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CONTENTS

EDITORIAL :

Translational Research : From Bench to Bedside

Manoj Kumar Chakrabarti

220

ARTICLES :

Protease-An Important Enzyme in Detergent Industry

P.K.Praveen Kumar, M. Sivanandham, Karthick J and C.V.Priyadarshini

222

Role of Genetically Engineered Micro-organism in Environmental Clean-up

Jyoti D. Vora and Ashwati Sarman

227

Biopiracy : The Misappropriation of Indian Traditional Knowledge

Manisha Saini and A. S. Yadav

231

Assignment of Different Colours to Musical Notes in Ancient Indian Literature : A Modern Look and its Scope in Botany

Archan Bhattacharya

236

Chemistry is a Vital Part in Everyday Life

A. B. Naik and P. A. Pawar

245

Cultivation of Tomato in Kitchen Garden by Stem Cutting

D. K. Singh, S. Aswal and I. N. Gupta

249

The Effect of Opposite Physical and Socio-Psychological Conditions Nearly Match

Pooran Koli

252

101st Indian Science Congress- Jammu, 2014 : An Overview & Recommendations

260

KNOW THY INSTITUTIONS

269

CONFERENCES / MEETINGS / SYMPOSIA / SEMINARS

273

S & T ACROSS THE WORLD

276

ISCA PRESIDENTIAL ADDRESS (1986 TO 1991)

| President | Title of Presidential Address* |
|---|--|
| Dr. T. N. Khoshoo 73 rd Indian Science Congress 1986, Delhi | Role of Science and Technology in Environmental Management |
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As per decision of Council meeting held on May 3, 2014, Presidential Addresses will not be printed henceforth in Everyman's Science as they are already printed in the above mentioned book.

EDITORIAL**TRANSLATIONAL RESEARCH : FROM BENCH TO BEDSIDE**

The term translational research first appeared in 1993 and was used in reference to research in cancer. At that time, the literature on cancer research would often use the term translational research to refer to work spanning different types of research, like immunology studies spanning basic and clinical research, or work spanning disciplines within a particular type of research, such as bench research involving molecular genetics and immunology. In the present century translational research is defined as the research that involves moving knowledge and discovery gained from the basic sciences to its application in clinical and community settings. The present concept is often summarized by the phrase “bench-to-bedside” and “bedside-to community”.

Translational research has few areas of translation. One is the process of applying discoveries generated during research in laboratory, and in preclinical studies, to the development of trials and studies in humans. The other area concerns research aimed at enhancing the adoption of best practices in the community. An important aspect of translational research is to develop cost effective treatment strategies and prevention methods. Thus, translational research findings are moved from the researcher's bench to patient's bedside and community.

Translational research fosters the multidirectional integration of basic research,

patient oriented research and population based research, with the ultimate aim of improving the health of the people. This type of research is differentiated into 3 parts, *viz*, T1, T2, and T3. T1 research expedites the movement between basic research and patient oriented research that leads to new or improved scientific understandings or standards of care. T2 research facilitates the movement between patient oriented research and population based research that leads to better patient outcomes. T3 research promotes interaction between laboratory-based research to stimulate a robust scientific understanding of human health and disease. Interaction of several disciplines is required to translate knowledge from one type of research to another. This sort of collaboration amongst different disciplines of research facilitates emergence of novel concepts and approaches to address important health issues which is the main goal of translational research.

In order to flourish translational research requires a knowledge driven system where the components themselves generate, contribute, manage and analyse data available from all parts of the system. The main objective is the creation of a continuous feedback loop to accelerate the translation of data into knowledge and this requires a certain amount of training. Training in translational research varies depending on the background of trainees and the areas of research they

want to pursue. As their educational backgrounds and research interests are diversified, it is absolutely necessary to design a customized curriculum for almost every trainee. Translational research is a cyclic process. It moves from one type of research to another- from basic research to patient oriented research, to population-based research, and back- and involves collaboration amongst researchers from different disciplines. The design of an effective training programme in translational research is a challenge the programme must offer each of its trainees the opportunity to master a combination of skills that are not taught together in normal traditional training. The approach to evaluating the success of translational research training programme must be flexible enough to accommodate the needs of individual institutions and individual trainees within the institutions, but at the same time it must also be rigorous enough to document that the

programme is meeting its short-, intermediate- and long term goals. To commemorate the achievements in translational research, the National Institutes of Health (NIH) has created the Clinical and Translational Science Award. The award is created to accelerate the movement of laboratory discoveries into treatments for patients.

Translational research aims to make findings for basic science useful for practical applications that enhance human health and well being. This type of research is practiced in environmental and agricultural science and also in health, behavioral and social sciences. Translational research is seen as a key component to finding practical applications, especially in healthcare. With its focus on multi-disciplinary collaboration, translational research has the potential to advance basic sciences.

Dr Manoj K Chakrabarti

Director in Charge, NICED (ICMR)

Nothing was ever achieved without enthusiasm

— ***Emerson***

PROTEASE-AN IMPORTANT ENZYME IN DETERGENT INDUSTRY

P.K. Praveen Kumar*, M. Sivanandham, Karthick J and C.V. Priyadarshini**

Proteases are enzymes that catalyze the cleavage of peptide bonds in proteins. Proteases are found in a wide diversity of sources such as plants, animals and micro-organisms. Proteases have applications, mainly in detergent industries. Microbial proteases especially from *Bacillus sp.*, are the most widely exploited industrial enzymes in detergent formulation.

INTRODUCTION

Proteases are degrading enzymes which catalyze the hydrolysis of proteins into smaller peptides or aminoacids. Proteases represent one of the three largest groups of industrial enzymes and account for about 60% of the total worldwide sale of enzymes¹. Microorganisms represent an excellent source of protease enzymes owing to their broad biochemical diversity and their susceptibility to genetic manipulation. Proteases execute large variety of biological functions², to produce cascade systems such as signalling, haemostasis and inflammation, etc.

PROTEASES AND THEIR FUNCTIONS

Protease enzymes are involved in essential biological processes like blood clotting, controlled cell death, and tissue differentiation. They catalyse important proteolysis steps in tumour invasion or in infection cycle of a number of pathogenic microorganisms and

viruses. This makes proteases a valuable target for new pharmaceuticals. Proteases also participate in protein catabolism in degradative or biosynthetic pathways and in the release of hormones and pharmacologically active peptides from precursor proteins. Proteases or Proteolytic enzymes conduct highly specific and selective modifications of proteins such as activation of enzymes by limited proteolysis and collaborate with the transport of secretor proteins across membranes.

In view of the recent trend of developing environmentally friendly technologies, proteases are envisaged to have extensive applications in leather treatment and in several bioremediation processes, and in pharmaceutical industry for preparation of medicines such as ointments for treatment of wounds. Proteases assist the hydrolysis of large polypeptides in smaller peptides and amino acids, thus facilitating their absorption by the cells. The extracellular enzymes play a major role in nutrition due to their depolymerising activity.

Protein engineering techniques have been exploited to obtain proteases of unique

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specificity and for enhanced stability at high temperature or pH or in the presence of detergents and to understand the structure-function relationships of the enzyme. Human Immunodeficiency Virus (HIV) a causative of AIDS, prevents an aspartic protease essential for the retroviral life cycle and it has been a good target for the chemotherapy with specific inhibitors³.

SOURCES OF PROTEASES

Proteases are found in a wide diversity of sources like

Plant Protease : Papain (from Papaya), Keratinases (from some botanical groups of plants) and Bromelain (from Pineapple).

Animal Protease : Trypsin (Porcine pancreas), Chymotrypsin (Bovine pancreas), Pepsin (Pig stomach) and Rennin (calf stomach).

Microbial Protease : Alkaline & Neutral Protease (from *Bacilli sp.*), Alkaline Protease (from *Lactococci sp.*), Acid Protease (from *Aspergillus sp.*).

CLASSIFICATION OF PROTEASES

Proteases are grossly subdivided into two major groups, i.e., exopeptidases and endopeptidases, depending on their site of action.

Exopeptidases cleave the peptide bond proximal to the amino or carboxy termini of the protein, whereas endopeptidases cleave peptide bonds distant from the termini of the protein. The degradation is initiated by endopeptidases followed by exopeptidases at the extra- or intracellular site.

Proteases are also classified into six broad groups based on the aminoacid that it target for action. They are serine proteases, threonine proteases, cysteine proteases, aspartate

proteases, glutamic acid proteases and metalloproteases, which act on metallic proteins.

Moreover, proteases are classified on the basis of their activity in acidity values. Neutrase, a neutral protease, is insensitive to the natural plant proteinase inhibitors and is therefore useful in the brewing industry. Bacterial neutral proteases are active in a narrow pH range (pH 5 to 8) and have relatively low thermo tolerance.

Alkaline proteases have an optimum pH greater than or equal to 9.0. They hydrolyze proteins and break them down into more soluble polypeptides or free amino acids. Alkaline proteases are the most widely used enzymes in the detergent industry.

MICROBES AND MEDIA USED FOR PRODUCTION OF PROTEASES

(a) Industrial Micro-organisms : *Aspergillus niger*, *Bacillus subtilis*, *Bacillus licheniformis*, *Bacillus circulance*, *Bacillus cereus*, *Bacillus alvei*, *Bacillus sphaericus*, *Bacillus pumilus*, *Penicillium janthinellum* & *Nocardioopsis sp.*

(b) Medium-Macronutrients

Industrial Carbon sources : Glucose, Sucrose.

Industrial Nitrogen sources : Ammonium sulphate, yeast extract, Ammonium chloride, Ammonium nitrate, Peptone.

(c) Medium-Micronutrients

Other sources : Potassium dihydrogen phosphate, Magnesium sulphate, Sodium nitrate, sodium carbonate, potassium chloride.

Cheapest sources like groundnut cake⁵, neem seed cake⁶, wheat bran⁵, and sugarcane bagasse⁷ are used as raw materials for the

medium substituent for the production of protease. Rice bran, a by-product of the milling of rice is a good source of proteins at present underutilized as a food material. The use of cheap sources of carbon and nitrogen like wheat bran, corn husk, cassava peel, rice bran, casein, soy meals are important as these can significantly reduce the cost of production of protease.

(d) Protease production and its characterization

Dynamics of protease production from microorganisms is characterized with respect to its optimal value of pH (7-11), temperature (30-80°C), incubation periods (1-5 days after inoculation) and substrate concentration (1-15 mg.ml⁻¹). The biochemical nature of the protease is characterized by studying the effect of metal ions (Ba²⁺, Cu²⁺, Hg²⁺, Mn²⁺, Ca²⁺, Zn²⁺ & Co²⁺) and inhibitors (EDTA & NH₄OH). After inoculation of microorganisms, optimization of protease activity⁸ in production is carried out by incubating the flasks under various optimal conditions, as mentioned above.

(e) Determination of protease activity - Method

The proteolytic activity was assayed by casein digestion method by estimating the Tyrosine amounts after degradation of casein.

Protease activity is represented in terms of Units/ml enzyme, and is derived by :

$$\frac{\mu\text{mole Tyrosine equivalent released} \times \text{Total volume (in ml) of assay}}{\text{Volume of enzyme (ml)} \times \text{Time of assay (min)} \times \text{Volume used in calorimeter (ml)}}$$

One unit of enzyme will hydrolyze casein to produce colour equivalent to 1.0 μmole (181 μg) of tyrosine per minute at pH 8.0 at 37°C⁹.

INDUSTRIAL APPLICATIONS OF PROTEASES

Proteases play vital role in

- Detergents Industry
- Leather Industry
- Food Industry
- Pharmaceutical Industry
- Dairy Industry
- Baking Industry

USAGE OF PROTEASES IN DETERGENTS

The use of enzymes at lower temperatures to be employed and shorter period of agitation are needed, often after a preliminary period of soaking. For an enzyme to be used as a detergent additive, it must be stable and active in the presence of typical detergent ingredients, such as surfactants, builders, bleaching agents, bleach activators, fillers, fabric softeners, and various other formulation aids. In general, enzymatic detergents remove protein from clothes soiled with blood, milk, sweat, grass, etc. far more effectively than non-enzyme detergents.

However, using modern bleaching and brightening agents, the difference between looking clean and being clean may be difficult to discern. At present only proteases and amylases are commonly used. Although a wide range of lipases is known, it is only very recently that lipases suitable for use in detergent preparations have been described.

Enzymes are used in surprisingly small amounts in most detergent preparations, only 0.4-0.8% crude enzyme by weight (about 1% by cost). Although one effect of incorporating enzymes is that lower washing temperatures may be employed with consequent savings in

energy consumption, the enzymes must retain activity up to 60° C.

Detergents such as Tide®, Ariel® and Biz® contain proteolytic enzymes, most of them produced by the members of the genus *Bacillus*. It should be noted that all the proteolytic enzymes described are fairly non-specific serine endoproteases, giving preferred cleavage on the carboxyl side of hydrophobic amino acid residues but capable of hydrolyzing most peptide links. They convert their substrates into small, readily soluble fragments which can be removed easily from fabrics. Only serine protease; may be used in detergent formulations¹⁰: this proteases (eg. Papain) would be oxidized by the bleaching agents, and metalloproteases (eg. Thermolysin) would lose their metal cofactors due to complexing with the water softening agents or hydroxyl ions.

DESIGN OF WASHING POWDER

2% protease of enzyme free washing powder solution is taken in test tubes. Strips of photographic films about 4 mm wide is added to the washing powder solution. Incubation in a water bath at 50-60 °C is done for 30 minutes with gentle agitation. Various pH concentrations of protease enzyme are tested with photographic film for detergent activity. The pictures on film are made from silver halide crystals held in a gelatin layer. As the protease enzyme breaks down the gelatine, the crystals are released and the picture disappears indicates detergent activity of protease as shown in Figure 1.

Legend :

Protease enzyme produced in various optimized conditions is estimated for detergent activity by time taken for decolorizing of photographic film in solution.

