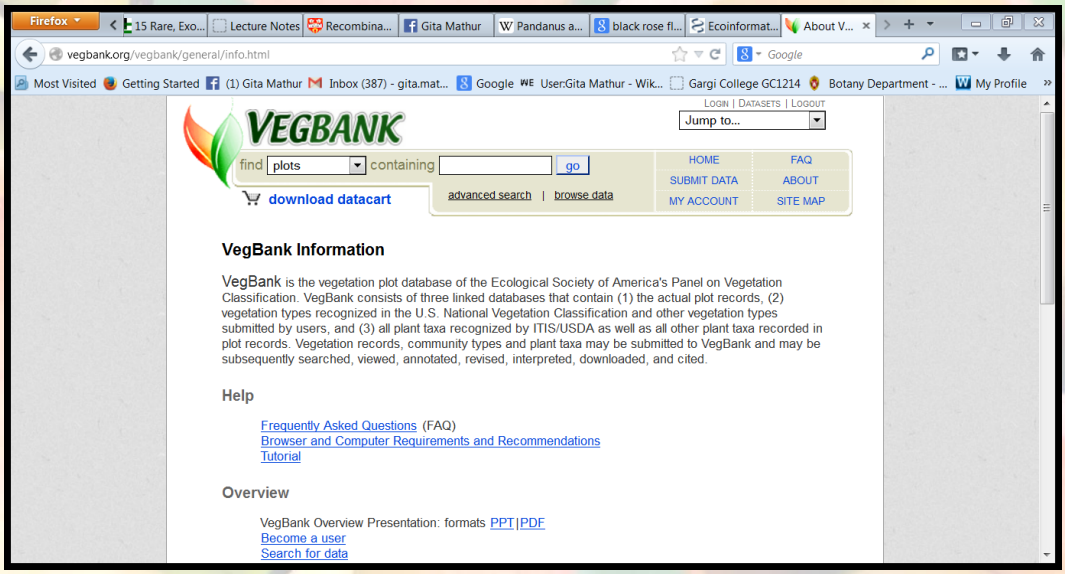
science with fewer purely descriptive studies. Still later ecology moved towards mathematically derived models. Since 1960's, there has been a shift towards experimental methodologies. Now there is a challenge to deal with the large amount of data generated.

Ecological data is different from the data generated by experiments in genomics and proteomics. Ecological data ranges from genes to biospheres and may contain measurements of processes like herbivory etc. Ecological data occurs in many forms like numbers, text, images and videos; data can be un-digitized! This makes documentation and analysis of ecological data more challenging. The use of computers to manage ecological data has given rise to a new field called **ecoinformatics**. Another challenge that is faced by ecologists is the enormous variability in scales that is encountered, spanning microbial community dynamics, communities of organisms inhabiting a single plant or square meter, and ecological processes occurring at the scale of the continent and biosphere (Michener & Jones, 2012).

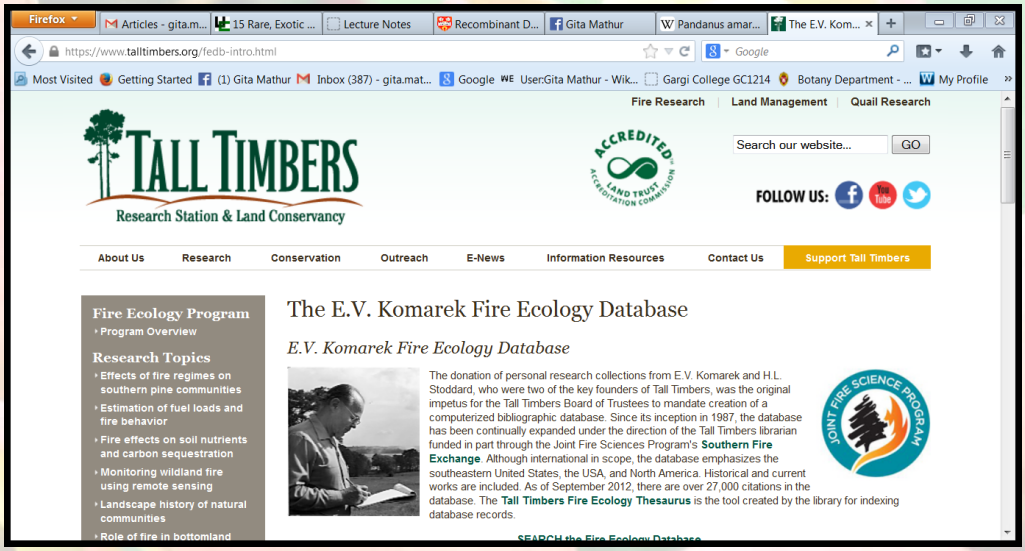
Computational ecology involves synthesis of data from multiple sources and looking for solutions. An interesting example of how difficult it is to analyze ecological data has been reported by Knapp et al. (2004). In an international project they compared the effects of different grazers and fire on grasslands in North America and South Africa. Plot size, plant species, growth forms (only grasses, only trees or both), methodology, fire and grazing regions differed from one region to the other. Only with specialized software can such a wide data be organized and analyzed.

In its initial stages Eco informatics just meant that researchers managed and organized ecological data by entering it into spread sheet based software tools. Now data warehouses like VegBank, EBSCO, ECOTOX have been designed which serve as centralized data archives to store data pertaining to a common theme collected by many different investigators.

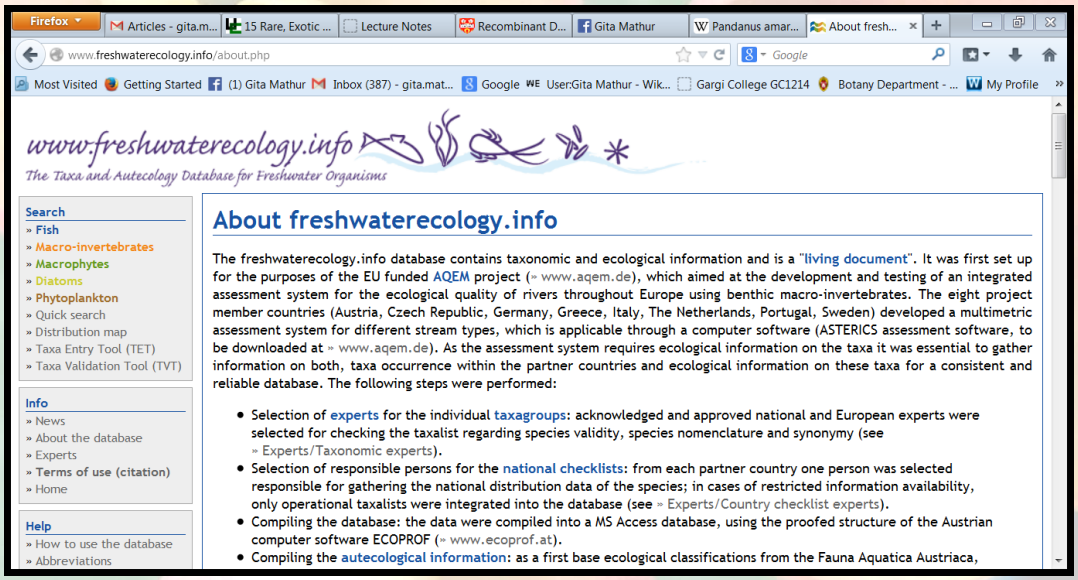
- **VegBank** is the vegetation plot database of the Ecological Society of America's Panel on Vegetation Classification. Vegetation records, community types and plant taxa may be submitted to the VegBank and may be subsequently searched, viewed, annotated, revised, interpreted, downloaded and cited.



- **EBSCO** is the world's largest index to literature on wild mammals, birds, reptiles and amphibians. Comprehensive coverage includes more than a million bibliographic records, many of which include abstracts, with topic areas such as studies of individual species, habitat types, hunting, economics, wildlife behavior, management techniques, diseases, ecotourism, zoology and taxonomy.
- **ECOTOX** is a comprehensive database, which provides information on adverse effects of single chemical stressors to ecologically relevant aquatic and terrestrial species.
- Another very interesting ecology data base is the **Tall Timbers Fire ecology database** which includes data and literature on fire ecology, wildfires, fire histories and case studies, ecology of the south-eastern United States.



- The **freshwaterecology.info** database. Here we can find autecological characteristics, ecological preferences and biological traits as well as distribution patterns of more than 12,000 European freshwater organisms, belonging to fish, macro-invertebrates, macrophytes, diatoms and phytoplankton**.** The ecology data feature (amongst others) **eco-regional and altitudinal distribution, temperature and stream zonation preference, substrate or microhabitat preference, feeding type, life duration, saprobity** and many more. All ecological parameters can be individually combined and queried.



Eco informatics is also now being used to predict which species are probable invaders. This has been a long-standing goal of ecologists. Although restricted to few taxa, these studies reveal clear relationships between the characteristics of releases

and the species involved, and the successful establishment and spread of invaders (Kolar & Lodge, 2001). According to Jones *et al*. (2006) integrating ecologically pertinent data into the chain of information from the gene to the biosphere will significantly enhance our understanding of the natural world and promote wise management strategies for natural resources.

References:

- Kolar, C.S. & Lodge, D.M. 2001. Progression in invasion biology: Predicting invaders. Trends in Ecology and Evolution. **16(4)**: 199-204.
- Jones, M.B.; Schildhauer, M.P.; Reichman, O.J. & Bowers, S. 2006. The new Bioinformatics: integrating Ecological data from the Gene to the Biosphere. Annual review of Ecology, Evolution and Systematics. **37**: 519-544.
- Michener, W.K. & Jones, M.B. 2012. Eco informatics: Supporting ecology as a data intensive science. Trends in Ecology and Evolution. **27**: 85-94.
- Knapp, A.K.; Smith, M.D.; Collins; S.L.; Zambatis, N. & Peel, M. 2004. Generality in ecology: testing North American grassland rules in South African savannas. *Front. Ecol. Environ.***2(9):**483–91

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NIPGR: A Salient Asset of Genome Research

Prachi Sharma
Botany (Hons.) III Year

Botany department organised a visit of students of B.Sc. Botany Honours to NIPGR on February 12, 2014, to give us exposure to current advancements in research in the field of Genomics. We were accompanied by three faculty members: Dr. Gita Mathur, Dr. Geeta Mehta and Dr. Aparajita Mohanty. The group was briefed about the institution and then taken to various laboratories in smaller groups by Dr. Mukesh Jain, Mr. Ramashankar and Ms. Annapurna. As it was our first exposure to an advanced research institute we were excited and highly motivated to learn. This following article is an outcome of the visit followed by literature survey. The photographs of the various instruments taken by Dr. Gita Mathur (with permission) will help us remember what we learnt at the visit.

Genomics research is a rapidly advancing field in biological science which is providing bridges between different branches of natural sciences. National Institute of Plant Genome Research (NIPGR) is an autonomous institute aided by Department of Biotechnology, Government of India, which is hugely contributing towards the growth of genomics research in major crop plants in India. The institute is actively undertaking various collaborative programs with other international institutes engaged in plant genome research.

NIPGR is aimed to contribute towards frontier areas of genomics that include structural genomics, functional genomics and comparative genomics. Various branches of plant biology are recruited by the scientists there in order to understand the above said areas of sciences. These include computational biology, genome analysis, transcriptome analysis, and molecular mapping and molecular breeding. Active research is being done in NIPGR to understand the molecular mechanisms of abiotic and biotic stress responses, nutritional biology, plant immunity, plant-developmental and -architectural biology. Transgenic research is another allied field that is being actively utilised for crop improvement purposes. Various crop and experimental plants used at NIPGR for the above said research include *Arabidopsis*, rice, chickpea, tomato, *Brassica*, foxtail millet and many more.

Structural genomics approach involves understanding of the structure and composition of all the genes in a particular organism. This is accomplished by whole genome sequencing techniques. Recently NIPGR have generated the whole genome nucleotide draft sequence of a desi type chickpea genome (chickpea is the third most important food legume crop). Additionally, many BAC clones of tomato

chromosome 5 are sequenced at NIPGR as a part of the international initiatives on Solanaceae genomics (SOL). Furthermore, several thousand chickpea (*Cicer arietinum)* and periwinkle (*Catharanthus roseus)* EST sequences have been produced using DNA sequencing facility. The automated DNA sequencing facility at NIPGR is equipped with ABI3730 xl DNA analyzer capable of analyzing 96 samples within two hours. Big dye terminator chemistry version 3.1 is being used for cycle sequencing with the help of ABI9700 PCR cycler. Cloned DNA, PCR products and BAC ends are analyzed using POP7 polymer and 50 cm array that can produce up to 900 base reads.

Functional genomics is another important branch of omics sciences that deals with understanding the whole genome expression status of all the genes of a particular organism at one or more time points in its life cycle. Simultaneously, this branch of science aims to understand the function of genes along with arrangement of genes on plant genomes and manipulation of plant genes/genome in order to improve varieties of food and industrial crops for high yields and for better quality products. Microarrays and next generation sequencing are the two major tools employed for deducing the global expression profiles. The transcriptome thus obtained serves as a reservoir for picking up important candidate genes for complete characterization. Expression analysis of many developmental and stress stages of different plants have been thoroughly investigated at the institute. Functional identification and characterization of important genes have led to production of many stress tolerant, disease tolerant and nutritionally enhanced transgenic plants.

Comparative and evolutionary genomics holds the key to understand the interspecific or intraspecific relatedness at the genome level. Using tools like genome wide association study (GWAS), similarities of the different genome sequences are analysed to interpret the evolution and also to make phylogenetic maps. Identification of association of certain sequences with agronomic traits allows segregation of crop variants on the basis of sequence.