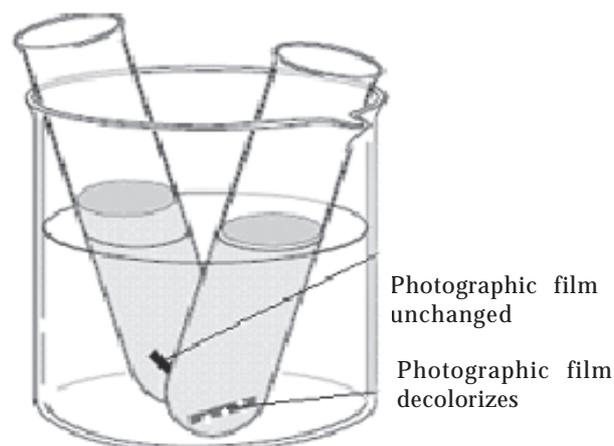


Figure 1. Photographic film decolorizes in detergent solution as protease degrades

CONCLUSION

Proteases are a unique class of enzymes, since they are of immense physiological as well as commercial importance. The biodiversity represents an invaluable resource for biotechnological innovations and plays an important role in the search for improved strains of microorganisms used in the industry. A recent trend has involved conducting industrial reactions with enzymes reaped from exotic organisms that inhabit hot waters, freezing Arctic waters, saline waters, or extremely acidic or alkaline habitats. Exploitation of biodiversity to provide microorganisms that produce proteases well suited for their diverse applications is considered to be one of the most promising future alternatives.

The existing knowledge about the structure-function relationship of proteases, coupled with gene-shuffling techniques, promises a fair chance of success, in the near future, in evolving proteases that were never made in nature and that would meet the requirements of the multitude of protease applications. Advances in microbiology and biotechnology have created a favourable niche for the

development of proteases and will continue to facilitate their applications to provide a sustainable environment for mankind and to improve the quality of human life.

REFERENCES

1. R N Z R A Rahman, M Basri, A B. Salleh *Annals of Microbiology*, **53**, 199-210, 2003.
2. Elmore Susan, *Toxicology Pathology*, **35**, 4: 495-516, 2007.
3. H M Abdel Rahman, G S Karamany, Koussi EI N A, Youssef N A , Y. Kisso Y. *Current Medicinal Chemistry*, **9**, 21, 1905-1922, 2002.
4. Tuhina Verma, Vandana Baiswar, Isolation and Characterization of Extracellular Thermoalkaline protease producing *Bacillus cereus* isolated from tannery effluent, *The IJES*, **2(7)** : 23-29, 2013.
5. PK Praveen Kumar, V. Mathivanan, M Karunakaran M, S Renganathan S and S Sreenivasan. *Indian Journal of Science and Technology*, **1** (4), 2008.
6. R. Sumitra, KS Sudheer, L. Christian, RS Carlos, P. Ashok. *Bioresource technology*, **98**, 2000-2009, 2007.
7. P. Rathakrishnan, P. Nagarajan, T. Rajesh Kannan, *Research in Biotechnology*, **3** 4, 1-10, 2012.
8. Fikret Uyar and Zubeyde Baysal, *Process Biochemistry*, **39**, 1893-1898, 2004.
9. S. Geethanjali and S. Anitha, *Enzyme Research*, Article Id, **874050**, 1-7, 2013.
10. Wellingta Cristina Almeida do Nascimento and Meire Lelis Leal Martins, *Brazilian J. Microbiol*, **37**, 307-311, 2006.

ROLE OF GENETICALLY ENGINEERED MICRO-ORGANISM IN ENVIRONMENTAL CLEAN-UP

Jyoti D. Vora and Ashwati Sarman

It has become need of the hour to implement remedies to protect our environment from getting depleted and degraded. Since centuries studies are done to discover ways to degrade the toxic pollutants which are thrown out into the environment due to man-made factors. However, a new method of using genetically modified micro-organisms has come into limelight due to its advanced, ecofriendly characteristics and enhanced degrading capabilities. Here the significance and approaches for utilizing genetically modified organisms in elimination of environmental toxins are highlighted.

In the present environment urbanization and highly evolved technology have led to various significant advancements. However this has given rise to significant increase in the concentration of toxic pollutants or xenobiotics in the environment. Some of the most dangerous among man made substances, are Chlorophenols, Nitrophenols, Benzene, Ethyl Benzene, Toluene, Xyrene, polychlorinated biphenyls and organic solvents. The main sources of these compounds are coal gasification, refinery, petrochemical plants and industries involved in the synthesis of chemicals, pesticides and herbicides. These toxic substances are carcinogenic and mutagenic and their rate of degradation is very slow. They are thus retained in the environment for a long period of time. Thus the removal of these recalcitrant substances is an essential quest in the sustainable management of pollution. In order to make

the treatment of organic pollutants more ecofriendly, techniques involving biological methods were introduced. Thus a safe and cost effective technology called bio-remediation was adopted which to a large extent helps in solving the problem of contamination. Bioremediation refers to a process which promotes degradation of organic wastes and removal of contaminants from the environment using microorganisms and their enzymes. Majorly bioremediation can be classified into types, namely, *in-situ* bioremediation which involves bio-augmentation, bio-stimulation and bio-venting and *ex-situ* bioremediation involving land farming, bio-piles and bio-reactors.

Many species of microorganisms are able to break down and degrade the contaminants, thus bioremediation techniques employ microorganisms. These microorganisma have the ability to decompose or transform hazardous substances into less toxic metabolites or they degrade the substances into less toxic end products. This process is

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called as co-metabolism. In this process transformation contaminants yields little or no benefit to the cell, thus this process is non-beneficial biotransformation.

In the late 1970s and early 1980s, the development of genetic engineering techniques and intensive study of metabolic potential of microorganisms led to the design of genetically modified organisms. The advancements in the studies has enabled in better understanding of biochemical reactions, many degradative pathways, enzymes and respective genes dealing with degradation of organic substances. This knowledge helps in the generation of engineered microorganisms having new metabolic pathways. Genetically engineered or modified microorganism is the one whose genetic material has been altered using genetic engineering techniques which is carried out by natural exchange of genetic material between the microorganisms. The techniques which are employed are collectively called as recombinant DNA technology.

These genetically engineered microorganisms show enhanced degrading capabilities of wide range of organic and chemical contaminants present in the environment. Molecular biology has helped in creating innovative approaches to reduce the level of toxic organic compounds in the environment by maintaining the ecological status. Gradual studies helped in identification of genes responsible of the degradation specific environmental pollutants. For the degradation of different compounds specific set of plasmids are required. Few categories of plasmids are as follows :

OCT plasmids degrades octane, hexane, decane ; XYL plasmids degrades xylene and toluenes ; CAM plasmids decomposes camphor; while NAH plasmid is found to degrade naphthalene.

In 1981, in USA the first two genetically modified strains of *Pseudomonas aeruginosa* *Pseudomonas putida* were patented. They were found to contain genes for degradation of naphthalene, salicylate and camphor. Later on in 1970, genetically engineered microorganisms called super bug was constructed. It had the property of degrading oil by the transfer of plasmids. It could degrade a number of toxic organic chemicals like octane, hexane, xylene, toluence, naphthalene and camphor. Proper identification and subsequent manipulation of specific genetic sequences helped in the development of genetically modified microorganisms. These genetically modified microorganisms have the ability to degrade wide range of xenobiotics and they have the potential for bioremediation in the environment. The genetically engineered microorganisms are designed on the basis of information of interaction between the microorganisms and the xenobiotics, the genetic basis of interaction, biochemical mechanisms, operon structure and ecological application. Genetic engineering of endophytic and rhizospheric bacteria for use in plant associated degradation of toxic compounds in soil is considered as one of the most promising new technologies for remediation of contaminated environmental sites. There are three criteria that has been recommended to select a suitable strain for gene recombination to generate the new organism having improved characteristics which are as follows :

1. The strain should be stable after cloning and the target gene should have a high expression.
2. The strain should be tolerant or insensitive to the contaminant and
3. Some microbial strains can survive only specific plant rhizosphere.

There are several approaches which are followed for the construction of genetically engineered microorganism for bioremediation application. The first approach involves the proper identification of organisms suitable for the modification with specific relevant genes. As example to explain is, as many microorganisms are well adapted to survive in the soil environment and these microbes may not be able to survive in aquatic environment. Thus genes from aquatic microbes can be used to develop genetically engineered microorganisms by inserting the gene in specific microorganism for bioremediation of aquatic sources. Adoption of such technique reduces the need for supplementation of nutrients into the inoculated environment thus reducing the cost incurred and maintenance required.

Second approach involves suitable pathway construction, extension and regulation. The aim of developing a genetically engineered microorganism is to improve the existing catabolic pathways to degrade those compounds which are not degraded by using wild strain. When multiple genes of desired characteristics are introduced in a single microorganism, the genetically modified microorganism will possess degradation capabilities of different microbial communities due to alteration of gene sequences. Thus it improves the efficiency of catabolic pathways.

The third approach involves the modification of enzymes specificity and affinity. During the process of modification of micro-organisms, enzymes that are produced by transcription and translation of specific genes mediate the metabolic pathway. The genetically modified organisms are produced by gene cluster. These gene cluster alter the enzyme activity and substrate specificities, thus improving the

transforming and degrading capabilities of the microorganisms.

Fourth approach involves proper monitoring and control and bioaffinity, applying sensor applications for chemical sensing toxicity, reduction and end point analysis. In this approach certain gene are introduced in the microorganism which themselves monitor the bioremediation and degrading processes. For example, bioluminescence can be easily detected and this do not require expensive devices or addition of chemical or reagents. Thus genes of bioluminescent organisms can be introduced in desired micro organism. This also helps to understand the spread of microorganisms in polluted area and also indicates the end point of bioremediation process.

Construction of strains with broad spectrum of catabolic potential with heavy metal resistant traits make them ideal for bioremediation of polluted environment in both aquatic and terrestrial ecosystems. The development of genetically engineered microorganism is done with the aim of overcoming the drawbacks of using wild species of microorganisms. Before selecting the strains of microorganisms for bioremediation, all the Xenobiotic and organic waste present in the multicontaminated site should be studied. If the genetically engineered microorganisms are to be used in anaerobic environmental conditions, then these microorganisms are developed by inserting genes for oxygenases during modification by recombinant DNA technology.

The genetically engineered microorganisms offer properties of many microorganisms as insertion of many microorganisms as insertion of genes is carried out in a single microorganism. Thus, these microorganisms can successfully be used in bioremediation

techniques. An optimal clean-up agent with respect to the genetically modified microorganisms are those which displays maximum degrading or catalytic ability with minimal cell mass. It is of utmost importance to ensure that the use of genetically modified microorganisms will not pose as a risk to the environment and human health. Usually microorganisms or Genetically Modified microorganisms (GMM) use the organic waste as the source of carbon, nitrogen and energy. However, they may disperse in an uncontrolled manner and may cause adverse effects in the environment.

Scientists have been developing a novel strategy to construct Suicidal Genetically Engineered Microorganisms (SGEMs) to minimize the hazards that may be caused and to achieve efficient and safe decontamination of the polluted sites. To design a novel SGEMs is based on the knowledge of killer-antikiller genes which is responsible to make microorganisms susceptible to programmed cell death after the completion of degradation of

organic wastes. This technology is very beneficial as it eliminates the microorganisms after degradation of xenobiotics by their autolysis. Thus it reduce the risk to environment and human beings. Nowadays, as the problem of toxic waste accumulation is every increasing, a relatively safe and cost effective technique is necessary to tackle this problem and application of genetically engineered microorganism in bioremediation of toxic waste has proved to meet this need as it follows eco-friendly and human-friendly approaches.

REFERENCES

1. S. Kulshreshtha, *J Bioremed Biodeg*, **4**, 133, 2013
2. A. A. Snow, D. A. Andow, P. Gepts E. M. Hallerman, *Ecological Applications*, **15**, 2, 2005.
3. Md Abdul Kalam Azad, Latifah Amin *Chinese Science Bulletin*, 2014.
4. [www. bioetika.edublogs.org](http://www.bioetika.edublogs.org)
5. www.jstor.org

BIOPIRACY : THE MISAPPROPRIATION OF INDIAN TRADITIONAL KNOWLEDGE

Manisha Saini and A. S. Yadav

India is one of the twelve mega biodiversity countries of the world and holds rich treasure of traditional knowledge but because of the biopiracy it is spared of the benefits out of its natural resources, so an efficient legal uphold against biopiracy assumes huge importance for India to preserve its medical heritage.

INTRODUCTION

The advances in biotechnology in the last few decades have played a crucial role in the development of agricultural, pharmaceutical and medical industries. The biotechnology is a billion dollar industry today, so the inventors in this field prefer to follow intellectual property rights system to protect their inventors. The multinational pharmaceutical companies have found a way to patent the plant products and genetic material and thus claim these products as their own inventions¹. These companies also take the cultural knowledge associated with the plant without having prior consent from the indigenous people that have been cultivating these plants in their fields for several generations, thus depriving them of their share of benefits emerging out of the commercialization of these products. In this way these corporations are getting rich while the indigenous people and the countries that are the main origin of that research are still struggling for survival. Most of the world's biodiversity rich countries are the developing

countries like India that are located in the tropics. These countries could have benefitted largely by trading their biological resources and the traditional knowledge associated with them^{2, 3}. But this is not the case. The giant corporations of the developed countries who are involved in the misappropriation of the biological resources and the traditional knowledge associated with them without prior consent from the country of main origin of such resources are the major players of this game and the indigenous people of the developing countries who have been cultivating these crops for years in their fields are their victim. The most tragic situation is when the countries that are the main source of origin of the biological resources have to pay higher prices for the seeds and the medicines derived from these resources. In the developing countries like India, the knowledge of these biological resources has been conserved in their cultures for centuries and passed from generation to generation and has become common among the people and belongs to the whole community. The concept of intellectual property rights is unknown to these people. Hence, no patent had been claimed in the past for these resources by anyone in these

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countries. The intellectual property rights allow the monopoly on the common goods of human exercise that are naturally occurring like air, water and plants. But now a days, these are being co modified through proprietary rights on biological inventions⁴. Biopiracy came into existence in 1980s when the developed countries blamed the developing countries of ruining their intellectual property rights and causing loss to their corporations in case of drugs, product design, trademark and computer software⁵. Biopirates are the persons or the countries that use the intellectual property rights to access, utilize and benefit from the biological resources and the associated traditional knowledge without having consent from the original innovator and without having benefit agreement with them⁶. According to Dr. Vandana Shiva (2001), a biologist from India, biopiracy refers to “the use of intellectual property systems to legitimate the exclusive ownership and control over biological resources and processes that have been used over centuries in the non-industrialized cultures”⁷. Biopiracy poses a threat to the traditional knowledge as well as sovereignty of the developing countries to utilize and benefit from their own biological resources.

The present paper is a review of the various studies that have been done in the field and throws a light on the current knowledge on the concept of biopiracy, its effects, consequences and various case studies in India. The paper has been derived from various relevant research articles and journals and is a summarized review of literature.

CASES OF BIOPIRACY IN INDIA

The appropriation of biological resources and traditional knowledge of indigenous people would affect food security, livelihood of the indigenous people and consumers' choice⁸.

Patenting of our own fundamental crops like wheat, rice, maize will pose threat to the consumers. Many countries have prohibited the patenting of biological material, for example European Patent Convention (1975) stated that no one could patent whole plant varieties. The patenting of biological technology will encourage monopoly control of plant material by the developed countries and their corporations while the farmers' varieties will be vanished posing a threat to the biodiversity and conservation as well as survival of the farmers⁹. India, a country of immense heritage of nature which has a rich treasure of biological resources and the traditional knowledge is one of the main victims of biopiracy. There are several cases of biopiracy, which have come to the front in the recent few years.

The most renowned is the case of neem (*Azadirachta indica*) as a fungicide which has finally been won after a ten year long battle at European Patent Office (EPO). Neem has been used in India by the common people for several generations as a fungicide and has been cited in the various literatures of the country as ayurvedic medicine to cure various skin diseases and fungal infections. The patent right on the method for controlling fungi on the plants by aid of hydrophobic extracted neem oil had originally been granted by the EPO in 1994 to the United States department of agriculture (USDA) and the New York based multinational agribusiness corporations WR Grace. In opposition, Dr. Vandana Shiva, director of Delhi-based Research foundation for Science, Technology and Ecology (RFSTE), Ms. Megda Aelvoet of the Green group in European Parliament and Ms. Linda Bullard of International Federation of Organic Agriculture Movement (IFOAM) jointly filed case against the grant of this patent in 1995. They claimed that the fungicidal property of

neem had been in traditional knowledge of Indian people for centuries, so the patent granted to USDA was not only unfair was illegal also due to lack of novelty in the claimed patent. As a result EPO revoked the patent in 2000 and finally the patent was revoked for the last and final time by EPO in March, 2005⁹.

Another case was the turmeric patent case. The turmeric patent had been granted to two non-resident Indians in 1995 for "use of turmeric (*Curcuma longa*) in wound healing". These two non-resident Indians were associated with the University of Mississippi Medical Centre, Jackson, USA. Turmeric has been used in India for several centuries by the common people of this country for many purposes like as a painless antiseptic and as kumkum in Hindu temples and in many diseases and it is also in the literature of country. The patent was revoked on the basis of lack of novelty¹⁰.

The case of basmati rice variety named "Texmati" is also a well renowned case of biopiracy and unfair patenting in India where a Texas, US based company Rice Tec in 1997 patented a strain of basmati rice crossed with a semi-dwarf variety. The claimed variety was the communal property of northern Himalaya's rice growers and hence the patent was illegal and Rice Tec chose to withdraw its claims¹¹. Several other basmati varieties need to be patented by India as these are the local varieties of people in Haryana, Himachal Pradesh and Punjab.

The case of production of BT Brinjal (also known as egg plant) by Monsanto, US, one of the world's largest biotechnological companies and its attempt to steal nine indigenous brinjal varieties and genetically modify them is another controversial case of biopiracy. In 2005, the company through its Indian subsidiary

Mahyco and some agricultural universities in India, inserted a bacterial gene into the indigenous variety of brinjal and the modified variety were sown in some parts of the fields for trial in the country. Monsanto tried to claim the variety and commercialize it as its own invention without asking India's National Biodiversity Authority (NBA) for consent. In opposition, NBA announced to prosecute Monsanto for carrying out its research without seeking its permission and consent of the farmers who have been cultivating the indigenous varieties of brinjal in their fields for several generations and violating the India's Biological Diversity Act, 2002 which states that if the companies want to genetically modify the indigenous varieties of seeds and plants for research or commercialization purpose, they must obtain prior consent of the authority¹².

These are not the mere cases of biopiracy in India. There are several cases which have made a huge hue in the recent few years. Patent on karela, amla, anar, gulmendi are still needed to be revoked. The use of karela (bitter gourd, botanical name is *Momordica charantia*), jamun (*Jambulina sp.*) and brinjal (*Solanum melongena*) for control of diabetes is a common practice and it is a traditional knowledge of common people in India. So the patent which is claimed by the US Company for the use of karela or jamun in controlling diabetes is false since it has been known and documented widely in Indian medical literature^{13, 14}. Several other ayurvedic preparations are still pending to be patented. Some of them are: the composition for treatment of asthma, the composition for treatment of diabetes (use of aloe vera and cinnamon for curing diabetes), anti-inflammatory composition for healing wounds and for skin diseases and many others which

are documented in the Indian medical literature. The Traditional Knowledge Digital Library (TKDL), which is a collaborative project between Council of Scientific and Industrial Research (CSIR), Ministry of Science and Technology and Department of Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homoeopathy (AYUSH) and Ministry of Health and Family Welfare, involves documentation of such traditional knowledge available in public domain from the existing literature related to Ayurveda, Unani and Siddha in digitized format, in five international languages which are English, French, German, Spanish and Japanese. So far, the TKDL includes about 2.12 lakh medicinal formulations (Ayurveda: 82,900; Unani: 115,300; Siddha: 12,950), from 148 books available in public domain. Several yoga postures from different books on yoga are also included and transcribed. Government of India, on 29th June 2006, approved to provide the access of TKDL database to International Patent Offices, under Non-disclosure Agreement, between CSIR and respective International Patent Office so that all these tradition knowledge of Indigenous people could be saved from bio-pirates^{15, 16}.

It is clearly evident from all these cases that biopiracy causes serious social and economic damage to the developing nations. So there is an urgent need to implement such systems which can prohibit or limit such activities. Several conventions have been made like Convention on Biological Diversity (CBD) which attributes to create a fair management system for intellectual property and biological resources. But there are also conventions like Paris convention and TRIPS agreement that deal with the industrial properties and provide the basis of biopirating to these corporations. But after the intervention of developing countries in the reviews of TRIPS agreement

in 1999, TRIPS had to be in harmony with CBD on Oct 29, 2010. There are more than 100 million plants that are still in waiting list at US patent office. India is not the only country who is suffering from the crisis due to piracy but there are many other countries like most of the African countries that are facing the biopirates. But India is leading battler against these biopirates¹⁷.

REFERENCES

1. Runguphan and Titima, Biopiracy in Asia. The University of Hong Kong, 2004. (Retrieved from <http://hdl.handle.net/10722/30867>).
- 2, K. Das, Combating biopiracy - the legal way, 2005. Retrieved from: www.indiatogether.org/2005/may/env-biopiracy.html.
3. Convention on Biological Diversity. (1992). Text of the Convention: Article 1. Retrieved from <http://www.cbd.int/convention/text/>
4. Secretariat of the Convention on Biological Diversity 2002, Convention of Biological Diversity. <<http://www.biodiv.org/convention/articles.asp>> accessed on 2 Aug., 2002.
5. W. Lianchamroon, "Biopiracy," The Research Programme on Bio-piracy in Thailand. Bangkok: The Thai Network on Community Rights and Biodiversity, 1998, **2541**, pp 5-12.
6. Genetic Resources Action International (GRAIN). Biopiracy, TRIPs and the Asian Rice Bowl. 2002. www.grain.org/publications/rice-en-p.html.
7. V. Shiva, "Biopiracy," Protect or Plunder? : Understanding Intellectual Property Rights. 2001, pp 49-68, Zed Books, London.

8. V. Shiva, *Biopiracy : the plunder of nature and knowledge* Boston, 1997, pp 7-18 South End Press, Boston Mass.
9. Sharma and B. Ashok. "EPO revokes neem patent rights", *The Financial Express*, March 10, 2005.
10. <http://www.goodnewsindia.com/Pages/content/traditions/turmeric.html>
11. <http://www.grain.org/article/entries/27-biopiracy-trips-and-the-patenting-of-asia-s-rice-bowl>.
12. <http://www.thehindu.com/news/national/article2340768.ece>
13. <http://www.progress.org/patent03.htm>
14. <http://www.twinside.org.sg/title/tur-cn.htm>.
15. <http://www.tkdل.res.in/tkdل/langdefault/common/Biopiracy.asp?GL=Eng>
16. Traditional Knowledge Digital Library AYUSH.
<http://indianmedicine.nic.in/showfile.asp?lid=316>
17. V. Shiva. "Abduction of Turmeric provokes India's wrath", 2002, Good NEWS India.
<http://www.goodnewsindia.com/Pages/content/traditions/turmeric.html>

ASSIGNMENT OF DIFFERENT COLOURS TO MUSICAL NOTES IN ANCIENT INDIAN LITERATURE : A MODERN LOOK AND ITS SCOPE IN BOTANY

Archan Bhattacharya

In some ancient Indian literature specific colours have been allotted to different Indian musical notes. Apparently it might appear as chromesthesia but proper research indicates the difference. There was some other mode of perception or (mathematical!) calculation. It is known that if audible frequency of musical middle octave is elevated (transposed) 40 octaves, it reaches (mathematically) visible band of light frequency and then, each note exhibits a specific colour. Comparison of such colour range with the ancient description unveils some striking similarity! The field might have implication in colour and music therapy of plants.

INTRODUCTION

Indian music, like that of most of the other nations, inherits a rich versatile musical culture, and is replete with rhythm, harmony and emotion. Here, seven musical notes or swars from Sa to Ni (Do to Ti as western equivalent) construct the Saptak (heptad) and Sa to (double) Sa form the Oshtok (octave). There are 22 shrutis (microtonal intervals / demi-semitones) in one octave, and each of seven swaras is separated from its neighbours by intervals of two, three or four shrutis¹. These microtonal intervals permit fine shade of musical expressions². The Indian musical scale, unlike that of the western, is not equally tempered (due to different ethnic ontogeny of notes). Indeed, the notes can be varied slightly to suit the particular raag (also spelled as raga or rag; the melodic framework

with some basic melodic principles, rules and regulations used by the Indian musical systems with taal *i.e.* cyclical rhythmic pattern¹) and the same note, in different raags, may have slightly differing positions³. Fig. 1 shows the structural hierarchy of components in Indian Music.

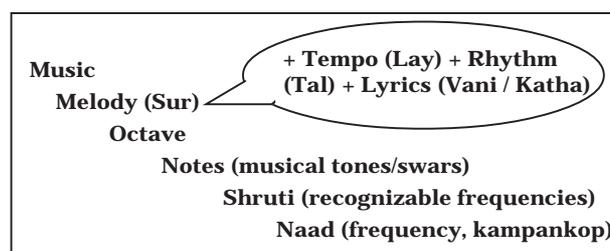


Fig. 1. Structural hierarchy of components in Indian music

ASSIGNMENT OF COLOURS TO DIFFERENT INDIAN MUSICAL NOTES BY SOME ANCIENT INDIAN LITERATURES

In different ancient Indian literatures the association of swar(s) with different casts (Jati),

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colours (varna), islands (dwip), sages, Devs (Gods) and aesthetic tastes (ras) are interesting (although there is some variation among them)⁴. According to the Sangeet Ratnakar by Sharngdev, a highly revered and authentic Sanskrit Musicological text of Indian music, colours of sa to ni are as follows:

पद्माभः पिञ्जरः स्वणेवर्णः कुन्टप्रभोडसतः ॥ ५४

पीतः कर्बुर इत्येषां जन्मभूमिरथ ब्रवे ।

[Padmabhoh pinjaroh swarnovarnoh kundoprobhositoh || 54 / Peetoh karburo ityeshang janmabhoomeratho bruve | - Sangeet Ratnakar, by Sharng Dev] This means the colours of sa (do) to ni (ti) are (1 to 7): 1. like lotus (red, pink, white or blue) (some species of *Nymphaea* Linn. or *Nelumbium speciosum* Willd., plant family Nymphaeaceae⁵), 2. slight yellow, 3. golden, 4. like kunda flower - white (*Jasminum pubescens* Willd., plant family Oleaceae⁵), 5. black or Krishna (blue?), 6. yellow and 7. complex (or mixed or composite) respectively⁶.

EXPLANATION FOR COLOUR ASSIGNMENT TO NOTES

IMAGINATION

This is the simplest and poorest way to explain and later part of this write up indicates probably it was not mere imagination.

CHROMESTHESIA

Apparently, it might appear as chromesthesia (a type of synesthesia) of ancient authors. Synesthesia is the simultaneous response to a stimulus in more than one sensory mode⁷. And chromesthesia is a specific form of synesthesia in which audible sounds produce a colour as well as an audible perception. This means individuals create colour associations with music as mental stimuli. According to Marks (1975)⁸ the synesthetic experience may actually be a

natural kind of sensory processing in youngsters that becomes weaker across time due to a lack of reinforcement in the society. If this is true, colour associations later in life could be explained as remembered responses from the years when synesthesia was in effect. However, proper research indicates that colour association with music is different from chromesthesia as the response (colour perception) is not necessarily simultaneous with the presentation of the stimulus (music)^{9,10}. Furthermore, chromesthesia is implicated to musical composition, rather than musical notes. The origin of colour association with music is unclear. There was some other mode of perception or (mathematical!) calculation behind the ancient description!

CORRELATION WITH PHYSICS

Correlation of the ancient Indian description of colours of notes with a modern finding in Physics is interesting. If the audible frequency of the musical middle octave is elevated (transposed) 40 octaves, it reaches (mathematically) the visible band of light frequency. This octave elevation is known as transposition. Then, each note exhibits a specific colour.