National Plant Gene Repository (NAPGER) is also housed in NIPGR. This national facility aims to receive, store, catalogue and inventories plant genes, ESTs, promoters and constructs generated in Indian laboratories. It also aims for their distribution to the researchers, academic institutions or other organizations in public and private sectors. Thus, this repository acts as a common pool of all the genic information in the country about the plant which has free access to the researchers.
NIPGR has a well-equipped central instrument facility (CIF) which is shared by all the laboratories in the centre. CIF consist of various instruments which are used in various complex processes of plant genome research .Some of them are as follows:

- Real time PCR (Quantitative PCR) is used for various purposes like diagnostic uses, microbiological uses, in research, detection of phytopathogens, and genetically modified organisms, clinical quantification and genotyping. Quantitative PCR is used widely to detect and quantify specific DNA sequences in scientific fields that range from fundamental biology to biotechnology and forensic sciences. It combines the functions of a thermal cycler and a fluorimeter, enabling the process of quantitative PCR. Real-time or quantitative PCR (qPCR) allows quantification of starting

amounts of DNA, cDNA, or RNA templates. Q-PCR is based on the detection of a fluorescent reporter molecule that increases as PCR product accumulates with each cycle of amplification. Quantitative PCR instruments monitor the progress of PCR, and the nature of amplified products, by measuring fluorescence. Fluorescent reporter molecules include dyes that bind double-stranded DNA (i.e. SYBR Green I) or sequence-specific probes (i.e. Molecular Beacons or TaqMan® Probes). qPCR exceeds the limitations of traditional end-point PCR methods by allowing either absolute or relative quantification of PCR product at the end of each cycle.

- DNA microarray is a modern methodology for studying gene expression. DNA microarray analysis is a fast and versatile approach to achieve high throughput explorations of gene expression, genome structure and gene functions. Global expression analysis using microarrays now allows for simultaneous interrogation of the expression of thousands of genes in a high-throughput manner and offers unique opportunities to obtain molecular signatures of the state of activity of diseased cells and patient samples. Microarray analysis provides invaluable information on disease pathology, progression, resistance to treatment, and response to cellular microenvironments and ultimately may lead to improved early diagnosis and innovative therapeutic approaches for cancer.

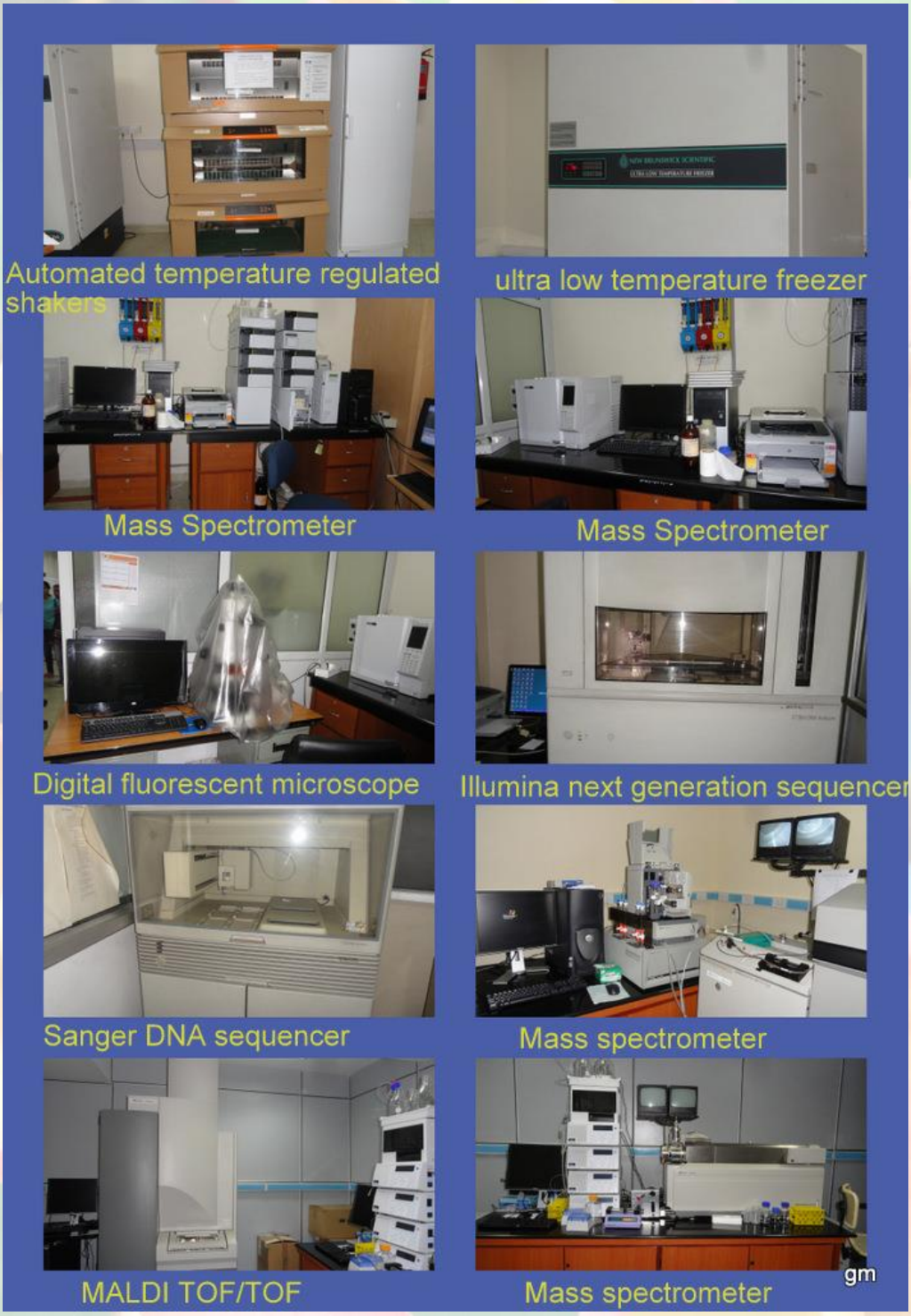
- GENE gun (bio- rad) for plant transformation purposes, it is a device used for injecting cells with genetic information. A gene gun is a Biolistic Device or a Biological Ballistic device. It is used to get novel genes into the nuclei of living cells. This is known either as transfection, trans-gene infection, transformation, genetic modification or transgenic production. A gene gun can be used to genetically infect cells or whole organisms with foreign DNA by aiming the barrel of the gun and firing. The microshot projectiles in the biolistic gene gun are made of microscopic (or nano) sized gold or platinum powders. These expensive powders are soaked in DNA or RNA (in raw or plasmid form) that are engineered for insertion into the genome of the cells or organisms under the gun.

- Gene electroporation system uses electric pulse to produce transient pores in plasma membrane there by allowing macromolecules into the cells. It is used for sRNA and DNA delivery into primary, suspension, and difficult-to-transfect mammalian cells, including those that are resistant to chemical transfection using lipid-based reagents. It has a general applicability and many animal cell types that could not be transfected .By other approaches were successfully transfected by this Approach.

- Cryostat – microtome used to cut histological slides that are used in a process called frozen section histology.

- P. F. G. E (Pulse Field Gel Electrophoresis)- it used for the separation of large deoxyribonucleic acid (DNA) molecules by applying to a gel matrix an electric field that periodically changes direction. PFGE may be used for genotyping or genetic fingerprinting. It is commonly considered a gold standard in epidemiological studies of pathogenic organisms. PFGE uses molecular scissors, called restriction enzymes, to cut bacterial DNA at certain locations (restriction sites). These molecular scissors are selected to generate a small number of DNA pieces that can be separated based on size. The bacteria are loaded into an agarose suspension, and then the bacterial cell is opened to release the DNA. Once the DNA is released then the agarose and DNA suspension, also known as a plug, is treated with restriction enzymes. The treated plugs are then loaded onto an agarose gel and the restriction fragments are separated based on size using an electric field.
- Mass Spectrometer (MS) which uses an analytical technique to measure the mass charge ratio of ions. This analytical technique is also known as Mass spectrometry. An ion is an atom or group of atoms which have lost or gained one or more electrons, making them negatively or positively charged. Mass spectrometry is an important emerging method for the characterization of proteins. The two primary methods for ionization of whole proteins are electrospray ionization (ESI) and matrix-assisted laser desorption/ionization (MALDI). Matrix-assisted laser desorption/ionization (MALDI) is a soft ionization technique used in mass spectrometry, allowing the analysis of biomolecules (biopolymers such as proteins, peptides and sugars) and large organic molecules (such as polymers, dendrimers and other macromolecules), which tend to be fragile and fragment when ionized by more conventional ionization methods. The Time of flight (TOF) method of measuring particle mass-to-charge ratio is done as follows. An ion of known electrical charge and unknown mass enters a mass spectrometer and is accelerated by an electrical field of known strength. This acceleration results in any given ion having the same kinetic energy as any other ion given that they all have the same charge. The velocity of the ion will depend however on the mass-to-charge ratio.

Photos: Dr. Gita Mathur



Photos: Dr. Gita Mathur

Photos: Dr. Gita Mathur

NIPGR has placed India amongst the major contributors to plant genomics in the world. In the coming years, the ongoing efforts of NIPGR will help India to emerge as one of the most important national and international resource institutes for material, knowledge and technologies in the areas of functional, structural, evolutionary and applied genomics of plants, including crop plants.

In the end I want to express my gratitude towards Dr. Gita Mathur for

motivating and guiding me in writing this article and Dr. Priyanka Deweshwar for editing it.

REFERENCES:

www.nipgr.res.in
www.bio-rad.com
www.cmu.edu
www.clinchem.org
www.sigmaaldrich.com
www.bioacademy.gr
www.princeton.edu
www.cdc.gov

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Did You Know?

Set 1

Nikita Dalal

M.Sc Botany (Department of Botany, DU)

GCBS President, 2012-13

1. 'Oomycota' has been removed from Fungi and placed in Straminopila, in which brown algae and golden algae have also been placed.

2. No more ICBN (*International Code of Botanical Nomenclature*), its ICN (International Code of Nomenclature for algae, fungi, and plants) from 1st January 2013.

3. Scientists have discovered a new strain—the first in 40 years—of *Clostridium botulinum*, the bacterium that is ultimately responsible for causing botulism. And although they have reported their findings in a scientific journal, the investigators have taken the extraordinary step of withholding key details of the discovery. That's because the toxins made by *C. botulinum* are the most dangerous known to humankind and currently there is no antidote for a toxin generated by the new strain. The fear is that malevolent organizations or rogue governments might use the information to reverse engineer their own version of the new bug, making it a potent and real bioterrorism threat.
C. botulinum toxin is high on the list of feared biological weapons because minute quantities can fatally paralyze people who swallow or breathe it.

4. CRATER LAKE: Lonar Lake in Buldhana district of Maharashtra is believed to be the den of a mythical giant demon, slayed by Lord Vishnu.
The lake dates back to the Pleistonic era and was formed by the hypervelocity impact of either a comet or a meteorite and is Asia's ninth largest crater. Though there are such lakes created by meteorite impact in other parts of the world, Lonar is perhaps the only one that has basalt rocks at the base and in the surroundings.
* The soil around the lake has magnetic properties and therefore no magnetic compass is able to deflect in a proper direction.

* The lake is said to have some special microbes which feed on methane thereby cutting off a portion of CFC's.

5. Heard of Pomato and its failure? Now there's a plant which produces tomato above ground and potato below ground rightly named 'TomTato' in UK. Ipswich based horticulture firm says "These plants are not Genetically Modified", it is grafted or should i say beautifully crafted for our use. Here's how it was a success.

References:

- http://www.bbc.com/news/uk-england-24281192
- http://www.bbc.com/news/science-environment-26614092
- http://www.bbc.com/news/uk-england-24281192

DID YOU KNOW? Set 2

Dr. Ahalya Chintamani
Translated from Kannada publication:
'Sudha' by the Printers (Mysore) Pvt. Ltd

MAARI MENASU

When trying to pluck the colourful peppers "don't pluck" said Subrahmanya. If you prepare sambhar with these peppers you cannot eat a spoon full of rice with it – so hot!! He said local name is MAARI MENASU.

Indian origin Bhoot jalokia – a very hot Gandhari capsicum has already entered Guinness book of world records. May be Maari Menasu is the sibling of bhoot jalokia. Trirthahalli near Sulugodu – Majjigehalli Subramanya brought the seeds of this pepper from his grandfather's place Banavas. Tender young fruits are not that hot – they prepare pakoras, raita and also Badies.

As it ripens it becomes more and more pungent and hot shining, stiff fruits. Younger fruits are green but when they are ripe they have rich yellow color. Life of a plant is about 5-6 year. Subrahmanya grows this plant for his domestic use only.

Green pepper is very palatable to birds but the birds do not come near the ripened fruits. The lice which attacks the bears etc – when the extract of thin pepper is sprinkled on lice it dies.

BLACK ROSE

When the lovers get angry is it right to give black rose? -Vinaya Kumar BH

Red, white, pink and yellow roses are common. But is there black rose grown naturally? In Halfeti in Turkey a small village, this black rose grows luxuriantly. It appears as if someone has sprinkled black colour on it. Except colour this rose has all characters of rose. The specialty of this rose is a few flowers in summer only. The special soil of Hyalphati and the Upretus Rivers under current may be the reason for black rose in spring this red like other rose but in summer they turn black! Pitch black…

Local people relate a relation between friendship and envy in people. Some say this rose is symbol of death and bad news.