CONVERTING AUDIO NOTE OR TONES (TRANSPPOSITION) TO THE VISIBLE SPECTRUM OF LIGHT-COLOUR (TRANSLATING SOUND TO COLOUR)

The octave of visible light, extending from the red to violet, is forty octaves higher than the middle audio octave. Thus, to convert middle C (523 Hz) to its corresponding wavelength in the visible spectrum (light octave band) 523 would be raised to forty octaves (523×2^{40} cycles/sec). This is equivalent to green band of the visible light spectrum. Thus, when we raise each note in middle audio octave by forty octaves we find its

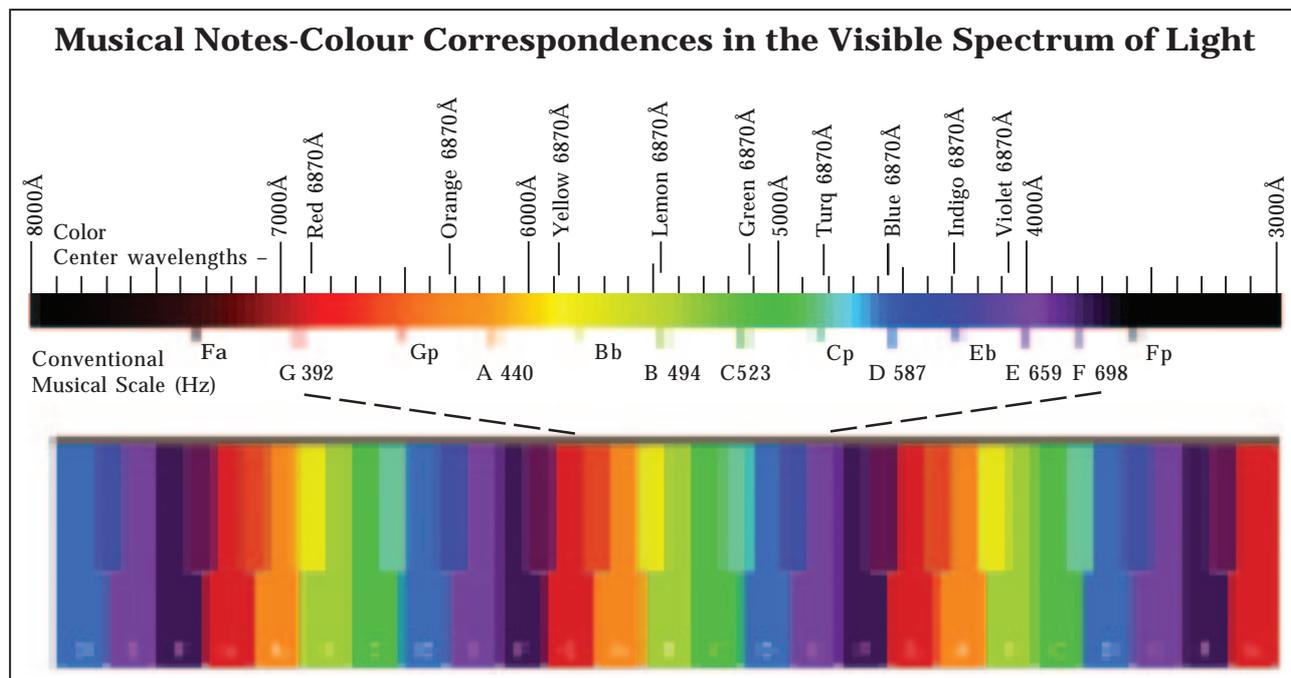


Fig. 2 : Corresponding colour of each note after transposition (Fiorenza, 2010)¹¹
 [Image used with permission: Nick Anthony Fiorenza, www.lunarplanner.com/Harmonics/planetary-harmonics.html]

corresponding colour harmonic. This yields data shown in Table 1¹¹ and Fig. 2¹¹. The transposition shows that VIBGYOR = ED#DCA#AG.

Table 2^{6.11.12} shows a comparison between the present (modern) colour range of the notes and early allotment of colours to notes. The comparison certifies some striking similarity. As per the Sangeet Ratnakar, about five colours are identical to those assigned by the modern physics school *viz.* G - red (like lotus, Sa?), A - slight yellow (Re?) A# - golden (Ga?), B - parrot green (Ma? Sangeet Ratnakar defines 'Ma' as like kunda flower which is white at maturity; kunda bud is green, although Ratnakar does not define the stage of the flower), D/D# blue or indigo ('asit' in Sangeet Ratnakar, 'asit' means black or Krishna, while the mythical person Krishna was blue in skin complexion! Pa?), F/F# - complex or composite colour (Ni?) (*vide* next paragraph). In this list, even the

sequence of colours shows similarity!! However, the matter of B is somewhat out of tune as Ratnakar does not specify the stage of Kunda. But, in some old Karnatak description, 'parrot green' (B) is available for Re (not for Ma)! Then the sequence becomes disturbed. Thus one more colour might show similarity to modern finding. The affinity is amazing!!

The note 'F' lies in the far violet area of the visible spectrum. This is near where the human eye range of colour perception begins to drop. Then, the note F# lies even further from violet, in near ultra-violet area of the spectrum. If it is raised 39 octaves, it resides in the far-red (or near infra-red) region. Thus F# has some red and some violet perception (to human eye), a combination that produces more or less purple colour¹¹, this is a composite or complex colour.

There is another noticeable factor. The red, green and blue are the primary colours, as

greatest no. of colour combinations can be created from them. For example, red and green tunes together make yellow. Red, green and blue tunes combined in equal ratio, produce white light¹³. And these three colours have been specified for Sa, Ma and Pa respectively while Sa is the tonic note (most important, first note in octave!), Ma is invariable (dividing the octave as well as the string of the vina in two equal halves!) and Pa is an overtone of Sa! All are 'udatta' or four shruti tones (four shruti tones are regarded as major notes in Indian music)!

SIGNIFICANCE OF THE SIMILARITY

To realize the significance of the similarity between the ancient (determined by some method unknown today) and modern findings it is necessary to consider the origin and evolution of swars. Such history^{14, 15} indicates that after a long series of gradual modification, evolution and compilation of both music and musical notes, slight augmentation and diminution of some notes, insertion of (new ethnic and/or mathematical) notes in the octave band, the resultant movement of position of notes (on different frequencies or shruties) within the octave band, polyphyletic origin of notes, amalgamation of Indo-European (Aryan), Shok-Sumerian, Dravirhian (Dravidian), Austric and numerous other ethnic cultures, Arabic and Persian impact – still the similarity in colour description (perception?) prevails. The dissimilarity, which has arisen, might be mainly due to position change of the notes, augmentation and diminution and insertion, and due to lack of faultless documentation or controversy among different schools, time lag and something else. Again, in modern physical experiment also, using the speed of light in air or the speed of light in a vacuum will yield slightly different results¹¹.

CROSS TEST OF RELATIONSHIP BETWEEN COLOUR AND NOTES

The 'unanimity' of colour of light and musical notes might be cross tested by the outcome of some experiments on the effect of musical notes on plants during the second half of twentieth century (1950-2000). So far few experiments have been done with simple (single) musical notes on plants. Rather, ultra- and infra- sounds have been tested recently. Possibly, the ultrasound has been shown to have greatest effect on plants, specifically on seed germination¹⁶. If we transpose such ultra- and infra- frequencies to visible light and audible musical notes – a comparative account of the effect of colour of incident light (and other frequencies) and musical notes on plants may be prepared.

Table 3a¹⁷ shows the experiments dealing with three musical notes *viz.* B, D and F. As a result of B and D, most of the plants (except African violets) were affected negatively and ultimately they died. If the result is translated into the transposed colour version of the musical notes B (~464nm, *i.e.* green) and D (~552nm; very close to green - between greenish blue and deep blue), then the fact is that green and greenish-bluish are hostile for plants. This is expected as plants' chlorophyll can't absorb green light and so their photosynthesis ceases. Thus result of B, D and green light are same on plants. The African violets, although drooping at the start, during first week they revived and started flowering. This means somehow the plant can function in presence of 'greenish-bluish' tunes and for this acclimatization it needs about one week.

In the second experiment with same plants, on one group F note was played constantly for eight hours and all the plants (even African violets) became stone dead. On the other group, F was applied for three hours intermittently;

plants grew healthier than those under control (silence). The result is remarkable; it varies depending on the varied application of the same note. If F note stands for far violet (~390nm), it shows that intermittent, curtailed far violet promotes growth while it is destructive if prolonged. In far violet, photosynthesis becomes very rapid as chlorophylls are rapidly photo-excited and photo-oxidized with the help of carotenoid system (absorbance 380-520nm) (carotenoides + far violet/~390nm ® excited carotenoids ® ground state carotenoids + longer wavelengths including 430 and 450 nm where Chlorophyll a and b respectively exhibit their one absorbance maximum). Now, if far violet is ceased (intermittent) then the carotenoid system gets time to reduce and thus restore the chlorophylls as well as to destruct different reactive oxygen species (ROS) originated as byproduct which otherwise destroy chlorophyll (bleaching), purines in DNA and RNA, and poly-unsaturated fatty acids (PUFA)¹⁸. If far violet is prolonged, then carotenoid system can't get time for proper functioning, plants die off.

Table 3b^{19, 20, 21 & 22} deals with some other frequencies except musical notes. In first experiment, if the fact is that 50 H frequency ° G-G#° red, then it may stimulate seed germination and root growth through phytochrome activity (phytochrome P_r form + red light ® active P_{fr} form of phytochrome ® activation of light sensitive specific photomorphogenetic genes ® seed and root promotion). In next experiments, if the colour equivalents indigo and violet are considered, growth promotion is expected by photosynthetic activity which is the fact in the Table 3b.

The cross test should be taken with a pinch of salt. As par the resonance hypothesis [sound (and other) frequencies resonate with objects;

with every object (even cell, membrane, cytosol, organelle, tissue, stomata *etc.*) a resonant sound frequency can be found; and when playing that sound the object would resonate and then the influence of the sound is resulted by signal transduction)], effect of specific wavelength (such as light or infra-/ultra- sound) can't be mimicked by some other transposed frequencies (*e.g.* musical notes) as the latter can't elicit the resonance response of the target organelle or cell or tissue. Further, the case never can be that G-G#, D# or F# would be alternative energy source for photosynthesis, the notes might be accelerating only. If modern experiments prove at least some of the cross tests, there must be some other mechanism behind the similar influence of the musical notes, other sound waves and colour of light.

COLOUR THERAPY AND MUSIC THERAPY OF PLANTS

Actually plants are much more sensitive to the colour of incident light *e.g.* blue light influences stomatal opening, red light affects seed germination, red and far red light determines flowering time, blue and violet light influences chloroplast movement in photosynthetic cells *etc.* Even, plants can sense ultraviolet rays also (UV A and B)! Light regulates their photomorphogenesis (control and/or change in development and form in response to light) through plants' system involving light energy perception, transduction of the energy into a signal and coupling of the signal to gene expression and regulation of products¹⁸. There are several photoreceptors in plants *viz.* chlorophyll a and b (absorbing red and blue light, involved in photosynthesis), carotenoids (carotene and xanthophyll), phytochrome (regulated by red/far-red light; involved in seed germination, seedling growth, root elongation, chloroplast development, flowering and circadian rhythms²³,

Table 3a. Study on the effect of specific musical notes on plants

| Applied by | Musical Notes Notes | Transposition | Corresponding Colour | Applied on | Effects |
|---|-----------------------|--|--|--|--|
| Mrs D. Retallack and her associates (1950s to '70s) In: P. Thompkins, & C. Bird, 2004 ¹⁷ | B & D | raised 40 octaves higher ($X 2^{40}$) to attain the visible spectrum | B -parrot green D - light blue; between greenish blue and deep blue | philodendron, corn, radish, geranium, African violet | African violets remained neutral, others negatively affected |
| | F, prolonged exposure | | F - far violet | | stone death |
| | F, limited exposure | | F - far violet | | much healthier |

Table 3b. Study on the effect of some other frequency on plants

| Applied by | Other frequency | Transposition | Musical Note Equivalence | Corresponding Colour | Applied on | Effects |
|---|--------------------------------|---|--------------------------|----------------------|--|--|
| H. Takahashi, H. Suge and T. Kato; 1991 ¹⁹ | vibration at 50 Hz | if raised 3 octaves higher ($50 \times 2^3 = 400$), resides in between 391.996 Hz or G and 415.305 Hz or G [#] | G-G [#] | red | rice and cucumber | stimulated seed germination and root elongation in both rice and cucumber; stimulated the elongation of rice coleoptiles |
| Q. Yu-Chuan, L. Won-Chu, C. Young-Cheol, & K. Tae-Wan; 2003 ²⁰ | 20,000 Hz ultrasound for 3 hrs | if dropped 5 octaves lower ($20,000 / 2^5 = 625$), reaches slightly higher to D [#] | D [#] | blue/indigo | Chinese cabbage (both seedling and mature plant stage) | highest polyamines levels, highest oxygen uptake |
| j. Yi, B. Wang, X. Wang, D. Wang, D. Chuanren, Y. Toyama & A. Sakanishi; 2003 ²¹ | 1400 Hz at 95 dB | if dropped 1 octave lower ($1400 / 2^1 = 700$), resides in between 698.457 Hz or F and 739.989 Hz or F [#] | F-F [#] | violet-purple | chrysanthemum roots | increases in amylase activity, soluble sugar, and protein |
| B. Wang, J. Shao, L. Biao, L. Jie and D. Chuanren; 2004 ²² | 1400 Hz | | | | chrysanthemum callus | increase in indolacetic acid levels while decrease in abscisic acid levels |

cryptochrome [absorbs blue/UV-A (315-400nm), involved in phototropism, stomatal opening and photoperiodic control of flowering²⁴], protochlorophyllide reductase (involved in chlorophyll synthesis), a UV-B receptor [inducing plants' defensive responses against UV-B (280-315nm) radiation by stimulating genes for chalcone synthase which is important in production of flavonoids – the major phytosunscreen against UV-B] *etc.* Plants are sensitive to different tunes also. However, their 'musical sense' still needs further research for scientific foundation. The colour perception from musical notes, might have implication in both colour therapy and music therapy of plants. So this field deserves serious research work.

REFERENCES

1. B. Osmer, "Raga chikitsa and raga ragini vidya," <http://yogasangeeta.org>, 2006.
2. en.wikipedia.org/wiki/Sangeet
3. www.buzzle.com/articles/indian-music.html
4. en.wikipedia.org/wiki/Sangeeta_Ratnakara
5. D Prain, Bengal Plants, Vol. I, 1903 (2004 Rep. Ed.), pp. 214, 231 & 659, Bishen Singh Mahendra Pal Singh, Dehra Dun, India
6. P.K. Ghosh, translation work, Sangit Ratnakar by Nihshanka Sharngdev, 1994, p.151, West Bengal State Music Academy, Kolkata-33.
7. R. E. Radocy and J. D. Boyle, Psychological Foundations of Musical Behavior, 1979 (4th Ed., 2003), pp. 323–324, Charles C Thomas Pub. Ltd., Springfield, IL.
8. L. E. Marks, *Psychology Today*, **9**, 1, 48–52, 1975
9. H. S. Odbert, T. F. Karwoski and A. D. Eckerson, *Journal of General Psychology*, **26**, 153–175, 1942.
10. G. E. Thayer and C. T. Eagle, *Journal of Music Therapy*, **7**, 1, 3–19, 1970.
11. N. A. Fiorenza, www.lunarplanner.com/Harmonics/planetary-harmonics.html, 2010.
12. P. Datta, "Understanding Karnatik classical music," datta.pk2003@gmail.com, 2010.
13. R. Sharma and M. K. Sharma, Colour Therapy – Miracle of Sun Rays, 2007, p.16, Pustak Mahal, Delhi, India and London.
14. B. N. Dutta, Raag Sangeet O Prachin Bharat (Raag Music and Ancient India), 2008, pp. 22-24, 36 & 37, Deepayan, Kolkata-09.
15. Swami Pragnanananda, Bharatiya Snagee-ter Itihas (History of Indian Music), Vol. I, 3rd Ed (1987), 1953, pp. 263 & 268, Shri Ramkrishna Vedanta Math, Kolkata-06.
16. F. W. Telewski, *American Journal of Botany*, **93**, 10, 1466–1476, 2006.
17. P. Thompkins and C. Bird, The Secret Life of Plants, 2004, pp. 146–162, Rupa and Co., New Delhi.
18. D. W. Lawlor, Photosynthesis (3rd Ed.), 2001(First Indian Ed.), pp. 35, 45, 47 & 264, Viva Books Pvt. Ltd., New Delhi.
19. H. Takahashi, H. Suge and T. Kato, *Plant and Cell Physiology*, **32**, 5, 729–732, 1991.

20. Q. Yu-Chuan, L. Won-Chu, C. Young-Cheol and K. Tae-Wan, *Ultrasonics* (Elsevier), **41**, 5, 407–411, 2003.
21. J. Yi, B. Wang, X. Wang, D. Wang, D. Chuanren, Y. Toyama and A. Sakanishi, *Colloids and Surfaces: Biointerfaces*, **29**, 115–118, 2003.
22. B. Wang, J. Shao, L. Biao, L. Jie and D. Chuanren, *Colloids and Surfaces: Biointerfaces*, **37**, 107–112, 2004.
23. A. J. Lack and D. E. Evans, *Instant Notes Plant Biology*, 2001, pp. 83–86, Viva Books Pvt. Ltd., New Delhi.
24. L. Taiz and E. Zeiger, *Plant Physiology* (2nd ed.), 1991, p. 711, Sinauer Associates, Inc., Publishers, Massachusetts.

CHEMISTRY IS A VITAL PART IN EVERYDAY LIFE

A. B. Naik and P. A. Pawar

The things we see and can't see have to do with the science of chemistry. The air we breathe is a mixture of chemicals substances and the process of breathing is a chemical reaction. The foods we eat are all chemical products and the ways in which our body turns them into muscles, bones, nerves and brain cells are some of the greatest of chemical mysteries. The cloths we wear, the books we read, the medicine we take, the house in which we live these are products of chemistry.

INTRODUCTION

In 2011, chemists will encourage the world to celebrate an International Year of Chemistry (IYC). However the International Union of Pure and Applied Chemistry (IUPAC) (formed in 1919) was the driving force behind this initiative. The objectives of the international year of chemistry are;

- Increase the public appreciation and understanding of chemistry in meeting world needs
- Encourage interest of young people in chemistry
- Generate enthusiasm for the creative future of chemistry
- Celebrate the role of women in chemistry (2011 is the 100th anniversary of the award of the Nobel Prize in Chemistry to Marie Curie)

Molecular transformations are lead to the production of foodstuffs, medicines, fuels and essentially all manufactured and extracted products. We will rely on this science to

maintain a sustainable environment for all the Earth. IYC 2011 is a wonderful opportunity for everyone to celebrate the central contributions of chemistry.

Our entire universe is made up of matter which is constantly changing forms and evolving into other forms of energy. Chemistry is defined as the study or science of this ever changing matter. The other sciences which we study commonly like biology, physics and mathematics are all dependent on chemistry and are known as specific studies under the elaborate subject of chemistry. Since there is chemistry seen in biological forms as well as physical states of nature, there are subjects called biochemistry and physical chemistry which help study these changes. We find chemistry in daily life in the foods we eat, the air we breathe, our soap, our emotions and literally every object we can see or touch. Even our body is made up of chemical compounds, which are combinations of elements while our body is mostly contains water i.e. hydrogen and oxygen.

There are many chemical changes which occur around us every day but we are never aware of them. But this is a great way of

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teaching chemistry with real examples in everyday life. Chemistry is playing a big part of our everyday life. Vegetables are necessary for sound health. Our forefathers by trial and error experimentation selected specific vegetables that were naturally available within the region in a particular season. Thus, vegetables that are naturally available in the summer are diuretic antioxidant and protective against solar radiation. Similarly, vegetables available in winter contain health protective properties that enable us to adjust to the cold climate¹.

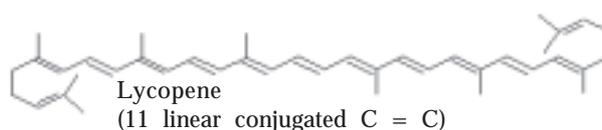
Onion inside the onion cells there are some chemical compounds that contain sulfur. When we cut an onion its cells are broken and those chemical compounds then undergo a reaction that transforms them into a more volatile sulfured product, which are released into the air.



These sulfured compounds react with the moisture in our eyes forming sulfuric acid (H_2SO_4), which produces a burning sensation. The nerve endings in our eyes are very sensitive and so they pick up on this irritation. The brain reacts by telling our tear ducts to produce more water, to dilute the irritating acid. So we cry to keep our eyes protected from the acid. There are some tips to make onion-dicing less problematic :

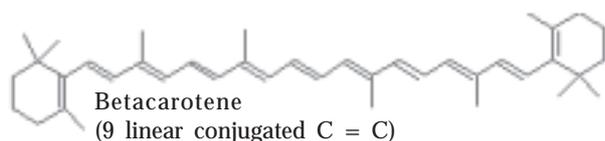
- Chop the onion under cold water. The volatile sulfured compounds will be released but then they react with the water, instead of reaching your eyes.
- You can freeze the onion for 10 minutes before cutting it. The cold temperature of the onion will slow down the chemical reaction which forms the volatile sulfured compounds.

We have long been told that our diets should include lots of fruits and vegetables because they are good sources of antioxidants. It protects against cardiovascular disease, cancer, and cataracts and they slow the effects of aging. Many vegetables and fruits are strongly colored because it contains a special kind of chemical compounds named carotenoids i.e. chromophore, which absorbs and gives off particular wavelengths of light, generating the color that we then perceive. The chromophore is formed by a sequence of linear carbon-carbon double bonds (represented as $C = C$), so the atoms remain closer to each other. In general, it's necessary at least seven linear conjugated double bonds for a carotenoid to produce a color. Besides, the more the number of bonds conjugated, the longer the wavelength of the light absorbed and also the more red the vegetable. The tomato is red because of the carotenoid lycopene, which contains 11 conjugated carbon-carbon double bonds.

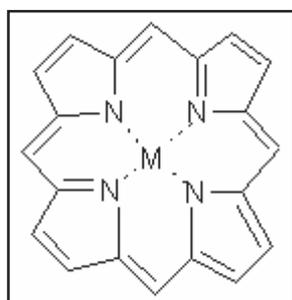


This compound is generated by the plant to protect itself from the air oxidation. So it's a good antioxidant useful for us too protecting our cells against the action of free radicals (potent oxidants), which are one of the main responsible of cardiovascular diseases, cancer and aging.

Carrot is a good source of carotene but not of protein so small quantity of carrot can supply the minimal daily requirement of vitamin A. The pigment present in carrots is the beta-carotene, with 9 linear conjugated double bonds, less than in lycopene.



This compound is also a potent antioxidant and besides it's transformed in our body into vitamin A, very important for the maintenance of healthy skin, good vision and a robust immune system.



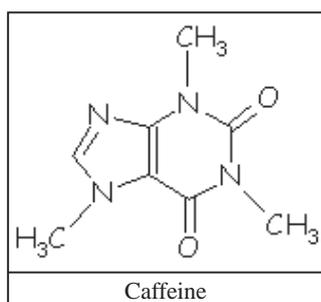
Where M = Mg, Fe

to carry on photosynthesis, transforming solar energy and carbon dioxide into chemical energy in the form of carbohydrates and oxygen. This process is essential for life. The structure of chlorophyll contains a ring as a chelate with magnesium atom, a metal ion in the center to form a metal ligand complex².

Spinachs, turnip green, parsley contain large amounts of vitamin A and also lutein. This green color because they contain chlorophyll, a pigment which enables the plant

to carry on photosynthesis, transforming solar energy and carbon dioxide into chemical energy in the form of carbohydrates and oxygen. This process is essential for life. The structure of chlorophyll contains a ring as a chelate with magnesium atom, a metal ion in the center to form a metal ligand complex².

Why after consuming a big cup of coffee our muscles tense up, we feel excited and our heart beat increases? The reason is that caffeine operates using the same mechanisms of a m p h e t a m i n e s , cocaine and heroin to stimulate the brain, though with milder effects.



It manipulates the same channels as the other drugs and that is one of the things that give caffeine its addictive qualities. There is a chemical in our brain called adenosine, which binds to certain receptors and slows down

nerve cell activity when we are sleeping. To a nerve cell, caffeine looks like adenosine and it binds to the adenosine receptors. However, as it's not really adenosine, it doesn't slow down the cell's activity like adenosine would. So the cell cannot see adenosine anymore because caffeine has taken up all the receptors adenosine binds to. Then, instead of slowing down because of the adenosine level, the cells speed up. The pituitary gland sees all of this activity and thinks some sort of emergency must be occurring, so it releases hormones that tell the adrenal glands to produce adrenaline. Adrenaline is the fight hormone, and it makes our heart to beat faster, the breathing tubes to open up, the liver to release sugar into the bloodstream for extra energy and our muscles to tighten up, ready for action. Moreover, as amphetamines, caffeine also increases the levels of dopamine, which is associated with the pleasure system of the brain, providing feelings of enjoyment and reinforcement.

Why does the mouth get cold when eating Ice Cream? Eating ice cream soon causes the mouth to get cold, possibly to the extent of making it feel quite uncomfortable. The mouth of a normal, healthy adult has a temperature of about 37°C, and the ice cream has a maximum temperature of 0° C, although it is likely to be in the range -5 to -10°C if it recently came from the freezer³. A large difference in temperature exists, so energy transfers from the mouth to the ice cream, causing it to melt (The law of thermodynamics).

Recent studies show that Chocolate has high levels of antioxidants-complex mixtures of phenolic compounds. On a weight basis, the concentration of antioxidants in chocolate is higher than the concentration in red wine or green tea and 20 times higher than the concentration in tomatoes. Dark chocolate

contains more than twice the level of antioxidants as milk chocolate. Unfortunately, white chocolate contains no antioxidants. Another piece of good news is that stearic acid, the main fatty acid in chocolate, does not appear to raise blood cholesterol levels the way other saturated fatty acids do.

CONCLUSION

Chemistry is one of the most important of all sciences. The proper use of chemistry makes it possible for farmers to feed the world's ever-increasing population. For engineers to develop new means of transportation and

communication that will bring the peoples of the world closure together, for doctors to cure the diseases of mankind. Manufactures are producing the thousands of items that are necessary for better living.

REFERENCES

1. K. Kulshreshtha, *Science Reporter*, **48**, 10, pp 45, 2011.
2. Raymond Chang, *Chemistry*, 1994, 895-896, McGraw hill pub Vth ed.
3. Paul Monk, *Physical Chemistry*, 2004, 77-78, J. Wiley and Sons, ltd. England.

CULTIVATION OF TOMATO IN KITCHEN GARDEN BY STEM CUTTING

D. K. Singh, S. Aswal and I. N. Gupta

Cultivation of tomato by stem cutting enhances fruit production. This article highlights new technology of vegetative propagation.

INTRODUCTION

Tomato is commercially grown by seedlings raised in nursery bed that takes more time to flowering and fruiting. Tomato crop can be easily propagated by soft wood stem cuttings because even the cells in its stems can become roots in a cup of water. Tomato cuttings are such incredibly easy rooters, they will even root in garden for continuous production of fruit throughout the year without deterioration of fruit quality. Hence, it gives the opportunity of buying just a couple of plants and then creating few more for free of charge. The plants are stronger if the cuttings are rooted in soil. It is very useful in kitchen. It is one of the most popular and widely grown vegetable in Rajasthan as well as India. A large number of hybrid varieties of tomato were released by various public and private sectors for cultivation. Unavailability of true type seeds and high cost of hybrid seeds are the major constraints of its cultivation by small and poor farmers. Thus, fast multiplication of plants by stem cutting could be the answer to such problem in tomato. Only vegetative propagation by stem cutting can ensure early and heavy fruiting with better

fruit quality (Fig.-3). Some perennial cucurbits like pointed gourd and kundru etc. as well as pumpkin¹ and bottle gourd² has been successfully propagated by stem cuttings.