In 1990 when Birsk dam was constructed this rose gradually reduced in number. During construction of the dam the village Halfeti submerged. The people rehabilitated in a village Karotlak. Ten miles away from Halfeti when the villagers tried to plant black rose, it did not flourish. Then the development authorities tried to grow it in the green house by setting the same environment and now they are glowing.

One cannot think the black rose as a symbol of love but it is wonderful to see this rose. When lovers get angry they may exchange black rose

However when anybody visits Turkey please do not forget to see black rose.

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The Charm of Abaca: "A Natural Fiber"

Aakanksha Sharma

Botany (Hons) III Year

With the upcoming advances in the lifestyles of people of the 20th century, new trends in technology and machinery must have acquired a great mark, but still organic and natural are the newfangled fashion drifts adopted by folks. The reason being, the excessive degradation of environment with consumption and commercialization of synthetics, people are going in for biological norms be it clothes, furniture, footwear, automotive, textile or chemical based industries, "go green" is in.

One such biological entity that has brought a phenomenal advancement to the world of plant sciences with position to use of natural fibers is the Abaca plant popularly known as Manila hemp all over the world. Abaca is one plant which has made its trademark significantly all over various industries. In the next section, I am going to introduce you to this remarkable fiber and what uses has it brought to our world.

Abaca is a name derived from Spanish origin, but scientifically the plant comes to be known as *Musa textilis* belonging to the family Musaceae. In morphology, the plant closely resembles the banana plant, *Musa paradisiaca*. It is not a true hemp species. Abaca originates from the rootstock carrying about 25 fleshy stalks each of which has a petiole sheathing the plant stalk to form a herbaceous non woody false trunk. The position of the petioles on the stalk determines the stalk color and the color of the fiber they yield. The outer sheaths being the darkest and inner being the lightest.

Abaca has originated from the Philippines. It is also widely grown in Ecuador and Costa Rica. It is widely used in European countries like France, Germany U.K, and Asian countries like, Japan, China and Korea.

The plant grows best in well drained loamy soils and reaches a maturity around 18 to 24 months of age. It is harvested every 3 years. The outer layer of the leaf sheath or the petiole is the fiber yielding layer and can be extracted and processed for commercial use through step- wise method of first, harvest followed by tuxying (removal of primary and secondary sheaths), stripping i.e. obtaining fibers and drying that usually takes place under the sun, and finally storage for further usage.

Now after we have learnt about the description of the Abaca plant, let's move on to the incredible quality that makes Musa suitable to be used for industrial applications and they are:-

1. Strong Strength
2. High Flexibility
3. Very buoyant
4. Exceedingly resistance to damage as they can bear salinity
5. Great length (5 to 11.5 feet)

Uses and Consumption:-

1. The pulped paper out of Abaca is used to make tea bags, filter paper and banknotes.
2. The fiber is employed in ships, fishing nets, transmission ropes and cables, drilling well wires and hawsers.
3. The hard texture of this fiber makes it exceptionally useful for making marine cordage and ropes.
4. The light weight of Musa and its immense strength makes it appropriate for textile industries making fabrics, chiefly used for hats, shoes and garments.

5. Also used for table mats and carpets.
6. A notable use in the automotive industry is filing of bolsters, interior trays, hat racks, also new applications include usage of Abaca as a substitute fiber for glass components used in reinforced glass components.

Ecological benefits:

As Abaca is a natural fiber, it provides nature with several benefits like zero carbon dioxide production, extraction of fibers without the use of water therefore, preserving water resources. Practices like intercropping of Abaca with monoculture plantations helps in restoring biodiversity and controlling soil erosion in rainforests. Also the waste generated after the processing of fibers can be utilized as organic fertilizers.

This is how *Musa textilis* has brought a new expansion and resourcefulness to the scenario of natural- living and I wish that now you all are encouraged to verve for “go natural go green”.

References:

en.wikipedia.org/wiki/Abacá

www.britannica.com/EBchecked/topic/331/abaca

www. plantvillage.com

Additional information by editors (Dr. Gita Mathur)

***Musa paradisiaca* fibre is also being utilized**

Musa textilis is the fibre yielding species of *Musa* as discussed above. Now *Musa paradisiaca* fibre is also being utilized.
Eco-friendly products are now being produced from banana fibre obtained from the strong and massive leaf sheaths of plants from which banana fruits have been harvested. Craft based livelihood is being developed by establishing Self-Help Groups (SHG) in villages around Bangalore.

The artisans extract the banana fibres by simple pressing machines, use it directly or combine it with other natural materials like korai grasss, wool, jute, khus or hibiscus fibre to bring more innovation to the craft.

The products hence produced are very beautiful and unique. I saw them at the Nature Bazaar Crafts Exhibition held in January 2014 in New Delhi and purchased some. The following pictures clicked by me speak their own story.

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Insight into the World of Orchids

SwayangSiddha Nayak

L.Sc. II year

It was overwhelming to attend a special seminar on ”Orchids: The Wonder Plants” presented by Dr. Sathish Kumar, senior scientist, Tropical Botanical Garden and Research Institute (TBGRI), Thiruvananthapuram in our college. The institute has established a living collection of orchids (600 species and 150 hybrids).

Orchidaceae is a diverse and widespread family first classified by Carl Linnaeus. It is estimated that the number of orchid species is twice that of birds and four times that of mammalian species. It encompasses 6-11% of seed plants. The largest genera are *Bulbophyllum* (2000 spp), *Epidendrum* (1,500 spp), *Dendrobium* (1400 spp), *Pleurothallis* (1000spp). It also includes *Vanilla*, *Phalaenopsis* and *Cattleya*.

The name ”orchid” comes from ancient Greek word (Orchis) meaning ”testicles” because of shape of the root. They are cosmopolitan in habit and are found in extreme environments that of even glaciers. One such fine example being that of *Acampe papillosa* found in the eastern Himalayas, India, and Myanmar. Few are perennial epiphytes that grow anchored to trees or shrubs in tropics and subtropics.

They are well known for their structural variations in the flowers, most having racemose inflorescence. The flowering stem can be basal like in *Cymbidium* or apical as in *Cattleya* or axillary as in *Vanda*. They consist of two sterile whorls. The outer whorl consists of three sepals and inner has three petals (together 6 tepals) and show bilateral symmetry. The characteristic resurpination occurs primitively in this family. In this the pedicel usually rotates 180 degrees so that labellum goes on the lower part of the flower making it suitable for pollination. There are some orchids having abnormal number of petals or lips known as Peloric, peloria is a genetic trait but appears randomly. Pollen is released as a single grain in Apostasiodeae and

Flower structure - *Dendrobium*

Vanilloideae. In other subfamilies, three anthers carry two pollinia (a waxy mass of pollen grain held together by glue like alkaloid-viscin.

It is believed that the orchids have originated 70-84 million years ago that is during the late Cretaceous period when dinasaurs coexisted. This revelation was made when palaeontologists discovered a fossil of extinct species of stingless bee, *Proplebeia dominicana* which was found trapped in Miocene Amber about 15-20 mya. The bee carried pollen of previously unknown orchid taxon-*Meliorchis caribea* on its wings. This also suggested that the active pollinators of orchids in that era were primarily “insects”.

Today it has been observed that orchids have shown tremendous complexities to achieve cross pollination. This was first investigated by Charles Darwin in 1862, in his book-“Fertilisation of orchids”. In his compilation, he had also mentioned about an orchid - *Angraecum sesquipedale* popularly known today as Darwin’s orchid, having a long spur. He had then assumed that a flower must have been pollinated by an undiscovered moth with a proboscis, the length of which had never been seen until an enthusiastic researcher discovered - *Xanthopan morganii praedicta*, about 21 yrs later.

The largest orchid in the world is *Grammatophyllum speciocum* about 5-7 tonnes and that the smallest is about 2mm in length.

Recent studies have also been done on colonisation patterns of different fungi on the roots of *Cymbidium hybridium* plantlets and their respective inoculation effects on the growth and nutrient uptake of orchid plantlets.

The orchids have been used in traditional medicines as herbs in China since 2800 BC. A fine example is *Gastrodia elata*. They have also been popularly used in the form of dried seed pods of Vanilla. Vanilla is commercially important as flavouring in baking, also used as hot beverages. Some saprophytic orchid species of the group - Gastroda produce potato like tubers used as food in Australia.

The scent of orchids is popularly used in perfumes. The aromatic orchids are also cultivated as a source of additional income, due to their ornamental inflorescence.

Orchids have also been used symbolically as city flower of Shaoxing, China. National flowers of more than ten countries are orchids. For example, National flower of Venezuela - *Cattleya mossiae*, National flower of Colombia -*Cattleya trianae* and National flower of Singapore - *Vanda* (“Miss Joaquim”)

Interestingly, in recent years paintings and costume designs and fabric are dominantly inspired by orchids due to their variety and beauty.

Today countries like Taiwan are positioned at the top seed in producing hybrids of orchids in order to preserve and conserve these creations of almighty and use them

for their cultural growth. The hybrids take several months or even years to bloom making it a sophisticated practise worldwide which yields pearls after years of labour.

Certainly, orchids are wonder plants which have attracted the attention of not just Botanists but nature lovers, artists, painters, poets and designers too.

References-

- http/www.ncbi.nlm.nih/pubmed
- Wikipedia.com
- Seminar talk by Dr. Sathish Kumar
- Book suggested by Sathish sir - JEWELS OF ORCHIDS

Orchid specimens brought by Dr. Sathish Kumar to Gargi College.

Photos: Dr. Gita Mathur

Live plants of different orchids on display at an exhibition held at India International Centre, New Delhi in February, 2014. Photos: Dr. Gita Mathur

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Do Plants learn? …. Oh Yes They Do!!!

Pooja Jangir

Botany (Hons) IInd Year

World of plants is amazing, bizarre and beautiful. They acquire revolutionary abilities to evolve, adapt, flourish, learn, communicate, sense danger and design sophisticated mechanism to avoid predators to sustain their position in nature. Unnoticeable to our eyes, plants move, turn and react to even slight disturbances in their surrounding environment.

Famous Bengali polymath Sir Jagadish Chandra Bose (1858-1937), over a century ago, proposed that plants could sense, learn and remember. Recent studies on plants proved him correct. Plants can not only feel but can recall biological data like other animals. In animals and off course humans, the function of data collection and memorization is performed by brain and the nervous system. Analogous to animals plant also acquire biological information from their surrounding but they do it all without a brain.

Research by Monica Gagliano, an Australian Research Council research fellow at The University of Western Australia's Centre for Evolutionary Biology, and three fellow scientists provided concrete proof for their theories. Their study offers proof that plants not only learn from their experiences, but remember what they have learned for relatively a long period of time.

Mimosa pudica (Mimosaceae) commonly called as touch me not plant, live and die plant, shame plant and humble plant, is a sub shrub of tropical America and Australia. It is also found growing in India with curved thorns and having sensitive soft grey green leaflets that fold and droop at night or when touched or disturbed.

Photos of *Mimosa pudica* plants: Dr. Gita Mathur

Their distinctive folding behavior has given them the label of ‘curiosity plant’. It appears to be a favorite candidate for scientists to perform further research due to its defensive leaf folding abilities.

Dr. Monica Gagliano and her fellow researchers performed experiments on this sensitive plant by using the same experimental apparatus which is used to study learnt behavioral responses in animals. They trained the plant by repeatedly dropping water on their leaflet by specially designed equipment in both high and low light controlled environments. In response to the disturbance (drops of water) *Mimosa* plants folded their leaflets like they usually do. After repeated dropping of water for a long period of time, *Mimosa* plants stopped folding their leaves when they realized that the disturbance have no real damaging consequences. Astonishingly, these plants remembered their behavior for many weeks even when they were left undisturbed in completely different environmental conditions. This shows that these plants are smart enough to train themselves for changing environmental conditions by learning and remembering.

Plants may lack brains and neural tissues but they do possess a sophisticated calcium-based signally network in their cells similar to animals' memory processes, says Dr. Monica Gagliano.

The researchers admit that they still don’t fully understand the biological mechanism behind their learning abilities but it surely has changed their perspective towards plants. It will help us to improve the way we perceive plants and will help us to redefine a meaningful and justified definition for these amazing life forms and sideline the differences between animals and plants including our belief that learning is a characteristic feature of animals.

References

- www.ncbi.nlm.nih.gov/pmc/articles/PMC3459453/
- http://sciencealert.com.au/news/20141601-25169.html
- http://link.springer.com/article/10.1007/s00442-013-2873-7#page-1

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Moral duties of a science student…

Anindiya Tripathi
Botany (Hons) II Year

All right, readers, I know the heading is not at all appealing and appears a bit boring and philosophical. And, also here in this magazine full of articles, written by our budding botanists, it certainly seems out of place.

But, let's take a minute and think over it. Don't we as science students have certain moral, social, and political duties towards our society that is a very basic pillar of our existence? Shouldn't we give back to the society, help in the progress of our socio-political structure and try to contribute to make this country a better place? Why are we essentially labelled as 'nerds' or apolitical and people who can only be scientists? Numerous great personalities like Sir Abdul Kalaam have had immense success in both the worlds.

Also, the education system of India is designed in such a manner that after having a science subject till our graduation, we are still capable of studying any subject whether science or any other discipline. Whereas, the vice-versa is not possible. Now, when we are capable of thinking analytically, forming judgments by observing the nuances of the subject, and are fully habituated to indulge in deep rooted study of it, when we do possess the ability to broaden our view point and look at every specific angle why do we still limit ourselves to the age old professions and stagnant methods of teaching? When we can cover any socio- political, geopolitical topic within the ambit of our study, when we can focus on the very social system that this 'human' has created and perhaps can combine the very two disciplines then why do we limit ourselves only to the studies of genetic make ups of humans, their anatomy and evolutionary achievement?