Fig. 2. Rooting behavior of steam cutting of tomato

Stem cutting of 15-20 cm long with 4-5 nodes is harvested with sharp knife from 2-3 month old mother plants and clip off any flowers or buds. Clip off the bottom leaves leaving only one or two upper leaves on the cutting. Put the cuttings into the soil and press the soil up around them. Make sure the places where cut off the lower leaves is buried. The cuttings should be planted in north-south direction in rainy season and winter season and east to west direction in summer season for proper sun light and shaded from any direct sun. The basal 4-5 cm portions of these cuttings are treated with 500 ppm IBA for 15 minutes in winter and summer season for better rooting. In rainy season 0.1%

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carbendazim was mixed with 500 ppm IBA for the prevention of rotting.

HOW CUTTING PRODUCE EARLY AND HEAVY FRUITING

The stem cutting is taken from mature juvenile mother plants that give early flowering and fruiting. Profuse rooting is induced by the exogenous application of IBA (500 ppm solution) and survival of plant is also increased. Vegetatively propagated plants are capable to induce maximum branching that increases the yield.



Fig. 1. Visit to vegetative propagated field by Honorable Vice Chancellor, Agriculture University

CARE AND MANAGEMENT

The treated cuttings are subsequently planted in field at a distance of 60 cm × 45 cm. It needs very careful irrigation which should be just sufficient at right time. First irrigation must be done at the time of planting. Overwatering or insufficient irrigation is harmful. Foliar spray of 1.0 % urea with 1.0 ppm 2,4-D is effective to increase fruit set and yield. Proper training and pruning of shoots also increase the yield and quality of fruit.

ADVANTAGES OF STEM CUTTING

The advantages of fast multiplication of tomato by stem cuttings are given below.

1. Propagating tomato plants by stem cuttings can enhance the fruiting time about 3-4 weeks earlier than seedling plant.

2. It is very cheap and easy method.
3. It maintains vigour and characteristics of the hybrid plant.
4. Early and heavy flowering and fruiting occurs.
5. Planting material can be achieved all round the year.
6. Large quantity of planting material can be produced.
7. Replanting is easy due to early fruiting.



Fig. 3. Tomato production by stem cutting

Table-1: Growth and yield of vegetative propagated tomato by stem cutting

| SNo. | Particulars | Stem cutting | Seedling plant |
|------|--|--------------|----------------|
| 1. | Number of primary roots per plant | 14.26 | 10.38 |
| 2. | Number of secondary roots per plant | 59.97 | 120.81 |
| 3. | Length of primary root (cm) | 29.99 | 18.27 |
| 4. | Survival of plant (%) | 95.77 | 99.87 |
| 5. | Number of branches per plant | 8.28 | 4.21 |
| 6. | Number of days taken to first flower emergence | 28.55 | 59.69 |
| 7. | Total number of fruit per plant | 59.78 | 59.82 |
| 8. | Fruit weight (g) | 124.42 | 124.37 |
| 9. | Yield per plant (kg) | 7.19 | 7.10 |
| 10. | Shelf life of fruit at room temperature (days) | 6.33 | 5.48 |

CONCLUSION

Cultivation of tomato by stem cutting enhanced one month earlier fruit production than seedling plant without any effect on yield deterioration and fruit quality of hybrid tomato variety Hybrid-5005 (table-1). Number of primary roots (14.26) and its length (29.99 cm) was higher in vegetative propagated cuttings than seedling plants. Plants raised from tomato seedling produced profuse rooting (59.97 secondary roots/plant) in comparison of stem

cutting plants (Fig.- 2). The number of fruit and yield of both type of plant were almost similar. The new technology of vegetative propagation by stem cuttings was demonstrated in technical week and Krishi Vigyan Mela for farmer's interaction (Fig.-1).

REFERENCES

1. D. K. Singh, *Vegetable Sci.*, **24** : 176-178, 1997.
2. D. K. Singh, *The Horticulture J.*, **17**, 1 : 83-87, 2004.

THE EFFECT OF OPPOSITE PHYSICAL AND SOCIO-PSYCHOLOGICAL CONDITIONS NEARLY MATCH

Pooran Koli*

In case of the properties like food preservation, superconductivity, etc., the effects of opposite physical conditions are quite similar. Similar is the case with opposite conditions of sociological and psychological states. Although, the mechanistic aspect may be different in opposite conditions associated with similar effects.

INTRODUCTION

An extreme in weather conditions adversely affects the physical and biological systems. The regions seeing weather variation are caught in the grip of the harsh cold wave during the winter; and a strong, hot, and dry wind known as the Loo during the daytime in the summer. Most people think of winter as the season for dry, itchy, cracked and moisture deprived skin problems. But, the summer weather characterized by hot and dry conditions can be equally troublesome for the skin, although the winter and summer seasons are characterized by opposite physical conditions of very low and high temperatures, respectively. Similarly, in case of properties like food preservation, superconductivity, etc., the effects of opposite physical conditions characterized by low and high temperature conditions are quite similar. Similar is the case with opposite conditions of sociological and psychological states. Thus, in this article, my main focus is to analyze various biological (food preservation, etc.), physical (like superconductivity, solubility, etc.), health (like

teeth, loo, cold, etc.) and socio-psychological (like sadness, happiness, etc.) phenomenon to show that extreme conditions of temperature and psychological states have nearly similar effects. Although, the mechanistic aspect may be different in opposite conditions associated with similar effects.

FOOD PRESERVATION

Temperature : Both the low and high temperature conditions have effect of food preservation, albeit the mechanism is different. For example, the food like milk can be preserved by keeping it in freeze and also by boiling and warming it intermittently. In general, low temperatures reduce the growth rates of microorganisms and slow many of the physical and chemical reactions that occur in foods. Freezing food slows down decomposition by turning residual moisture into ice, inhibiting the growth of most bacterial species. Freezing is an effective form of food preservation because the pathogens that cause food spoilage are killed or do not grow very rapidly at reduced temperatures. The process is less effective in food preservation than are thermal techniques, such as boiling, because pathogens are more

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likely to be able to survive cold temperatures rather than hot temperatures. One of the problems surrounding the use of freezing as a method of food preservation is the danger that pathogens deactivated (but not killed) by the process will once again become active when the frozen food thaws.

The use of high temperature conditions (Heat) may be used for preserving the food. Canning involves cooking food, sealing it in sterile cans or jars, and boiling the containers to kill or weaken any remaining bacteria as a form of sterilization. It was invented by Nicolas Appert¹. Cooking makes food palatable and tender and also destroys a large proportion of microorganisms and natural enzymes. The killing of microorganisms by heat is due to thermal denaturation of protein and enzymes of the microorganism required for its metabolic activity and growth. The heat removes moisture from the food. The use of heat also affects the food adversely and hence it is necessary to use only mild heat treatment that ensures freedom from pathogens and enzyme activity and enhance the shelf life of the food.

Pressure : The effects of high and low pressure are also similar on food preservation. The food can be preserved at very high and low pressure as well though techniques called Pascalization and Vacuum packaging, respectively.

High pressure processing technique called Pascalization²⁻⁴ (also called bridgmanization⁵) is a method of preserving and sterilizing food. In this technique a product to be preserved is processed under very high pressure. This high pressure causes inactivation of certain microorganisms and enzymes in the food. During pascalization, more than 50,000 pounds per square inch (340 MPa, 3.4 kbar) may be applied for around fifteen minutes, leading to

the inactivation of yeast, bacteria and mold. Pascalization stops chemical activity caused by microorganisms that play a role in the deterioration of foods. An early use of pascalization in the United States of America was to treat guacamole. It did not change the guacamole's taste, texture, or color, but the shelf life of the product increased to thirty days, from three days without the treatment.

The low pressure technique called Vacuum packaging can be used to preserve food for some time. This technique is based on "Vacuum"⁶⁻⁹. Vacuum is space that is devoid of matter. An approximation to such vacuum is a region with a gaseous pressure much less than atmospheric pressure. Physicists often discuss a perfect vacuum (simply called "vacuum" or free space), and a partial vacuum (an actual imperfect vacuum as in a lab or in space). The quality of a partial vacuum refers to how closely it approaches a perfect vacuum. Other things equal, lower gas pressure means higher-quality vacuum. For example, a typical vacuum cleaner produces enough suction to reduce air pressure by around 20%. Much higher-quality vacuums are possible. Ultra-high vacuum chambers, common in chemistry, physics, and engineering, operate below one trillionth (10^{-12}) of atmospheric pressure (100 nPa), and can reach around 100 particles/cm³.

Vacuum packaging¹⁰⁻¹³ is a method of packaging that removes air from the package prior to sealing. This method involves (manually or automatically) placing items in a plastic film package, removing air from inside, and sealing the package. Shrink film is sometimes used to have a tight fit to the contents. The intent of vacuum packing is usually to remove oxygen from the container to extend the shelf life of foods. Vacuum packing reduces atmospheric oxygen, limiting

the growth of aerobic bacteria or fungi, and preventing the evaporation of volatile components. It is also commonly used to store dry foods over a long period of time, such as cereals, nuts, cured meats, cheese, smoked fish, coffee, and potato chips (crisps). On a more short term basis, vacuum packing can also be used to store fresh foods, such as vegetables, meats, and liquids, because it inhibits bacterial growth.

SUPERCONDUCTIVITY

Temperature : The phenomenon of Superconductivity is observable in both the low and quite high temperature conditions. The low temperature superconductivity is a phenomenon of exactly zero electrical resistance and expulsion of magnetic fields occurring in certain materials when cooled below a characteristic critical temperature. It was discovered by Dutch physicist Heike Kamerlingh Onnes on April 8, 1911 in Leiden. The low temperature superconductivity usually have critical temperatures ranging from around 20 K to less than 1 K. Solid mercury, for example, has a critical temperature of 4.2 K. In mechanism (according to the BCS theory) of low temperature superconductivity, the electrons are held together in Cooper pairs by an attraction mediated by lattice phonons.

The high temperature conditions (> 20 K) have also the effect of making substances to show the high temperature superconductivity at which materials also show zero electrical resistance and expulsion of magnetic fields. The cuprate superconductors ($\text{YBa}_2\text{Cu}_3\text{O}_7$, one of the first cuprate superconductors to be discovered) can have much higher critical temperatures (92 K), and mercury-based cuprates have been found with critical temperatures in excess of 130 K. The explanation for these high critical temperature superconductors remains unknown as it can

not be explained by cooper pair concept used for low temperature conductivity. The best available model of high-temperature superconductivity is still somewhat crude. There are currently two main hypotheses – the resonating-valence-bond theory, and spin fluctuation which has the most support in the research community¹⁴. The second hypothesis proposed that electron pairing in high-temperature superconductors is mediated by short-range spin waves known as paramagnons.

Pressure : In superconducting materials, the characteristics of lower temperature superconductivity appear when the temperature is lowered below a critical temperature (T_c). The superconducting elements show a change of T_c with pressure. There are a few elements like thallium ($T_c - 270.77$ °C) for which T_c is low at low pressure as well at high pressure. The T_c of thallium is found to increase at low pressures. It passes through a maximum at about 0.2 GPa and decreases at higher pressures¹⁵. This unusual T_c dependence on pressure for thallium might be due to a modification of the electronic configuration under pressure¹⁶ and a change in the Fermi surface topology¹⁷.

SOLUBILITY OF PARTIALLY MISCIBLE LIQUIDS

Temperature : Partially miscible liquids (binary mixture) generally tend to be miscible with rise in the temperature. And, at upper critical solution temperature (UCST) or above UCST, the partially miscible liquids become completely miscible for all compositions. Some partially miscible liquids become miscible at low critical solution temperature (LCST) or below LCST also. But, there are some partially miscible liquids (nicotine-water; 3-Methylpiperidine-water; Methyl ethyl ketone-water) which are miscible at low as well as

high temperature. The nicotine-water system has an LCST of 61° C, and also a UCST of 210° C at pressures high enough for liquid water to exist at that temperature. The components are therefore miscible in all proportions below 61° C and above 210° C (at high pressure), and partially miscible in the interval from 61 to 210° C^{18,19}. Thus, the effects of low and high temperatures are same in some cases as far as the miscibility of partially miscible liquids is concerned.

Concentration : Similarly, the extreme conditions of concentrations have also similar effect on miscibility. For example, Phenol and water are partially miscible. However, when these two liquids are mixed in certain composition and slowly heated, these liquids will become miscible. The temperature at which Phenol and water become miscible is called mutual solubility temperature. And, the temperature above which a mixture of Phenol and water of all compositions become miscible is called upper critical solution temperature-UCST (which is 66.8° C for Phenol and water). At low and high percentages of phenol, the water and phenol mix completely below UCST, forming a single liquid phase. However, at intermediate compositions and below the UCST, the mixtures of phenol and water separate into two liquid phases²⁰.

HEALTH EFFECTS

Temperature : The conditions of both the high and low temperatures have nearly same effects on the health. Both conditions adversely affect the health, and prevention and protection from these adverse effects is also nearly same.

(i) *Teeth* - The extreme conditions of hot and cold have same effects on the human health. The gum and teeth pains by extreme hot as well as by cold. Doctor prescribes same gel for oral tooth brush. The prescribed

precautions in both cases are also the same - avoid extreme cold and hot.

(ii) *Skin* - Most people think of winter as the season for dry and itchy skin. But summer weather can be equally troublesome for skin causing dryness and itchiness. In both winter and summer, the skin is deprived of moisture.