If you ask yourself or any student of your class that WHAT HAVE THEY DONE TO THE CAUSE OF FEMINISM? GENDER EQUALITY? REMOVAL OF DISABILITY? All of these are present in society, still silently indoctrinated and imbibed by and in our psyche that stifle us and question the very cause and validity of our existence….

Now, the expected answer from most of you can be that they are not their issues and a particular section of the society is dealing with them. But, then one point must be taken into consideration that science is an ever- expanding discipline and the root of every subject is scientific. For example, gender studies, gender discrimination, all arise from the difference in gender that can be traced to the difference in genetic

makeup of an individual.

The very initiation of our social training starts with our scientific education. We are taught the importance of practically understanding every theory we study. To be able to become intrusive and to be able to question the norms of hypothesis is the ultimate aim of knowledge gaining procedure. The inculcation of this inquisitive mind set and creating a human who never blindly accepts anything and questions the established system is the basic reason for introducing practical.

Practical exams never mean completing bundles of files, getting them signed and then throwing them away as they won't be useful for us in any sphere of life. So, how can we accept any theory that the society, the government or the education system has given to us. Why do we never question and remain ignorant to the rampant spread of injustice when it is our mental and social development at stake.

Most of us have political views or apolitical stream of ideology and that is what we follow. But isn't it symbolic to give up and refuse the idea of defiance? Isn't this a dis-agreement with the establishment? If you don't question, don't protest, don't dissent with the policies that strangulate you, it means you simply agree being weak and submissive and accepting them won't do any good to you.

As the preacher of Vedanta philosophy, Swami Vivekananda rightly said "when you are born human, make a mark otherwise what is the difference between you and the plants, they too are born to live and then lease to exist"

Be it physics, biology or any other subject we have had contradiction and expectation to the agreed laws and patterns. This is symbolic of protest. Nature protests against established norms. But, sadly the very scope of protest is lost in this mad race of assignments, getting a degree, a job etc… and the most elitist and coveted foreign degrees and PhD. Studying for learning, gaining knowledge are alien concepts to us that are only found in an idealistic and utopian world of books or perhaps, this article. I might be slightly incorrect about various concepts and viewpoints presented in this article, but I believe that there is always scope for perfection and also" The pen is mightier than a sword".

I hope this piece of writing conveys the message that I wanted to…….

"CHANGE IS THE UNIVERSAL LAW"

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Famous Plant:

Vetiveria zizanioides: The Incredible Turf

Ayushi Gupta
Botany (Hons) II year

Vetiver is a densely tufted perennial grass, up to 2m tall. It is native to India and Sri Lanka where it grows wild along river banks and rich marshy soils. It is now cultivated in tropical and subtropical countries. The grass grows practically in all states of India, the bulk of it coming from the natural strands in Uttar Pradesh, Rajasthan, and Punjab. The rootstalk branches into a number of thin, fibrous, spongy, and aromatic roots (4-20 inches long and 1 to 3 mm wide) and these are the "khas" roots of commerce. The leaves are stiff, glabrous, about 1 m long and narrow (one third of an inch or less wide) and are odourless. The inflorescence is 6-12 inches long panicle and a very narrow bearing spikelet in pairs, one of which is sessile and perfect and other one is pediceled and staminate.

Vetiver flourishes best in rich sandy loams, particularly red laterite. Propagation is done generally by division of rootstalks.

EXTRACTION OF ESSENTIAL OIL FROM IT'S ROOTS

Vetiver oil is obtained by distilling the roots in steam stills, by water and steam units, or by solvent extraction. The freshly distilled oil is allowed to age in special cans. In India, the essential oil is collected over sandalwood oil. The yield of oil is 0.3 to 0.7 per cent in naturally growing plants but may go up to 2 per cent in cultivated varieties.

The oil is a brown to reddish brown, viscous liquid with a characteristic sweet, agreeable long-lasting odour, reminiscent of the oil of citronella. The principal constituent is vetiverols or vetivenols. Vetiveryl vetivenate and vetivones contribute significantly to its odour.

USES OF VETIVER

Vetiver grass is grown for many different purposes. The plant not only helps to stabilize and protect the soil against erosion, but also protects fields against pests and weeds. Vetiver can be used as an animal feed. From the roots, oil is extracted and used for cosmetics and aromatherapy. Due to its fibrous properties, the plant can also be used for handicrafts, ropes and more.

EROSION CONTROL

Vetiver does not form a horizontal mat of roots rather the roots grow almost exclusively downward (2–4 m) which is deeper than some tree roots. This makes vetiver an excellent stabilizing hedge for stream banks, terraces, and rice paddies, and protects soil from sheet erosion.

CROP PROTECTION AND PEST MANAGEMENT

Vetiver is used to protect crops. The essential oil of vetiver possesses some antifungal properties that help in protecting the crops against microbial attack.

AS A TERMITE REPELLANT

Studies by Prof. Gregg Henderson found that vetiver extracts could repel termites too!!

ANIMAL FOOD

The leaves of vetiver can be used to feed cattle, goats, sheep and horses. The nutritional quality depends on several factors such as soil quality, season etc…

FOOD AND FLAVORINGS

It is also used for flavoring sherbets. Khus syrup is made by adding khus extract to sugar, water and citric acid syrup. The syrup is used to flavor milkshakes and yogurt drinks like lassi, but can also be used in ice creams, mixed beverages like Shirley Temples and as a dessert topping.

PERFUME INDUSTRY

Vetiver oil obtained from roots is used for high grade perfumes, soaps, and cosmetics. It is one of the finest fixatives and blends well, particularly with sandalwood, patchouli, and rose oils. It is used as a starting material for vetiveryl acetate, a flavored fragrance mixture often used in luxury perfumes.

MEDICINAL USES

Medicinally it is used as a stimulant, diuretic, antispasmodic and as an emmenagogue. Old Tamil literature mentions the use of vetiver for medical purposes.

IN-HOUSE USE

Khus (vetiver roots) is often used to replace the straw or wood shaving pads in evaporative coolers. They do not catch fire as easily as wood shavings. Mats are made by weaving vetiver roots and binding them together with ropes or cords and they are used in India to cool rooms in a house during summer. These mats are usually hung in the door way and are kept moist by spraying water over them at regular intervals of time. This not only cools the passing air but also emits aroma that acts as room freshener. Vetiver roots are also tossed into the earthen pot that keeps a household's drinking water cool during summer.

CLEANING FUEL

A recent study reveals that the vetiver is capable of growing in fuel contaminated soil and also possesses the ability to clean it.

OTHER USES

Vetiver is used as a roof thatch as it is more durable. Mud bricks used for housing construction have low thermal conductivity. Garlands made up of vetiver grass is used to adorn the dancing God Natraja in the Hindu temples.

References:

- http://www.wikipedia.com
- http://www.aromaweb.com/essential-oils/vetiver-oil.asp
- Kochhar, S.L., (II ed), 1998, Economic Botany in the Tropics, Macmillan Publishers, India Ltd.

Additional information by editors (Dr. Gita Mathur)

***Vetiveria zizanioides* in art and handicrafts**

A visit to the annual Krafts festival held at Surajkund in February 2014 revealed a new utilization of the roots of vetiver.

A stall was dedicated to products made from vetiver roots. It had beautiful decoration

pieces and wall hangings; in addition bath scrubbers which gave nice fragrance on use; Ganesha idols in many sizes which give cool aromatic feel on sprinkling water on them in the prayer room or temple.

Hats ideal for wearing on a hot summer day with a sprinkle of water to keep the head cool can be a great asset for fields and outdoors workers. Fancy decorative bags and many other innovative items were on display too. Photos of some display pieces, clicked by me are added below.

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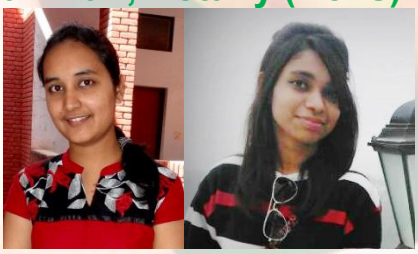
Famous Botanist:

Nikolai Ivanovich Vavilov (1887 – 1943)

Ayushi Gupta, Botany (Hons) II Year
Umama Khan, Botany (Hons) III Year



Nikolai Ivanovich Vavilov was one of the most outstanding Russian scientist of the twentieth century and a pioneer in the field of plant exploration and introduction. He was the son of a Moscow merchant who did grow up in a poor rural village plagued by recurring crop failures and food rationing. Vavilov was obsessed from his childhood with ending famine in both his native Russia and the world.

He is widely known for the popular gene Centre concept of cultivation plants and their wild progenitors. He was a biologist, geneticist, geographer, agronomist, and a plant breeder. Vavilov is recognized as the foremost plant geographer of contemporary times. The scientist formulated very important postulates in genetics, wrote more than ten books, and carried out the gigantic task of organizing a system of agricultural institutions in the USSR. It is noteworthy that all his scientific interests were interrelated. He was the first to see the possibility and the vital necessity of investigating cultivated plants from the viewpoints of genetics, evolution, and geography.

Vavilov wanted to end hunger and famine in the world by breeding super plants with the help of science that could grow in any climate and withstand extreme conditions. He formulated important postulates in genetics and wrote many books. He devoted his entire life to natural sciences. He graduated from Moscow commercial college in 1906. He joined Moscow agricultural institute and graduated in 1910. From 1913-1914, Vavilov worked in laboratories of Great Britain, France and Germany. He also worked as a lecturer at Department of Agriculture at Saratov Agricultural Institute and in 1918 he became professor there.

Under the direction of Vavilov, one of the greatest investigators in crop geography and genetics, extensive collections of cultivated plants and their wild relatives were made by sending expeditions all over the world. His deductions are based on varieties of facts, obtained from sources different from those of his predecessors, such as morphology, anatomy, cytology, genetics, distribution and reaction to diseases. Vavilov made an inventory of the diverse forms of our most important cultivated plants and their distribution of plant species is not uniform.

Theory on the origins of crops was given by Vavilov…..

Vavilov worked hard, and loved his job. “Life is short, there is no time to lose,” he used to say. He left behind a whopping 350 treatises on genetics, biology, geography, and selection. Many of his works have since gone down as famous in the history of science. From 1920 to 1940, Vavilov headed the Lenin All-Union Academy of Agricultural Sciences. He established 400 research institutes that employed up to 20 thousand people. Vavilov and his colleagues conducted extensive germplasm explorations and collections in many parts of the world. In 1926, Vavilov published his “**Studies on the Origin of Cultivated Plants”** which described his theories on the origins of crops. Vavilov concluded that each crop has a characteristic primary center of diversity, which is also its center of origin. Eight areas were recognized and suggested as centers from which all of our major crops were domesticated. Later, he modified his theory to include “**secondary centers of diversity**” for some crops.

In 1920, Vavilov became director of the All Union Institute of Plant Industry. He devoted his life to expeditions to gather plants from around the world. By 1940 Vavilov had a collection of over 250,000 plants, which he used to selectively breed improved crop species.

In 1920, he gave the law of homologous series in hereditary variation. He was not only a great scientist with inexhaustible energy but also an avid traveler. He travelled over five continents during three decades of his scientific work. His main motive and dream was to increase agricultural production and provide humanity with more food. Stalin’s collectivization of farmland caused chaos in soviet food production and millions died. Master plan of Vavilov did not meet the demand of Stalin’s who wanted immediate results. Lenin supported Vavilov but after Lenin’s death when Stalin took over, Vavilov’s dream turned into a nightmare. He was arrested for undermining socialist agricultural reforms and was sentenced to death but later on it was replaced with 20 years of imprisonment. Due to worse conditions of the cell where Vavilov was kept, he suffered from scurvy. This great scientist had a tragic end as he died of hunger in 1943 in Saratov jail on the Volga. His findings and his work is commendable and deserves praise till today.....

References:

- http://www.russiapedia-RT.com
- http://www.wikipedia.com
- Kochhar, S.L., (II ed), 1998, Economic Botany in the Tropics Macmillan Publishers, India Ltd.

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The Flora filled Mountain Spree: “A Botanical Excursion”

Aakanksha Sharma

Botany (Hons) III Year

A four day botanical excursion to the Mountains of Chail, Mashobra, Kufri and Pinjore was organized for the students of II year and III year honors of Botany and Life Science Department from October 4 to October 7 2013. The students were accompanied by Professors Dr. Gita Mathur, Geeta Mehta, Dr. Usha Prasad, Dr. Kiran Prabha and Dr. Aprajita Mohanty.

The children along with the teachers boarded the Shatabdi train from New Delhi to Chandigarh at 7.30 in the morning and were divided into groups of five, each guided by a Teacher and a team leader. On the way, we all were asked to observe the vegetation that we see throughout our whole trip. On the journey to Chandigarh from New Delhi, we saw belts of Eucalyptus Tree, farms of wheat and rice and stalks of sugarcane and ponds full of Water Hyacinth and also Cannabis.

We reached Chandigarh at around 12.00 in the afternoon and from there boarded the bus to Chail. The trail was filled with fun when the children played antaakshri and our wonderful teachers also joined us as well. Time passed with laughter and pleasure and soon we realized that we started to ascend to the mountains. Along the paths, we observed lining the hills was net like sheaths that were methods of controlling soil erosion and landslides. In between, we stopped by, near Shimla where we dropped down to see some lovely flora growing by, which included Equisetum, Urtica (the nettle plant famously known as bicchu booti and Rumex. As we climbed higher and higher the vegetation spun to newer plants like Silver Fern, Opuntia, Xanthophylla, Populous, and what didn’t take our eyes off were the stunning Belts of Pine all over adorned with male and female cones. A common practice Terrace farming also caught our eye.