The reason for skin dryness during summer is high temperature, heat and skin exposure to sunlight. High temperatures are a major part of summer that can be held responsible for the onset of dry skin in the summer. Heat can dehydrate the skin and cause dry skin conditions such as eczema in the form of red pus-filled spots or even blistering, irritated, inflamed patches of skin. If summer brings on elements of high humidity then this can also bring on dry skin problems. Sweat may be a natural cool-down for the body but the salty properties of sweat can dehydrate the skin and cause it to become irritated and very, very itchy. Exposing the skin to direct sunlight is a cause of dry skin in any climate. The heat of the sun dries out the skin by reducing the natural oils in the skin, leaving it very dehydrated and in need of moisture. The skin gets dry and itchy during cold weather due to both external and internal reasons.

External Causes : The colder the air, the less moisture it can contain, i.e., absolute humidity is low (absolute humidity, i.e. the volume of water per volume of air). In the cold, water vapor condenses. When it condenses it turns from "steam" back into water, which is too heavy to stay in the air. When the temperature drops the humidity level plunges too. Low humidity during winter, both outside and inside the house, enhances the drying effect on the skin. Exposure to dry wind, cold water or drying soaps further increase the skin dryness.

Internal Causes : When the skin becomes cold, the blood vessels supplying the skin become constricted. This reduces blood flow to the skin and sweat glands and oil producing glands in the body. When the water content of the skin diminishes both inside and outside, the skin cells become shrunken and dry. This produces flaking of the superficial skin cells. This irritates the nerves beneath and produces itching. Most people, because they do not feel thirsty during winter, do not drink enough water or fruit juices during winter. This produces low volume of the circulating blood causing dehydration, another cause for skin dryness.

The methods for prevention and protection from dry and itchy skin problems in winter and summer are same. Before you go outside in wintry and summer weather, create your own moisture barrier. Protect your most sensitive parts (lips, face, and hands) with a scarf and gloves. The relief in both cases is by the use of a sunscreen lotion variety that contains aloe or other moisturizing agents.

To keep skin smooth and supple drink plenty of water and fluids; take a balanced food containing all nutrients including vegetables, fruits, and fresh fish in your daily food intake; avoid chocolates, red meats, spicy fried food and fast foods as they will irritate the dry skin; avoid alcohol and coffee as they will dehydrate the skin and predispose to more drying and itching.

(iii) *Loo and cold, Hyperthermia and Hypothermia* - The extreme temperature conditions of summer and winter may cause one to suffer from loo and cold, respectively. The protection from both the cold and loo is from covering the body by scarf around head and face, and gloves on hand, and glasses on eyes. In both the sufferings, the doctor prescribes the rest and intake of plenty of water and fluids.

An individual's normal body temperature is usually in the range of 96-100 degrees Fahrenheit (about 36-38 degrees Celsius). The sufferings caused to one from summer and cold leads to disturbance in the temperature equilibrium of the body (body temperature may go up or go down).

Both the high body temperature (Hyperthermia) and low body temperature (Hypothermia) puts life at risk. When experiencing sunstroke, the body fails to regulate heat and this will most times end up in a high body temperature and fever.

Hyperthermia occurs when the body produces more heat than it can get rid of. Hyperthermia is usually the result of exposure to extreme heat (sun stroke in summer), which causes the body's temperature to rise to a level with which it cannot cope. Any illness that causes weakness or high fever makes the body more susceptible to hyperthermia.

Drinking plenty of fluids in hot weather is also a necessary precaution against hyperthermia. The following symptoms are typical when experiencing sunstroke: Hot and dry skin, rapid heartbeat and pulse, sweating stops, rapid breathing, increase in body temperature, muscle cramps, headaches, nausea, confusion and dizziness.

The symptoms tend to get worse. The loss of consciousness, fever and the damage of organs are the result if not treated. Drink a lot of water, because sunstroke makes you lose a lot of water in your body.

Hypothermia is a condition in which a person's body temperature drops below a safe level, and the body is unable to return to its normal temperature unassisted. Hypothermia can lead to brain impairment and death if symptoms are not recognized and treated immediately. Common initial symptoms of

hypothermia can include cold skin, shivering, balance problems, headache and lack of judgment. More severe symptoms of hypothermia are a drastically slowed pulse rate, shallow breathing, disorientation, and even a loss of consciousness or death.

Oxygen : The lower as well higher level of oxygen in environment causes harm to the health of animals. The normal air in our environment consists of ~ 78% nitrogen gas and ~ 20.9% oxygen. For humans and many animals to sustain normal functions, the safe zone percentage of oxygen in the breathing environment must be within a small range (19.5-23.5% oxygen). Serious side effects will occur if the oxygen levels are outside of the safe zone. At levels at or below 17%, the harmful symptoms like impaired mental abilities, extreme exhaustion from physical activity, very nauseous or lose consciousness, etc. appears in human being. The humans won't survive with levels at 6 % or lower²¹.

With extremely high concentrations of oxygen in the breathing zone, humans can experience harmful side effects. A very high level of oxygen causes oxidizing free radicals to form. These free radicals will attack the tissues and cells of the body and cause muscle twitching. When it comes to high concentrations of oxygen, greater than 50% according to some medical authorities, then oxygen becomes highly toxic. The earliest effects occurring within 24 to 48 hours are cough, sub sternal pain, and tracheal burning. With continued exposure mast cells may degranulate, secretory cells begin to secrete more mucus like substance; as things progress, and morphological changes at the cellular level occur and may be irreversible, resulting in scarring of bronchial tissue and thickening of cell membranes. The effects from short exposure can most likely be reversed, however

lengthy exposure to high levels of oxygen can cause death²².

Iron, Vitamins, Food, etc.: The intake of Iron, Vitamins, Food, etc. out of safe range is also causes same effect to the health and life. Both the low and higher levels of these nutrients have similar effect on health (i.e., harm to health and life).

SOCIO-PSYCHOLOGICAL EFFECTS

Extreme situations in life also create nearly same effects. A man may suffer from /or die of heart stroke in state of extreme happiness, and same may also happen in the state of extreme sadness. When a man is sad, his/her mind may not work and focuses on the study /work. He/she may like to share it with others at tea, etc. When a man is very happy, then also his mind may not work and not focuses on study /work. He/she may like to share it with others at tea, etc.

A man may suffer from /or die of heart stroke in state of extreme happiness, and same may also happen in the state of extreme sadness. Experts say that extreme happiness or sadness can actually be fatal. They say that a news that comes as a startling revelation, either good or bad can kill us. According to scientists from Germany a traumatic experience, whether good or bad, traumatic information causes the body to produce large amounts of stress hormones including adrenaline, which narrows the main arteries which supply blood to the heart. This apparently paralysis the heart's main pumping chamber and can lead to a change in the rhythm, causing a condition similar to heart attack. Following such a condition, the patient may face difficulty in breathing, experience chest pain and weakness and could even die, if not given medical attention on time. Researchers from the University Clinic of

Rostock, in northern Germany, have found a possible explanation to something that has been studied for quite some time. They say that people can die not just of bereavement or broken heart, but also during an argument or due to excessive unexpected happiness like winning a lottery. Dr Christoph Nienaber, Director of cardiology at the university Clinic of Rostock says that these patients suffer under a heavy emotional load, either positive or negative. Their hearts literally break. It usually happens within minutes to an hour of hearing the news. The typical scenario is bad news but there are reports of both and we don't know what causes it most^{23,24}.

Some people drink to forget, others to remember²⁵. Being a happy or a sad drunk is all down to your genetic make-up, a study suggests²⁶.

A man suffering from sadness calls someone whom he trust and verbalize what he is feeling. It's something that can be a struggle, and something that makes him feel that no one else understands him. So he calls someone and let someone know how he is feeling so that someone does understand him, and can talk to him about it^{27,28}.

SIGNIFICANCE

The basic significance of this article is that the extremities of variables have nearly same effects on some physical phenomenon. So, this conclusion may be used as a hint to have same physical phenomenon (phenomenon which have not been described in this article) in opposite conditions of variables. For example, nuclear fusion (called hot fusion) takes pace at very high temperature as in stars. The hint of present article is that the phenomenon fusion should also take place at low temperature (cold fusion). The literature²⁹ also shows efforts to get fusion at low temperature. For over 100

years, there has been speculation that nuclear fusion might happen at much lower temperatures by fusing hydrogen absorbed in a metal catalyst. In 1989, a claim by Stanley Pons and Martin Fleischmann (then one of the world's leading electrochemists) that such cold fusion had been observed caused a brief media sensation before other scientists began heavily criticizing their claim as being incorrect after many failed to replicate the excess heat.

Similarly, the significance of present article is that it gives hint to understand socio-psychological behavior (which is known in some conditions but not in opposite conditions) in opposite conditions. The present article helps to understand that the personality and growth of a child is adversely affected in both extreme conditions of care and neglect.

CONCLUSION

Some extreme situations of physical environment (like temperature, pressure, etc.) have nearly same effect on some physical phenomenon like the food preservation, conductivity, solubility, etc. Similarly, extreme situations of physical environment (like temperature, etc.) and psychological state have also nearly same effect on the life and health. Although, the mechanistic aspect of matching effects during the opposite conditions may be different.

APPROACH/METHOD USED

The various scientific phenomenons like food preservation, superconductivity, solubility, health, etc. were studied to find effects of variables like temperature, pressure, concentration, etc. The extreme values of these variables were noted to have nearly same effects on these phenomenons.

The observations regarding similar effects of extremities on socio-psychological behavior

are based on daily life experiences of people we talk/interact with, and such observations were then thought to be authenticated by literature published.

REFERENCES

1. http://en.wikipedia.org/wiki/Nicolas_Appert.
2. T. Ohshima, H. Ushio, C. Koizumi, *Trends in Food Science & Technology*, **4**, p.370,1993.
3. J. P. P. M. Smelt, *Trends in Food Science & Technology*, **9**, p.152, 1998.
4. en.wikipedia.org/wiki/Pascalization
5. K. Heremans, L. Smeller, *Biochimica et Biophysica Acta*, **1386**, p.353, 1998.
6. *Modern Vacuum Physics*, 2004, CRC Press, London.
7. *Speed Cleaning: Tips, Tricks & Strategies to Get Everything Done in Half the Time or Less*, 2005, p.97, Rodale publisher, USA.
8. G. Gabrielse et al., *Phys. Rev. Lett.*, **65**, p.1317, 1990.
9. en.wikipedia.org/wiki/Vacuum
10. *Encyclopedia of Packaging Technology*, 2010, 3rd edition, John Wiley publication.
11. *Illustrated Glossary of Packaging Terminology*, 2nd edition, Institute of Packaging Professionals, USA.
12. *Food Packaging: Principles and Practice*, 3rd edition, 2013.
13. en.wikipedia.org/wiki/Vacuum_packing
14. A. Mann, *Nature*, **475**, p.280, 2011.
15. L. D. Jennings, C. A. Swenson, *Phys. Rev.*, **112**, p.31,1958.
16. J. Hatton, *Phys. Rev.*, **103**, p.1167, 1956.
17. B. G. Lazarev, L. S. Lazareve, V. I. Makarov, *Zh. Eksperim, i Teor. Fiz.*, **44**, p.481,1963.
18. *Atkins' Physical Chemistry*, 2006, 8th edition, p. 187, W.H. Freeman & Company, New York.
19. *Properties of Materials*, 1999, p. 1755, Oxford University Press, Oxford.
20. <http://jeplerts.wordpress.com/2008/12/21/partially-miscible-liquids-determination-of-mutual-solubility-of-phenol-water/>
21. The Occupational Safety and Health Administration (OSHA) United States Department of Labor.
22. <http://classroom.synonym.com/minimum-oxygen-concentration-human-breathing-15546.html>
23. G. E. Schwarz, D. A. Weinberger, J. A. Singer, *Psychosomatic Medicine*, **43**, p. 343, 1981.
24. <http://www.counselheal.com/articles/3117/20121017/much-sadness-even-happiness-kill-study.htm>
25. http://www.colormagazineusa.com/index.php?option=com_content&view=article&id=305:why-we-drink-wine-
26. <http://www.telegraph.co.uk/health/healthnews/8427641/Drink-can-make-you-happy-or-sad-depending-on-your-make-up.html>
27. <http://www.calmclinic.com/anxiety/infinite-sadness>
28. <http://www.psychologytoday.com/blog/high-octane-women/201205/where-do-you-fall-the-burnout-continuum>
29. http://en.wikipedia.org/wiki/Cold_fusion

101ST INDIAN SCIENCE CONGRESS -JAMMU, 2014

An Overview & Recommendations

The 101st Indian Science Congress was inaugurated on February 3, 2014 by Dr. Manmohan Singh, Hon'ble Prime Minister of India, in the presence of Shri N. N. Vohra, Hon'ble Governor, J & K State; Shri S. Jaipal Reddy, Minister for Science and Technology & Earth Sciences, Government of India; Dr. Farooq Abdullah, Minister for New and Renewable Energy, Government of India; Prof. R.C. Sobti, Hon'ble Vice Chancellor, Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow, and General President, ISCA and Prof. M. P. S. Ishar, Hon'ble Vice Chancellor, University of Jammu.

The inaugural session was attended by a large number of distinguished scientists, academicians, Vice Chancellors of various Universities, Members of J& K Council of Ministers, Members of Parliament, senior functionaries from the State government, representatives from Industry, students and scholars.

The **Children Science Congress** popularly known as Rashtriya Kishore Vaigyanik Sammelan was inaugurated by Dr. A. P. J. Abdul Kalam, Former President of India on February 4, 2014. Prof. Yashpal, Former Director, Indian Space Research Organization and Former Chairman, University Grant Commission, delivered the Key Note Lecture in the Inaugural session.

More than 7000 students from different government and private schools of Jammu and nearby areas were invited to participate in the inaugural function. Prof. Arun Kumar, General Secretary (Scientific Activities), ISCA

Indian Science Congress Association, welcomed the guests and Prof. Pankaj Srivastava, Convener of the Children Science Congress highlighted the objectives of the programme. Prof. Mohan Paul Singh Ishar, Vice Chancellor, University of Jammu, addressed the gathering. Prof. R. C. Sobti, General President, ISCA presided over the function.

Eight students were awarded with the INFOSYS - ISCA Travel Award during the Inaugural function. After the Inaugural Ceremony, Dr. Kalam also inaugurated the Children Science Exhibition.