The sun started to set down and we started to feel a cool breeze blow across our necks and clouds seemed like a soft cushion embellishing the sight, we were at Chail surrounded by majestic Deodars or Cedrus and this feeling was amazingly divine for each one of us. By 6.00 in the evening we reached United 21 Chail Resort where we were greeted with welcome drinks and were accommodated into our rooms. In the night we were served a lavish dinner and then we all took off to sleep to be prepared for our next morning trail.

The next morning all of us after having breakfast decided to trek to the mountains and watch the natural beauty around. The flora of Chail entailed some very beautiful plants ranging from trees that included the *Pinus*, Oak, *Cedrus*, and *Alstonia*, one thing that really startled us and we had always heard our teachers talking about were the Sulphur showers, all roads covered in yellow dust. The Trek also featured some striking bryophytes, ferns and flowers some of them from the list comprise *Plagiochasma, Anthoceros, Pogonatum, Acayranthes, Selaginella, Polytrichum, Marchantia, Zinea, Onychium, Asplenium,* Cock's comb, *Dahlia, Kochia, Salvia*, Cobra plant and many others. Our trek ended at the highest Cricket ground of the world which was 2,444 meters above sea level where we decided to take down some rest and munch on some chips and slurp on some hot tea. Same evening we returned back to our hotel and again took a stroll to the closer mounds, finding some nice wild Mushrooms and also *Puccinia* growing on Barbery bushes. We also met a craftsman who had built a magnificent temple on his own without the use of machines and had embraced the use of natural art using plants for the decoration. Each one of us was highly inspired and encouraged to see the amount of hard work and ideas he had put over to achieve his dream. In all, the day turned out to be successful and brought quite wonderful and astonishing bag of amazements to us, of which we had until only heard or dreamt of in our lives.

On the 6th of October, the period was set off to visit the eminent Regional Horticulture Research Centre of Mashobra very famous for its Apple Orchards and also the renowned Central Potato Research Institute Situated at Kufri. At Mashobra Centre of Regional Horticulture we learnt about how collection, propagation and planting of apples, pears and cherries were done. Some varieties of apples that we were introduced with, were the Red Delicious, Golden Delicious, Gale Gala and silver spur, cultivated pear varieties included Flemish Beauty, Red Barlett and Red Heart, Black Heart and Stella were among the Cherry collections.

The Centre also had Floriculture Cultures in greenhouses of various flowers like *Pelargonium, Fuchsia*, Primroses, *Petunia,* Lisianthus, *Narcissus* and trees such as the *Cryptomeria*, the living fossil *Gingko, Abies* and *Magnolia*. Another Feature of the landmark was the apple museum.

At Kufri, we saw the famous Golf Course and also visited the Central Potato Research Station that was divided into two centers one that dealt with potato nucleus seed production and the other with breeder seed production. Some of the potato varieties developed there incorporated the Kufri khyati, kufri kisan, kufri kundan others which were under processing included Kufri chipsona, Kufri himsona and Kufri frysona. The region was equipped with glass green houses where potato plantations were grown.

After visiting and learning about these two brilliant agricultural constructions, we headed back to our hotel where a delightful surprise awaited us and that was the D.J party. Smiles, lit up on each of our faces and all of us infused with enthusiasm were

ready to rock and roll on our footsteps with the rhythm of the music. Teachers and students all had a ball and enjoyed a marvelous time together dancing and singing. After having an unforgettable gala, we relished the delicious dinner and went to sleep, all ready to set off for our last day at the Mountains and descend back to our pavilion. The last day, we got ready to leave Chail and plunged down the hills where our last stop was the Pinjore Garden. The Garden carried a Mughal impression with beautiful paintings and carvings and water bodies along with several attractive fountains. The garden comprised of Cycas palm, Traveler's palm, Araucaria, Royal palm, Mango trees, Chikoo Trees, Jamun Trees etc.

This was the last stop to our fun filled, knowledge packed, and enriching experience laden trip after which we l boarded the train back to Delhi carrying along with us the exquisite and glorious memories in our heads only to look back once again and share and cherish these memoirs with our friends and family. The Botanical trip to the Mountains came to become a Great triumph in our lives leaving us all with cheerful faces and joyful smiles.

Pinjor Gardens **Photos: Aakanksha Sharma**

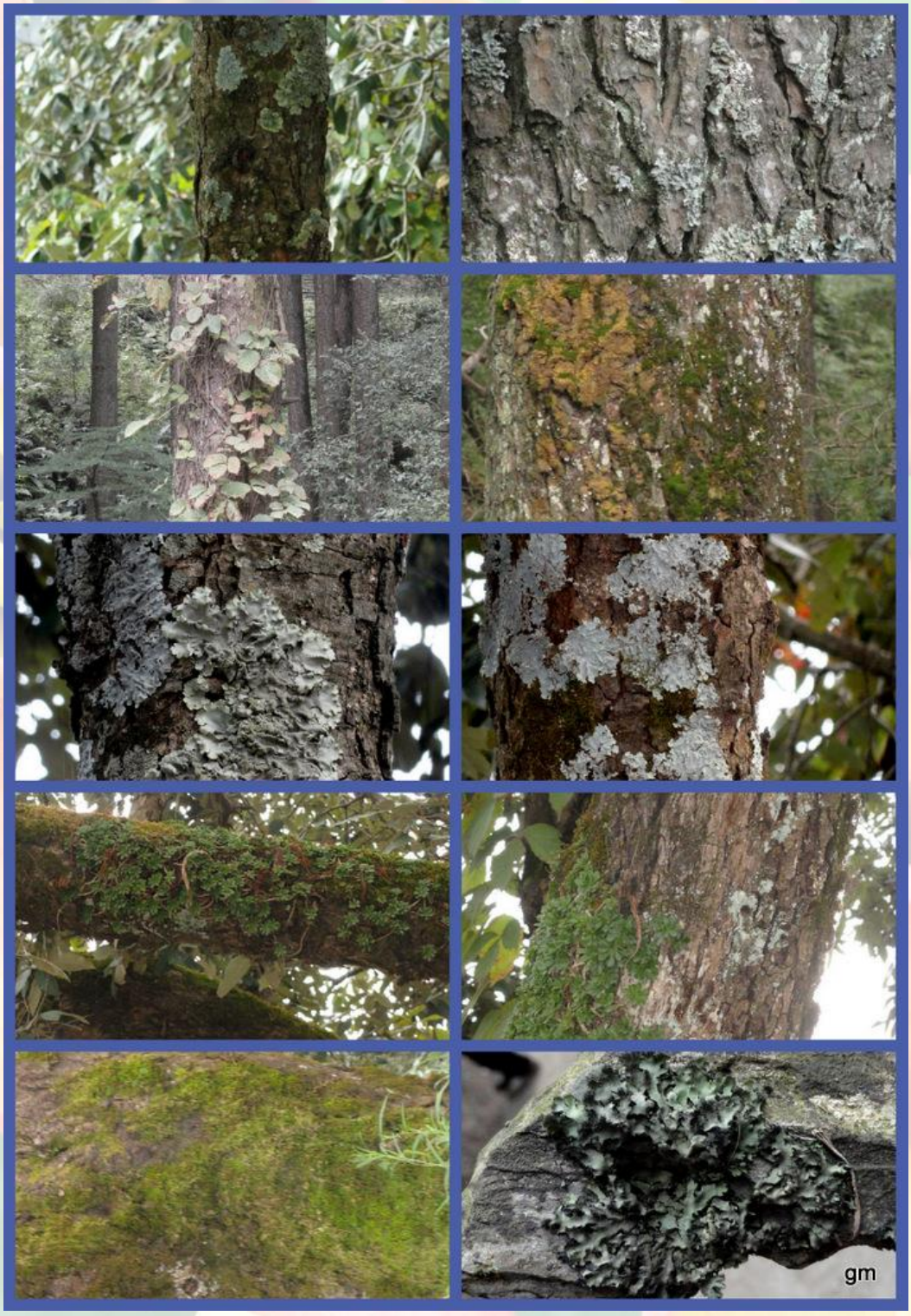
Mechanical methods of conservation of soil as seen in the mountains visited.

Photos: Dr. Gita Mathur

Bryophytes **Photos: Dr. Gita Mathur**

Pteridophytes **Photos: Dr. Gita Mathur**

Gymnosperms **Photos: Dr. Gita Mathur**



Lichens and Epiphytes **Photos: Dr. Gita Mathur**

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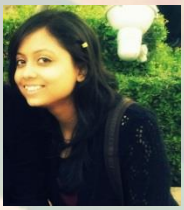
Regional Horticulture Research and Training Station (RHR&TS)

Sharfaa Hussain

Botany (Hons) III Year



A trip was organized by the faculty of Botany to Shimla and we were immensely lucky to be a part of it as it comprised of both knowledge and the beauty of the hills. We visited many places namely Chail, Mashobra and Nalderah (all under Shimla District). Being young Botanist we all were fascinated by the hill forests, the pines. We also got a chance to visit many horticulture based research institute realizing that Plant Science is actually very useful, important and broad.

Personally I was very much attracted by the Regional horticulture research station at Mashobra. It is a Centre for cultivation of many fruits like apple, pear, and cherry and also flowering plants out of which the most interesting to me were the varieties of apples they had. Actually that was the day when I realized that there are more varieties of apple than I ever imagined. I was impressed by their hold on pollinators, pests and other effecting factors for their growth.

Basically after visiting RHR&TS, I was acknowledged by the fact that knowledge of plants can do good to mankind and thus I would like to introduce you to it.

The Regional Horticulture Research and Training station (RHR&TS) of Mashobra (Shimla, Himachal Pradesh) is the main research station under Dr. Yashwant Singh Parmar University of Horticulture and Forestry. It was first started in the year 1953 under department of agriculture and later it was named as regional fruit research station in the year 1958. This station got its initiation by an apple orchard planted by Mr. Alexander Coutts where some of the famous English varieties of apple such as Yellow Newton, King of Pippin and Granny Smith were also introduced. I would like to mention the names of the apple varieties which were cultivated as they sound quite interesting: Royal delicious, Red delicious as standard cultivars. Vance delicious, top red, Hardeman, Skyline, Supreme, Bright-N-early, Real MeCoy as improved early coloring strains. Red chief, Oregon spur, Silver spur, Well spur, Red spur, Starkrimssion delicious, Gold spur, Starkspur golden under spur type cultivators. Scarlet gala, Gale gala, Red fuji, Coe fuji, Early red one, Scarlet spur-II, Oregon spur-II, Gibson golden, Red gravenstein under promising introduction. Red gold, Granny smith, Lord lambourne, McIntosh, Golden delicious and flowering crabs as pollinizers. Ambred, Ambroyal, Ambstarking and Ambrich cultivated as hybrid developers.

This station bears the responsibility of solving problems of temperate fruit and their germplasm conservation. It is in fact the largest germplasm conservation Centre for apples, pears and cherries in India .The common cultivators keenly follow the instructions provided by them. Presently they have 238 apples, 63 pears and 47 cherries. Himachal is now named as “Apple state of India” for which this station has been credited.

Soil and climate: The soil is clay loam to clay. It is fairly deep and slightly acidic with a pH of 6.5. It accounts for an annual rainfall of the area is 135 to 150 cm, most of which is received as monsoon rains during July to September. The temperature experienced during the year ranges from 29.4^{o} C to - 4^{o} C in winter months. It has an area of 64 acres.

Facilities and activities: Teaching, research and extension are the mandatory duties of this station. Their main area of research includes Fruit science, Floriculture and landscaping, Entomology, Plant pathology, Economics and extension education, Tissue culture and Fruit breeding.

Extension activities include farmer’s training programs, melas, exhibitions, workshops and seminars. Special courses, refresher courses and diagnostic team visits are also organized from time to time. Multi-locational trials are laid out to evaluate the performance of promising fruit cultivars in private orchards and PCDO’s. Every year they select 20 students from rural background to impart knowledge on temperate fruit production and floriculture for self-employment. They also transfer their knowledge through Doordarshan and All India Radio (AIR) and publish farmer related papers for their knowledge.

Infrastructure development: Three building blocks that include seven well equipped laboratories, Conference Hall and Library, Meteorological Observatory, Internet connectivity provided by ICAR, Video conferencing facility, Five glass houses and two poly carbonate houses, Cold Storage, Farmer’s Hostel, Packing-cum-Grading House.

I feel grateful and thankful to my department for organizing this ideal trip for us all, and immensely happy to light up my readers about this brilliant welfare executed by RHR&TS towards our country.

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Photo Gallery

Random Shots

Photos Courtesy: IRIS-Photographic Society of Gargi College.

Views on way to Chail Photos: Neha Saini

Exudate from Silver Oak (*Grevellia robusta*) and mushrooms on a fallen log.
Photos: Neha Saini

Mashobra Apple museum **Photos: Neha Saini**

Mashobra Glasshouse flowers Photos: Neha Saini

Roses and Dahlias in my garden. **Photos: Leena Arora**

Gerberas in my garden. **Photos: Leena Arora**

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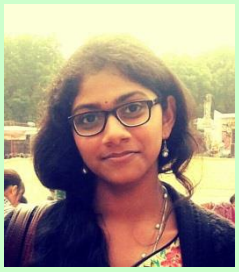
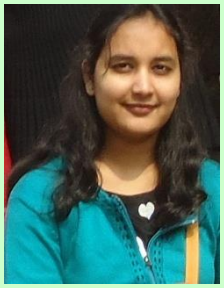
DEPARTMENTAL NEWS

Semester Toppers

Name	Current Class	Result of	Position in Class	Photograph
T.Rajhita	B.Sc. (H) Botany I	B.Sc. (H) Botany I Semester I **Dec. 2013**	I	
T.Ramya	B.Sc. (H) Botany I	B.Sc. (H) Botany I Semester I **Dec. 2013**	II	
Garima	B.Sc. (H) Botany II	B.Sc. (H) Botany I Semester II **July 2013**	I	
Pooja Jangir	B.Sc. (H) Botany II	B.Sc. (H) Botany I Semester II **July 2013**	II	
Aayushi Gupta	B.Sc. (H) Botany II	B.Sc. (H) Botany II Semester III **Dec. 2013**	I	

Garima	B.Sc. (H) Botany II	B.Sc. (H) Botany II Semester III **Dec. 2013**	II	
Prachi Sharma	B.Sc. (H) Botany III	B.Sc. (H) Botany II Semester IV **July 2013**	I	
Charu Singh	B.Sc. (H) Botany III	B.Sc. (H) Botany II Semester IV **July 2013**	II	
Prachi Sharma	B.Sc. (H) Botany III	B.Sc. (H) Botany III Semester V **Dec. 2013**	I	
Charu Singh	B.Sc. (H) Botany III	B.Sc. (H) Botany III Semester V **Dec. 2013**	II	
Shreya Satija	Alumni	Semester VI **July 2013**	I	

Nandini Rajput	Alumni	Semester VI **July 2013**	II	

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Gargi College Botanical Society

Inauguration of TARU 2013-2014

Shreya Tripathi
Botany (Hons) I Year

'TARU', the botanical society which transcends all limits of excellence and potential celebrated its inaugural ceremony on 6th September, 2013.The hallmark of the ceremony was the lecture delivered by Dr. Renu Deswal, Associate Professor, Department of Botany, University of Delhi. The ceremony took place in the seminar hall, the entrance of which was adorned by a beautiful rangoli designed by the students.

The function started with the welcoming of the chief guest Prof.Renu Deswal and our principal Dr.Shashi Tyagi. The lamp was lit by Dr.Priyanka Pandey, D r. Jasmeet Kaur, Dr. Renu and President Neha Tanwar. This was followed by saraswati vandana, which infused a feeling of tranquillity in the minds of all present there. The inaugural speech by the principal encouraged the young minds.

The lecture was attended by the exuberant teachers and students of the botany department. Dr. Renu Deswal delivered the Inaugural lecture on genomics and proteomics approach to identify, characterize, clone and over express seabuck thorn antifreeze proteins (AFP's) for crop improvement and food industry. The second topic which she discussed was proteomics approach for partial characterization of S-nitrosoproteome of *Brassica juncea* and to study the expression of major S-nitrosylated proteins under abiotic and nitrosative stress conditions.

The research dealt with analysis of antifreeze proteins by 2-DE-nano-LC-MS/MS in shoot secretome of *Hippophae rhamnoides* (seabuck thorn), which is also known as Himalayan wonder drug. The plant seedlings were subjected to minus five degree Celsius temperature treatment and the apoplast was extracted in which the AFP activity was detected. The AFPs were purified by IAC or ice adsorption chromatography. This research signifies the low temperature induced signalling in the secretome. The second research deals with the phenomenon of nitric oxide (NO) production during cold stress which regulates genes, diverse proteins including transcription factors and phosphosphingolipids.

Both the teachers as well as the students were equally whole-hearted in listening to the lecture and clearing queries.

In the series of events followed the assigning of badges to the newly elected office bearers, who swore to hold their posts with due allegiance

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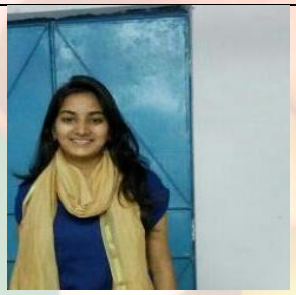
Executive Committee of TARU: Gargi College Botanical Society (2013-2014)

Post	Name	Photograph
President	Neha Tanwar	
Vice-President	Aarti Falswal	
Treasurer	Sanchita	
Secretary	Sakshi	
Executive	T. Rajitha	

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Gargi College Botanical Society (2013-2014)

Annual Report

Taru president –Neha Tanwar

Hello everyone! I am, Neha Tanwar, feeling privileged when writing this report. We all, the member of Gargi college Botanical Society: TARU, started this session (2013-2014) with an Inaugural lecture held on 6th September 2013 on "The Understanding the Regulation of Cold Stress Adaptome" by Dr. Renu Deswal, Department of Botany, University of Delhi.

During mid-semester break in winters, Botanical Excursion was organized for Botany and Life science's students. It was four-day three- night trip. We got a chance to visit Highest cricket ground (Chail), apple cultivation (Mashobra), Highest Golf Court (Naldera), Central Potato Research Institute(CPRI, Kufri), Pinjore Garden (Chandigarh). In Mashobra we were enlightened about apple cultivation-requirement for chilling temperature (-7◦c), Root stock of two types: seedling root stock and clonal root stock, uses of dwarf root stocks, harvesting time and its ways by their office bearer's. CPRI- kufri is one of the 7 potato institute in India. In this institute Germplasm evaluation, morphological description, study of diseases like late blight of potato, True Potato Seed (TPS) technology had been done, varieties of potato like kufri megha, kufri jyoti, kufri chipsona, kufri chandramukhi etc. were produced. On the second day of trip we also went for tracking to see the Vegetation of Chail, many plant species which we were studying in our labs, there it was an amazing experience to see those growing wild in Chail.

Third year students also visited NIPGR: National Institute of Plant Genomes Research. All biology research has been permeated by genomics and new ways of tailoring crops for the economic production of grains, vegetables, fruits, fibers, beverages, herbal medicines, pharmaceuticals and industrial molecules are emerging. Machines involved in Plant Biology such as autoclaves, laminar flow hood, MALDI, Micro-array chips, DNA extraction machinery etc. were also shown.

In this year inter-college Science Festival "SCINTILLATIONS", TARU organized two events: Botanical rangoli and Memory game. Students participated and won prizes, certificates were also given to the winners.

Students from our department have participated in many events; here are the achievements of these brilliant students who are not confined to studies only but to extra-curriculum also.

- Anjali Mehra , II Year, has got several prizes for her singing talent in the following college events:
  1st prize in PGDAV, Jesus and Mary college and Hindu college, 2nd prize in

lady Shri Ram college (DU) and Delhi Technological institute, 3rd prize in Kamla Nehru college.

- Kritika Khanna, II year, silver medal in D.D open delhi state judo championship, Gold medal in Delhi state Judo championship-under 20 category and Bronze medal in women category, Gold medal in LSR tournament, Bronze medal in Inter-college Judo championship, 2nd position in Bharti cup cricket.
- Anindya, II year, 1st at IIT-Kanpur as a part of Kshitij, Samarth, and an initiative to bring visually handicapped students in light. 2nd prize at St. Stephens.
- Srishti Negi, I year, 3rd in REVERIE: Gargi college Annual Fest, in western dance competition.
- Sneh Kunwar, I year, 1st in 100m run and Long Jump in inter-stream competition
- Swasti, I year, 1st in dance at IIT-Kanpur
- Shrishti, III year, has won 1st prize in Memory Game this scintillation
- Neha Kumari, II year, won 1st prize in Botanical Rangoli in Scintillations
- Ramya and Sonia, I year, won 3rd prize in Botanical Rangoli Scintillations.
- T. Rajitha, I year, won 3rd prize in Memory Game scintillation.

Our congratulations to all the winners.

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"SCINTILLATIONS": A REPORT

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Reverie: Gargi Annual Cultural Fest

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Antardhwani: DU Festival and Flower Show

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Presidents of Gargi College Botanical Society

No. of Years old	YEARS	NAME	ADVISOR / S	TIC
Started	1994-95	Kusum Yadav	G Mathur	AC
1	1995-96	Nandini Das	G Mathur	AC
2	1996-97	Saloni Mathur	UP & GMe	LS
3	1997-98	Sarika Upadhyaya	UP & GMe	LS
4	1998-99	Ragini Rai	ST & DJ	KK
5	1999-2000	Sagarika Sarkar	ST & DJ	KK
6	2000-2001	Pinky Aggarwal	KP & AC	ST
7	2001-2002	Ishani Sinha	KP & SD	ST
8	2002-2003	Nidhi Gupta	PM & SD	UP
9	2003-2004	Swati Chugh	BB & SD	UP
10	2004-2005	Neethi V. Rao	GMa & GMe	GMa
11	2005-2006	Neena Priyanka	GMa & GMe	GMa
12	2006-2007	Madhulika & Urvashi Bhatia	KP	KP
13	2007-2008	Bhavya Khuller	GMe & AM	GMe
14	2008-2009	Yashika Sharma	AM & PK	GMe
15	2009-2010	Neha Singh	KP & SV	KP
16	2010-2011	Rashmi Sanchita	PP & LJ	AM
17	2011-2012	Nikita Singhal	IS & PP	AM
18	2012-2013	Nikita Dalal	RMS & JK	JL
19	2013-2014	Neha Tanwar	UP & RSM	UP

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Department of Botany

Faculty

(August 17, 1932 to February 3, 2012)

DR. CHHAYA BISWAS
Founder of
The Department of Botany, Gargi College

Superannuated in 1993 as
Principal, Gargi College

Dr. Shashi Tyagi is now Principal (Officiating) of Gargi College.

Teachers' Day September 5, 2013

Scintillations 2014

Superannuated	**Current Faculty:Permanent**
Dr. Chhaya Biswas	Dr. Shashi Tyagi
Dr. Pushpa Markandan	Dr. Usha Prasad
Dr. Ahalya Chintamani	Dr. Gita Mathur
Dr. Bharati Bhattacharyya	Dr. Kiran Prabha
Dr. Lalita Sehgal	Dr. Geeta Mehta
Dr. Krishna Kumar	Dr. Aparajita Mohanty
	Dr. Priyanka Pandey
	Dr. Leisan Judith
	Current Faculty: Odd Semester
Voluntary Retirement	Dr. Jasmeet Kaur Abat
Dr. Kavita Walia	Dr. Renu Mundhara Soni
Dr. Asha Juneja	Dr. P. Kavita

Dr. Deepa Jethwani	Dr. Geeta
Dr. Shweta Vandana	Dr. Samira Chugh
	Dr. Priyanka Deveshwar
	Dr. Bhawna Madaan
	Current Faculty: **Even Semester**
	Dr. Jasmeet Kaur Abat
	Dr. Renu Mundhara Soni
	Dr. Shachi Aggarwal
	Dr. Vera Kapai
	Dr. Priyanka Deveshwar
	Dr. Samira Chugh
	Dr. Preeti Kaur
	Dr. Leena

Dr. Vera Kapai was awarded Ph.D. at the convocation of University of Delhi, held on March 14, 2014, for her thesis entitled:

"*In Vitro* Plantlet Regeneration and Acclimatization of Orchids: *Cymbidium* Lunalvin 'Atlas', *Thunia venosa* Rolfe and *Vanda testacea* (Lindl.) Reichb. F. and Application of Thin Cell Layer Technique in the Hybrid."

Congratulations!

Laboratory Staff

Superannuated	Current
Mr. H.S. Sawhney	Mr. D.D. Sharma
Mr. Kapileshwar Pandey	Mrs. M.D. Sharma
Mr. P.D. Raturi	Mrs. Shashi Bala
Mr. J.S. Negi	Mr. Ashok Kumar Rana
Mr. Vishwanathan S.	Mrs. Rajni
Mr. Liaquat Ali	Mr. Arun Kumar
Mr. H.C. Dhirwal	Mr. Pancham Singh
	Mr. Vijay Kumar Pandey
	Mr. Om Prakash
	Mr. Sonu Kumar
	Museum Curator: Mr. Ganga Singh

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Alumni of Botany Department, Gargi College

Joyita Deb
Batch of 2008)

I studied in the Botany Dept. of Gargi and graduated in 2008.I studied for a Masters in Molecular Genetics at the University of Leicester U.K. and graduated joint first in the batch of 2008-09. I am currently in the final year of my PhD. at the John Innes Centre.
Email: joyitadeb@gmail.com
Time flies when you are having fun, but when you enjoy your experiences, they remain crystallized in your memory almost frozen in time. My three years at Gargi were much too short and I have too many fond memories to recount. However, the one thing that resonates in all of them is the sense of Belonging. Gargi was a place where I found I could be myself, discover my passions and find friends with whom I still have strong bonds- and this friendship circle includes my teachers as well. I looked forward to college everyday (except perhaps Saturdays!) listening to lectures and taking notes about topics I would never have guessed I would like! I still like identifying mosses, looking at the wonderfully symmetric spore patterns on ferns, trying to identify plant families and looking at pine cones and remembering the term 'Sulphur Showers'. Practicals were fun as all of us worked together and chatted, and when the day came to an end, I remember feeling exhausted but satisfied at the same time. Ficus – The Botanical Fest- was a special time and I remember one year when possibly my entire batch worked together to decorate the auditorium, such a level of team work is very hard to find! I even remember exam times when each one of us found a book with useful notes and we would photocopy it for each other making sure we all had the same material. I think perhaps it was the perfect balance of work and play and an atmosphere of camaraderie that made the whole experience so enjoyable.
Unfortunately, all good things must come to an end and I had to leave the safe haven that I so cherished for three years. But the seeds planted there have been instrumental in shaping my career and developing me as a person. And even after almost six years of leaving Gargi, my friendships and memories remain as fresh as ever….. a friendly chat with a caring teacher, searching for old and much-used books in the library, debates and discussions with friends in the courtyard outside the canteen while munching on warm muffins waiting for the next class to begin.

Priyanka Dhakate
2000-2003 Batch

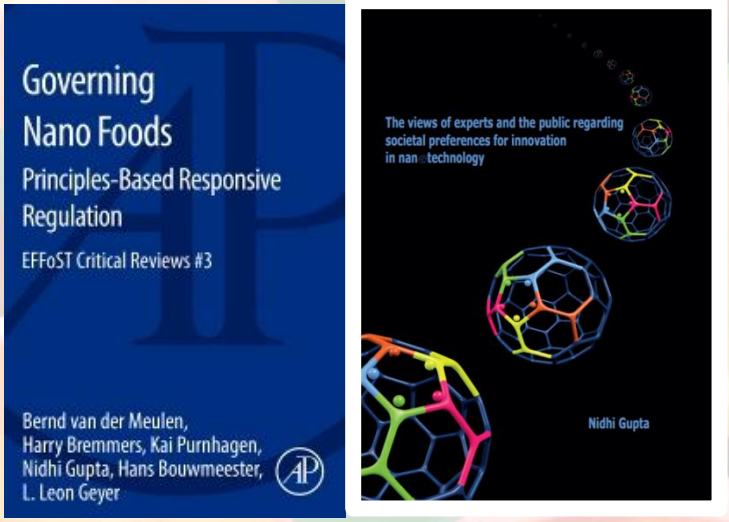
Hi there I am writing in my contribution for Anthesis. This one is for my department. I was too apprehensive to join Gargi college coming from a co-ed education system for 14 yrs. I "choose" Gargi over others for it "Looked well". I know it is too lame a reason but then at that time I really had no clue why I was taking up Botany, likewise the choice of college was no different. This is notwithstanding the respect I have for schools kids who are so aware of their careers. Although a lame way of deciding the college it was the best decision I have made for my life (both professional and personally). We were never told what the best way forward is but were taught how to decide what we want. The best comes to you when you have a guided exposure to all options around and unbiased expert opinions. It is in such environment can anyone take an informed decision. An simple example to this is that while we were studying Botany at the same time we were actively participating in Solid management drive at the nearby locality. This is how at least I think I was driven into research in science in a very organized way. While some of us took upto pure sciences there were so many who have found other spheres of work. I guess we were educated, beyond just academics. I learnt "Its Ok to not be perfect but its absolutely necessary to be aware of yourself and be proud of it". On a personal front, like any college life at Gargi was fun with a BIG twist of long class hours, however that were fun too. Our college prospectus published in 2000 had this line "We turn girls into confident young women" which was second reason of me joining Gargi, for it was something my mom was looking forward to. However, I remember and appreciate it now, as it certainly came true for me (I hope). I would take this opportunity to thank my teachers and also the lab staff from the bottom of my heart. The very fact I can't name a few favourite teachers goes to say that each and every one of the faculty was ABSOLUTELY fantabulous and ohhhh soooooooooooo awesome! I wish all the luck to the girls at Gargi for a bright future. With a hope that we could extend what we know to the society at large. Best Wishes Priyanka Srivastava Botany Hons (2000-2003) P.S : I am married now I am giving my old name in hope that my teachers remember me

Nidhi Gupta, Ph.D.
2000-2003 Batch

Nidhi has been conferred the degree of PhD, from Wageningen University, The Netherlands in 2013. Her thesis focussed on "experts and public view on societal responses to innovations in nanotechnology". During her PhD research she has been invited to present papers at various international conferences. In 2011, she was invited to present a guest seminar at the Australian Centre of Excellence for Risk

Analysis, Melbourne and at the Institute of Environmental Science and Research Ltd. (ESR), New Zealand. In 2013, she was invited to be the guest speaker at the European Commission "Workshop on Nanotechnology" in Madrid, Spain. One of her publications on expert opinion on nanotechnology was picked as research highlight in Nature Nanotechnology. Recently, she has been a co-author of a book entitled "Governing Nano Foods: Principles Based Responsive Regulation".

Nidhi Gupta Studied B.Sc. Hons. Botany at Gargi College. She was the president of Gargi College Botanical Society in 2003.



Manaswini Baldodhia

2006-2009 Batch

First of all, very much thank you for providing the alumnae, the opportunity to share our experiences to the readers of Anthesis. I, **Manasvini**, have graduated in Botany Hons. From Gargi College in 2009 with the rewarding experience. I started my masters in 2010 from Kurukshetra University in Environmental Science and PG diploma in Environment and Sustainable Development from IGNOU alongside. In my Summer Internship (which was a part of the curriculum), I joined as a conservation Trainee in the Natural Heritage Division of Indian National Trust for Art and Cultural Heritage (INTACH), New Delhi for the project 'Conservation Of Urban Biodiversity : A case Study of Avifauna of Southern Ridge of Delhi'. In the final winter of my masters, I explored more on the topic and did my M. Sc. Thesis from JNU with a publication titled 'Urban Avifaunal Diversity: An Indicator of Anthropogenic Pressures in Southern Ridge of Delhi'. The study revolved around the effect of human activities on the diversity, nature and

abundance of migratory and residential birds of South Delhi. Presently, I am working in Vardan Enviro Lab as a water and soil Analyst. Till now I have touched different domains of my subject to expand my knowledge. From my experience I can say that there is so much to learn and to know around you. Keep Learning and sharing.

Looking forward to the upcoming challenges and chances of life.
Manaswini

Rajni
1993 Batch

I joined Gargi College in the year 1993 for B.Sc. (G) Group 'B' Course. I studied here for three glorious years and gained a lot of knowledge from the best of academic faculty in Delhi University.

The faculty members were always helpful and ever embracing. A rare fortune stuck and I became a permanent staff member of my esteemed Alma Mater. I was appointed for the post of Laboratory Attendant in the Department of Botany in the year 2007 and later got promotion as a laboratory Assistant in the year 2012. An enriching experience of learning and working together with the department has been a constant part of my life.

I cherish beautiful memories of attending seminars and enjoying annual cultural festivals and departmental functions. Various research activities are being actively carried out which enable the students to update themselves with the recent trends going on in the field of Biology. Lecture sessions by the eminent speakers are a regular activity of the department. It is a pleasure to learn as you work. Fellow staff members also contribute to my growth in my professional sphere. After seven years it feels like a family to work here.

I am also on the editorial board of eManaswani as the reporter and Joint Treasurer of our college's Alumni Association, "Manaswini". I have been enjoying working for the association and compiling all the activities held by various associations and departments throughout the year.

Kavita Sharma
2006-2009 Batch

People see things; and says, "Why?" But I dream things that never were; and I say, "Why not?'

The above philosophy has played an important role in shaping my objectives and framing my future.

My undergraduate and master's background was of plant biology but my research interest shifted towards human diseases after M.Sc. 1st year summer research project which I did from National Institute of Immunology, Delhi on **Flagellin.** It is a protein that evokes human immune response. My project involved purification of recombinant flagellin and its entrapment in biodegradable polymeric particles. During that time, the focus of my research interest was set on **human diseases and its genetics.** Later, I got the chance to do my dissertation project from National Institute of Plant Genome Research, Delhi where I worked on the genetics of *Candida albicans* which is a human pathogen. The aim of my project was preparing a strain having knocked-out gene which is responsible for its growth.

Presently, I am working in the Institute of Genomics and Integrative Biology, Delhi and here my project research assignment is on '**Genome Wide Association Study (GWAS)'.** It is the technology that measures and analyzes DNA sequence variations across the human genome (~3 billion base pairs) in an effort to identify genetic risk/protection factors for diseases and health that are present in the population and that may predispose them to a disease.

I will be doing SNP genotyping (i.e., above mentioned GWAS) of two well-known cohorts of highland population i.e., healthy natives and diseased natives having hypertension, on **Illumina** platform which helps to apply innovative sequencing and array technologies to the analysis of genetic variation and function.

The ultimate goal of my study is to use genetic risk factors to make predictions about who is at risk and to identify the biological underpinning of disease susceptibility for developing new prevention and treatment strategies.

Sasi Bhatt

1988 Batch

My memories of college days

Gargi College holds a very special spot in my life as I had a wonderful time during those years. I was impressed by the building when I first saw the college. I loved the botany faculty as we really had very good teachers who really moulded us to where we are now. I can never forget our trip to Panchmari in second year as it really helped us to understand and experience the botanical side of nature. I made some really good friends during that time and the friendship is still on.

I still enjoy coming back to college and feel very proud that my best friend Kavita is teaching the students there. I am very pleased to be a part of 1988 batch.

My journey after leaving College

I studied Marketing Management, Public Relations and Advertising after graduation

and worked for different organisation as marketing executive. I got married and went overseas to New Zealand for 4 years. After that me and my family moved to Sydney for better prospects where I started my career in banking and worked in the banking industry for over 12 years. Currently I am working with the Railways of Sydney in the Customer Service Department. I really enjoy interacting with customers and am involved in other projects of the organisation as well. I have two children - my son is in University of NSW doing combined degree in Engineering and Commerce and my daughter is in year 8. I really enjoyed today, meeting my teachers and other staff of the science departments and it was a real honour to meet my favourite teacher Dr. Gita Mathur.

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Botanical Fun Pages

"Riddle Fun"

Aakanksha Sharma

Botany (Hons) III Year

"Kitchen Stars"

Given below are a set of fun riddles related to your kitchen economic botany. Tease your brains and run your minds to find out who these kitchen stars are, by giving their common names, scientific names along with their family to which they belong. Let's see if one can be a flavor saver.

Email your answers to gcbsonline@gmail.com. You may be the winner of a surprize gift!

1. Tall and giant, mush of a grass

A bottle of sweetness, I hold in my stalk, I am calorie carter, but people love me….

Sweet tooth i bring….coz candies and toffees are incomplete without me.

2. Healthy and hearty….tiny little drupe…barrel of fitness, mamma's adore

Nowadays desi samosa, it be, or Italian pizza topping, best oil dressing for a salad, I am a fruit full of talent.

3. High in protein, a miracle plant … shades of grey to farthest black

In my seed's hilum, chunky and chewy a rich source of calcium and iron…., I am proud to be a vegetarian's nutrition pack.

4. Berry Berry, tangy and pulpy…..my drink makes you go fresh and slurpy

Juicy vesicles are my heart, setting me ideal from rest apart; sunny yellow is my color…… pickle, soft drink be it a jam….I am a wealth of vitamin C can.

5. Round and tuber, you can't ignore me…. I have little eyes on my body

Boiled or fried, baked or roasted, easy to a hungry, fast to a meal

Energy bound veggie with a starchy feel.

6. I look like ginger but don't confuse yourself with me…… I am a herb, a

Plant remedy…. Pimples or scars, wounds or cuts, just apply me. I bring life

To the dull boring veggies…I am a robust rhizome, the best cure to your natural medicine store.

7. I am a tropical, a perennial vine…beads of black arranged in a twine…

A pungent aroma, a hot flavor…… soups, beverages, I make them savor

Green on tree, trodden on ground….. King of spices was the fame I found.

8. Classy and expensive…. beauty of Kashmir, tips of red, a violet flowery bed.

A crocin corm, the jewel of sweet dishes, using me in biryanis is a royal norm.

9. A fruiting umbel….green with ridges….tiny little specks

Zest of whiff, sweet or bitter….sauces, liqueurs or pickles,

and a pedicelled neck.

10. The air of hills is filled with my essence

The leaves are the vital part of my presence

Tannins rich, hot or cool, milky, gingery, limy flavors,

Rich or poor everyone favors Morning or evening freshness I bring Indians, Chinese favorite drink.

Crossword Puzzle

Ayushi Gupta
Botany (Hons) II Year

Find out 20 names of instruments and techniques which are used in biology labs from the given crossword.
Email your answers to gcbsonline@gmail.com. You may be the winner of a Surprize gift!

D	R	A	M	I	C	R	O	S	C	O	P	E	S	Q	L
J	A	U	A	U	T	O	C	L	A	V	E	M	H	L	D
O	S	T	S	K	R	K	S	L	A	A	W	Q	L	W	N
J	G	O	S	Z	C	N	H	K	I	D	F	L	P	K	P
C	F	R	S	T	I	T	R	A	T	I	O	N	S	T	C
H	E	A	P	T	S	H	L	D	V	S	A	N	G	E	R
R	W	D	E	A	W	Q	L	W	H	F	L	N	E	B	E
O	H	I	C	B	U	D	J	D	K	H	A	Z	L	H	N
M	U	O	T	W	H	J	B	A	L	J	M	A	F	Q	T
A	V	G	R	A	D	I	O	A	C	T	I	V	I	T	YX
T	I	R	O	G	R	N	M	R	E	W	N	I	L	N	O
O	L	A	P	Y	Y	C	U	N	N	D	A	T	T	G	E
G	L	P	H	L	S	U	T	F	T	F	R	E	E	X	P
R	U	H	O	A	L	B	W	N	R	K	F	H	R	R	S
A	M	Y	T	F	N	A	O	K	I	B	L	N	A	Z	H
G	I	T	O	U	F	T	K	Y	F	Y	O	X	T	K	A
H	N	K	M	W	B	O	L	J	U	C	W	R	I	Y	K
Y	A	T	E	H	H	R	I	R	G	M	N	U	O	L	E
A	T	R	T	S	T	F	U	E	E	D	G	P	N	B	R
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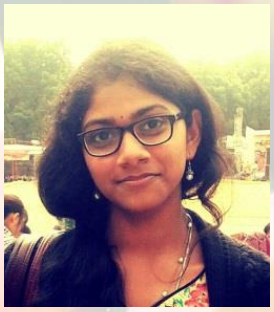
T	R	X	Y	M	I	C	R	O	S	C	O	P	Y	S	J

Poems

The Tree of Sorrow

T. Rajitha

Botany (Hons) I Year



Lush greens, fresh winds
December dawns
Foggy skies, dewy lawns
And a whispering scent

Standing alone
under the shade
over the white sheet
of fallen beauties

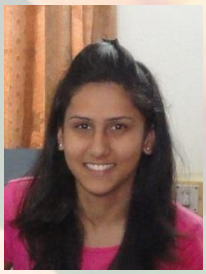
Beckoning
With your sweet scent
luring
with your vulnerable stance

To share the grief
the sorrow
But not your laden beauty
Oh queen of the night!!!!

The Story of a leaf

Nikita Dalal

M.Sc Botany, Department of Botany



I see gold everywhere,

For it is spring, beautiful, adorable.

None admires the beauty,

The aged leaf will soon fall off, hoping to start a new life in the soil,

The leaf has lived its life, it has written its will.

The gentle breeze convinces the leaf to detach from its soul: the tree...

The convinced leaf sways along the wind and lands on the ground.

Even then it was a treat to eyes, even now it is in a different shade of yellow.

Teachers' Day Celebrations 2013

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Farewell to Seniors April 2013

Shalini Singh, Aakanksha Sharma
Botany (Hons) III year

The Departmental Farewell for the batch of 2010 Botany Honors took place on the 11th of April 2013 at 10.00 am at Seminar hall, in Gargi College Delhi. The students were welcomed in a traditional way by placing tilak, showering flowers and offering sweets, performed by Karishma Sharma, Pranati Gogoi, Manisha Yadav and Rinchuila of 2nd year Honors. The event was also joined in, by all our Departmental teachers who made the event much more golden with their presence.

The event was hosted by Shweta Bhati and Swati Garg who began the event by a welcome speech. The affair was followed by a series of games and performances by the students. The main attraction of the event was the Miss Botany competition that comprised of various rounds like, ramp walk, show your talent and question answer round. In between this competition, students enjoyed some games and dance performances, a group dance by Umama, Sharfaa, Shikha, Neha Tanwar and Aakanksha, a duet by Umama and Sharfaa and a solo by Pooja Jangir of 1st Year honors. The students were thoroughly enjoying themselves throughout the episode.

Next, in the series, titles were awarded to all the seniors through a scroll, who were also presented by graduation hats, customized mementoes by the department. The seniors came up on the stage and shared their experiences and times they had spent in the college these last 3 years and expressed their gratitude for the same.

Followed by the title distribution, took place a recital by Pranati and Aakanksha on songs of friendship and college, like, yaaron, pal rahe ya Na rahe kal which left the seniors nostalgic. The performance ended and the judges which were our respective teachers were ready with the winner of the Miss Botany Competition, which went to Miss Aishwirya Dhall who was awarded with a sachet, a bouquet and also a gift by Dr. Gita Mathur.

The occasion concluded with a cake cutting session and photo clicking followed by dancing and singing together by all the students. Each student was also given a food coupon to enjoy a free lunch at the Mithas Restaurant.

Over all the farewell turned out to be a great success with the help of 1st and 2nd year students under the guidance of the departmental teachers, and seniors were bid a happy good-bye carrying along beautiful and cherish able memories along.

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Photos: Dr. Gita Mathur

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ANTHESIS: THE JOURNEY SO FAR

Anthesis was first published in 2005 as a photocopied and spirally bound version; soon we got sponsorships to produce a printed version. Now Anthesis has a new avatar as we are producing e-Anthesis since Volume 6. This electronic version is proof of our concern for the environment as well as our technological advancement. Here's a look at the seven earlier volumes

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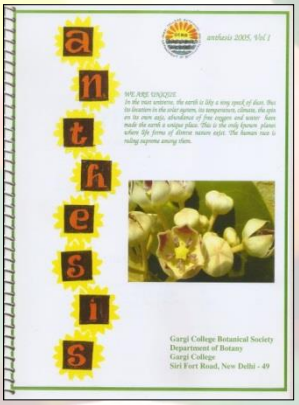

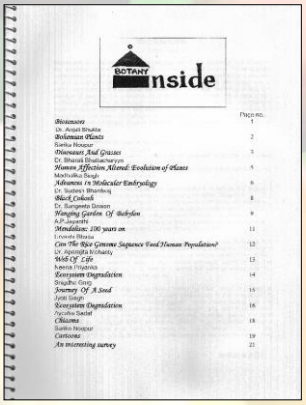

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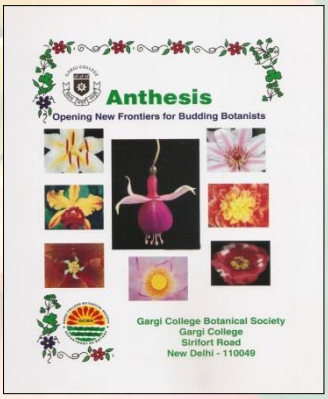

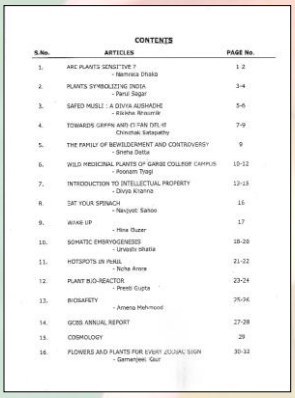

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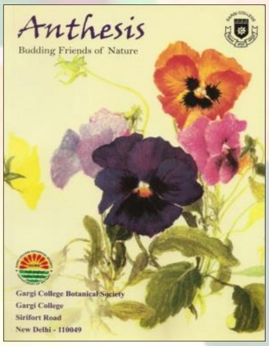

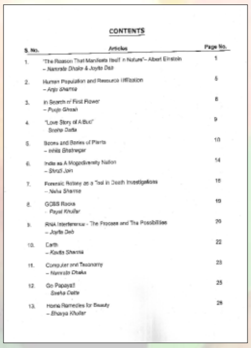

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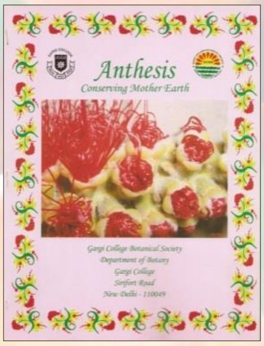

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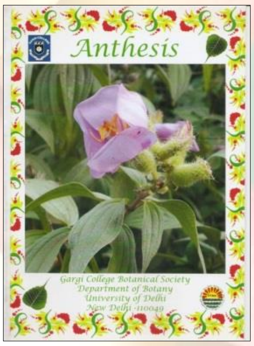

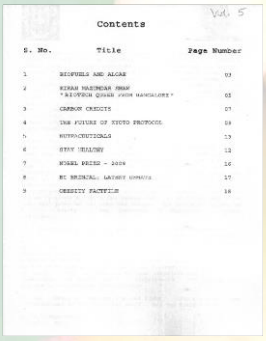

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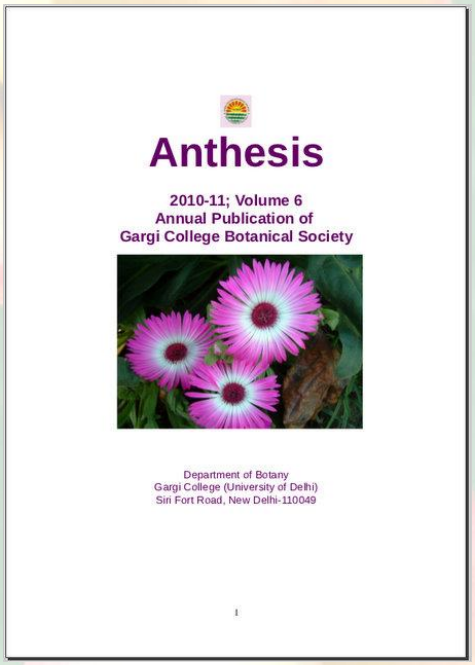

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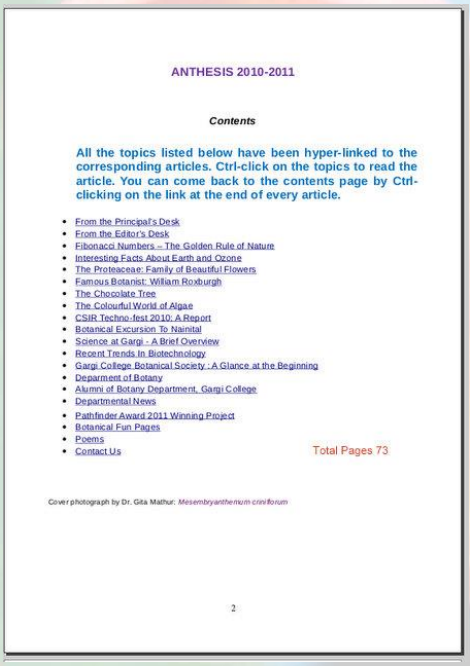

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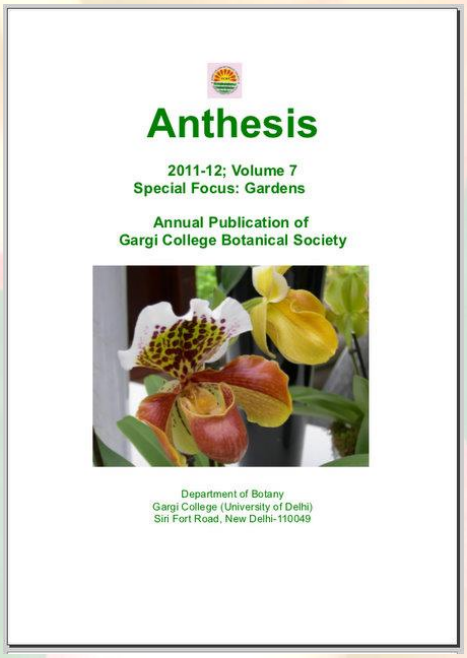

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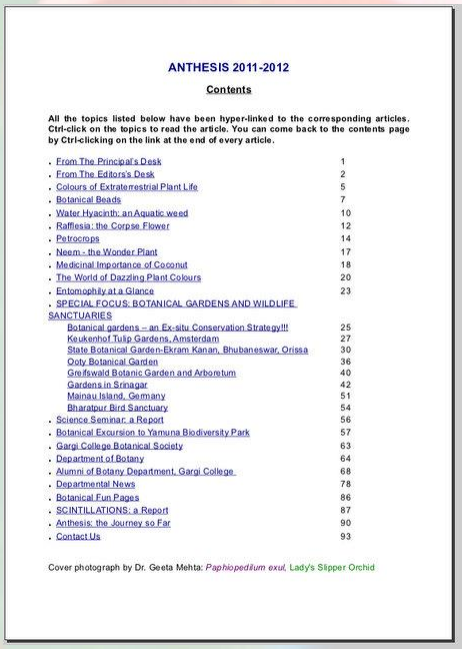

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Cover photograph by Dr. Geeta Mehta: *Paphiopedilum exul*, Lady's Slipper Orchid

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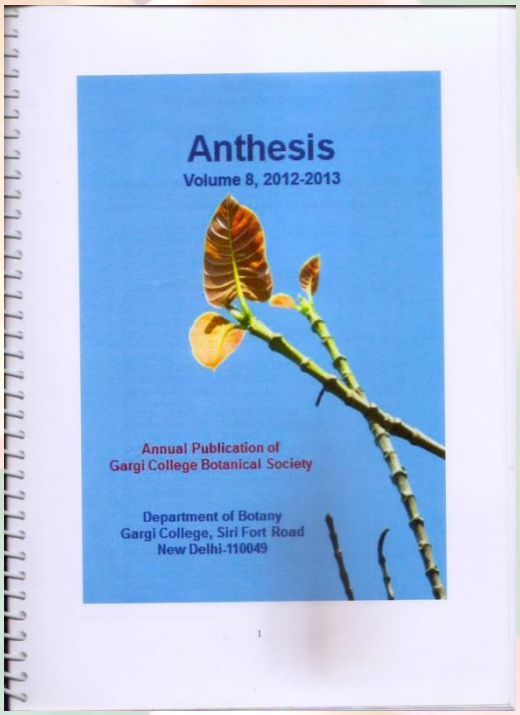

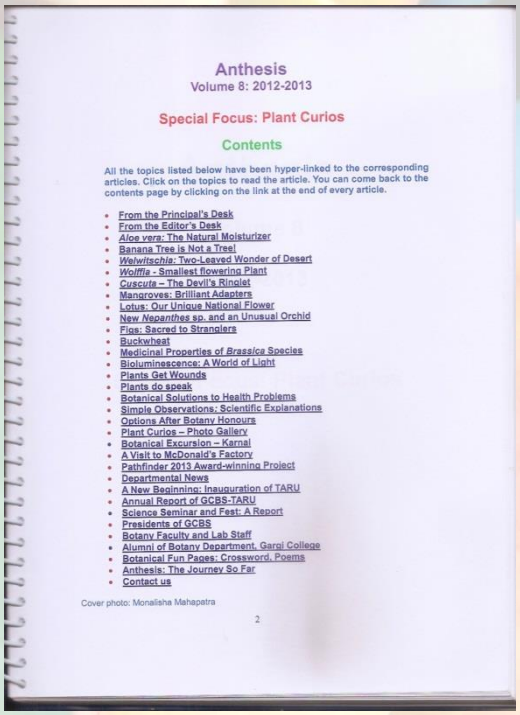

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