The Children Science Congress culminated with a gala Valedictory function where certificates were distributed to the Child Scientists and the teachers who accompanied them. Jenab Abdul Rahim Rather, Hon'ble Finance Minister, J & K Government was the Chief Guest of the function. Prof. M.P.S. Ishar, Vice Chancellor, University of Jammu presided over the function. Dr. B. P. Singh, Head NCSTC and Dr. D. K. Pandey, Scientist F, DST were the Guests of Honour.

The **3rd Women Science Congress** in the 101st Indian Science Congress was organized at University of Jammu from February 5-7, 2014 on the theme "Women in Science, Technology and Innovation". The Women Science Congress was inaugurated by Dr. Farooq Abdullah, Hon'ble Union Minister for New and Renewable Energy in the presence of Mrs. Usha Vohra, First lady of the State of Jammu and Kashmir, who was the Guest of Honors on the occasion; Prof. R. C. Sobti, General President, ISCA Prof. Arun Kumar, General Secretary (Scientific Activities) ISCA

and Prof. M.P.S. Ishar, Vice Chancellor, University of Jammu. Prof. Kasturi Datta, School of Environment Science, Jawaharlal Nehru University was the Keynote Speaker.

The three days Women Science Congress had a special lecture session along with six sessions which had various presentations over a broad range of fields. About forty eight (48) oral presentations were made during the six sessions. This programme motivated the participation of a large number of women scientist from various institutions across the country.

The Valedictory session of the Women Science Congress was organized on February 7, 2014. Mrs Shamima Firdose, MLA Chairperson, State commission for women was the Chief Guest and Dr. Shashi Ahuja, Advisor, Department of Science and Technology, Government of India was the Guest of Honour. Prof. Arun Kumar, General Secretary (Scientific Activities), ISCA was also present.

The **Seventh Science Communicators' Meet** (SCM) also known as "Rashtriya Vigyan Sancharak Sammelan", was inaugurated by Prof. R. C. Solti, General President ISCA on February 4, 2014. Prof. M.P.S. Ishar, Vice Chancellor University of Jammu, was the Guest of Honour. Dr. B.P. Singh, Head, NCSTC, DST, New Delhi along with Prof. Arun Kumar, General Secretary (Scientific Activities) and Er. N.B. Basu, General Secretary (Membership Affairs), ISCA also graced the occasion. Prof. Kamal K. Kapoor, Convener emphasized the mission and objectives of the meet to the august gathering.

The Seventh Science Communicators' Meet comprised of four Technical sessions and two poster sessions in which fifteen oral and nineteen poster presentations were held during the entire session spread over two days, where

members from different ISCA Chapters participated.

Jenab Feroz Ahmad Khan, Hon'ble minister of S & T, IT and Medical Education, J & K Govt. was the Chief Guest of the valedictory function. Prof. Talat Ahmed, Vice Chancellor, University of Kashmir, Prof. M.P.S. Ishar, Vice-Chancellor, University of Jammu, Prof. S. B. Nimse, President(Elect), ISCA, Dr. P. Asthana, DST and Dr. Manoj Patariya, Director, NCSTC, DST, Prof. Arun Kumar, General Secretary (Scientific Activities) and Dr. Amit Krishna De, Executive Secretary, ISCA were among the dignitaries present on the occasion.

Following the inauguration of 101st Indian Science Congress on February 3, 2014, the first edition of **Science Exhibition 'India Vision 2020 Mega Expo 2014'** was inaugurated by Sh. S. Jaipal Reddy, Hon'ble minister for Science and Technology Earth Sciences, Govt. of India, Jammu & Kashmir State and Prof. M.P.S. Ishar, Vice-Chancellor, University of Jammu. A large number of national/international delegates including eminent scientists, industry leaders, technocrats policy makers, entrepreneurs, innovators and academicians also graced the occasion.

The Science Exhibition was visited by thousands of students from various schools, college, polytechnics and other institutions. Members of civil society teaching fraternity and scientists also visited the Exhibition. Students rush made this exhibition a fundamental success.

The **Rural innovators Exhibition** was organized under the banner "National Innovation Foundation India an autonomous body of the Department of Science & Technology Government of India." About 30

innovators from rural areas including farmers from the states of Gujarat, Bihar, Tamil Nadu, Assam, Andhra Pradesh, Rajasthan, Himachal Pradesh and Jammu and Kashmir displayed their exhibits in the exhibition.

The **Valedictory programme** of 101st session concluded on February 7, 2014, in which Dr. Hamid Ansari, Hon'ble Vice President of India Jenab Omar Abdullah Hon'ble Chief Minister J & K State, Dr. Farooq Abdullah, Hon'ble Union Minister for New and Renewable Energy Prof. R. C. Solti General President, ISCA, Prof. M.P.S Ishar Vice Chancellor, University of Jammu and Prof. S. B. Nimse, President (Elect) ISCA.

On this occasion, awards and mementoes were also presented by Hon'ble Vice President of India. The Young Scientist Awards and Best Poster Awards were also presented.

The Congress had extensive, wide-ranging sessions which included fourteen Sectionals, twenty one Symposia, numerous Plenary and Invited Lectures, Special Evening Lectures, an Endowment Lecture, and Panel Discussions. Public outreach/ Interaction programs were also organized during the five day 101st Indian Science Congress by the Indian Council of Medical Research, Indian Space Research Organization, Ministry of Earth Sciences, DBT-Bill Gates Foundation, and Development of Atomic Energy and Indian Council of Agriculture Research.

About 480 oral presentations, 718 poster presentations and 200 Invited Lectures were delivered during the fourteen sectionals. Around 122 plenary/special invited lectures were organized during the five-day Mega-event.

The event attracted a staggering number of participants, around 6500, not only from across the length and breadth of the country of India; but also from foreign shores from the countries like USA, UK, Canada, Japan, Czech Republic,

Germany, France, Spain, Mexico, Sri Lanka etc. Noble Laureates Prof. Y. T. Lee, President, International Council for Science, and Prof. Ferid Murad, University of Washington graced the Congress.

RECOMMENDATIONS OF SECTIONAL PROGRAMMES

AGRICULTURAL AND FORESTRY SCIENCES

- A road map of total food grain requirement (domestic and export) and a plan for production at the suitable sites, procurement and storage.
- Nutrition enriched stable food crops – development, characterization and availability for people with chronic malnutrition.
- Designer crops with less tillering or even with single tiller with synchronous flowering in case of cotton and suitable harvest, reduce post harvest loss and lead to better crop management.
- For feasible conservation strategies to protect or restore plant reservoirs and native pollinators, creation of new protected natural areas to ensure food provision, mating and nesting site for pollinators requires multidisciplinary research approaches, development of novel management and conservation practices and a strong commitment to disseminate the results of these studies to the public and policy makers.
- Mechanization to be developed suitable for small holder farms and marketing arrangement at the rural areas where farmers will have access to the market and low cost storage facility. Contract farming can also be mobilized to encourage the farmers to produce better crops with money back arrangement.

- No till or low till farming sequester about 200 k carbon per ha/yr with deep fried and micro – sprinklers would bring efficient water saving and success of 2nd revolution of India.
- Private – public joint research project fashioned in network mode involving relevant laboratories and competent scientists may be planned to undertake C4/NUE (Nitrogen Use Efficiency)/N₂ fixation research in the major food grain crops like rice and wheat.
- Weeds cause about 40% crop yield loss and are a serious threat for the crop management of cereal crops, pulses, oilseeds, cotton, sugarcane etc. Direct seeding, zero tillage and use of water efficient crops require more science based weed management to obtain potential yield of genetic gains of improvement crops.
- Integrated approach of use of modern agricultural practice, consolidation of lands and mechanization need to be strengthened.
- GM research and value added GM crops need to be strengthened and GM crops should be available from laboratory to the land on the basis of scientific basis. Adequate funding is also required to support such genomics based competitive. GM crop research.

ANIMAL, VETERINARY AND FISHERY SCIENCES

- Basic biology should be made integral part of undergraduate and post graduate studies in biotechnology, microbiology, bioinformatics and other modern biology disciplines.
- With view to conserve biodiversity,

emphasis on strengthening of classical Zoology in the syllabus of undergraduate (U.G.) and post graduate (P.G.) programmes be given which is not reflected in new UGC syllabus. UGC may be requested to restructure the syllabus in the light of this recommendation.

- National funding agency should provide sufficient funding for research on animal taxonomy as classical taxonomy has gone on Blackfoot during last 2 decades and proper identification of species of biodiversity importance has become a problem for young researchers.
- Bioresources are the wonderful gift of the nature to the mankind whose sustainability can be effectively linked to rural livelihood and economic development, so science education should aim at attracting students for proper management and sustainable utilization and innovative idea of bioresources.
- The assemblage of species with which we share the planet represents a vast untapped genetic library, with undiscovered pharmaceuticals and other beneficial substances. So programmes needed to be initiated for the exploration of other less known potential varieties of life forms with a view to ensure livelihood, food, health and financial security.
- Ensuring dangers of climate changes to biodiversity be recognized and integrating measures be undertaken on priority.
- Biotechnological tools and innovative ideas should be used for conservation, management and restoration of all types of habitat.

- Check list of local fauna be prepared to know the status of biodiversity and submit the same to the concerned agency to undertake conservational measure.

ANTHROPOLOGICAL AND BEHAVIOURAL SCIENCES (INCLUDING ARCHAEOLOGY, PSYCHOLOGY, EDUCATION SCIENCES AND MILITARY SCIENCES)

- It is to be recommended, that India need to step up its public spending on both health and education with a greater focus on quality and honest spending.
- It is recommended that to attain the need of social justice to all and specifically to the communities of farfetched areas, these communities should come forward to meet with the pace of development by enhancing their quality of living.
- It is recommended, that greater emphasis be made on basic education with passionate objectives to bring education for economically deprived and marginalized communities.
- It is recommended, that an approach of holistic education be developed for each learner to enhance the understanding regarding the surging needs and challenges of national development.
- It is recommended that to attain both inclusive and positive development, proper teaching and training be ensured for child care to all future mothers.
- It is recommended, that behavioural scientists have to play a greater role in rectifying and managing the social vagaries in terms of prejudices, stereotypes, fanaticism, terrorism and political adventurism by developing work ethics and social harmony in all walks of

life, where each individual might associate with greater responsibility and commitment with the programmes destined for inclusive development.

CHEMICAL SCIENCES

- Timing of Sessions particularly the extra added Symposia should not clash with the Sections timing.
- Poster presentation for Award should be published properly as only 3 posters were considered for award while there were more than 250 posters in sections. All papers if a copy is sent to ISCA head quarters and other to sectional president can be considered for award.
- Regional Science Congress should be held in next year in area where it was never held earlier e.g. Uttarakhand, Western U.P. and H.P.

ENGINEERING SCIENCES

- Recommendations For Utilisation of Renewable Energy Sources (RES) For Domestic As well As Commercial Application
- Introduction of cluster base system installation in remote/Village area where no Grid power supply is there.
 - (a) To accord such units as a pilot project for motivation as well as to establish worthiness and functioning of system to eliminate doubts in residents of such area.
 - (b) Outreach of R.E.S. through
 - Demonstration.
 - E-Media
 - New Prints
 - To award identified well performing unit with proper incentives in enhancing R.E.S.

- Assuring availability R.E.s products and services at a glance.
- Proper financing mechanism for large / medium scale R.E.S. products are some of the significant recommendation.
- To adopt newly introduced fuels cell Technology.
- To design and manufacture intelligent chargers for Grid interface.
- To ensure economic viability through time to time reassessment of the cost.

ENVIRONMENTAL SCIENCES

- There is an urgent need of restoration of curable waste lands of our country by giving emphasis on ecological, agro-ecological and socio-economic consideration for the benefit of local communities so that they can further plan for long term management of the target areas. Strong and due financial support must be provided to all the stake holders.
- Exploration, documentation and conservation of biodiversity of wetlands, sacred forest/groves and all hot spot areas are recommended as most of our biodiversity data are under-documented in global scale in accordance with IUCN database. Blend of cultural, religious and scientific values should be incorporated in the policies pertaining to ecological restoration and biodiversity conservation for fostering bio-economy.
- An all India coordinated project on assessment of air quality in terms of inorganic pollutants (NO_x, SO_x, CO₂, CO, SPM, etc.) and organic pollutants (pollen grains, spores, bioaerosols, etc) has to be initiated in metropolis and other major cities of our country for documentation and mitigation that will help our clinicians for easy diagnosis and treatment of respiratory and other diseases.
- Easy access to pure drinking water (i.e., free of heavy metals, pathogens, pesticides, dyes, xenobiotics, etc) to the remote villages must be ensured. Thus, it is recommended to provide facilities in researches for assessment and maintenance of the quality of both surface and ground water.
- Special emphasis should be given to the traditional indigenous knowledge based natural resources (especially herbal medicine) as Indian traditional medicine system such as Ayurveda, Unani, etc. as they have long been tested as alternative medicine as well as are cost effective.
- Bioremediation and other related technologies need to be strengthened further involving biodiversity to solve environmental pollution related problems. Emphasis should be given to all the stakeholders.
- There is an urgent necessity to assess the alien exotic species which invaded our land and aquatic ecosystem and declined our natural indigenous flora. A national policy should be adopted for extermination of such alien species and in addition, they may be utilized as fuel, manure and other purposes.
- As per recommendation of the Kyoto Protocol in 1997, the greenhouse gases must be phased out. Hence proper research should be undertaken to assess the emission of greenhouse gases. There is an urgent need of further research to develop new technologies for the reduction of greenhouse gas emission.

- Global climate change is a very important concern for the coming generation. So, it is important to develop strategy to mitigate the impact of climate change on flora and fauna including human being. Special emphasis should be given to the ecologically sensitive areas of the country including coastal zones.
- There is an urgent need for strengthening of the existing scientific institutions working on various aspects of environment and development and also Departments of Environmental Sciences working in various Universities in terms of manpower, budget and infrastructure.
- As there are only few Institutions/Centers/Departments related to environmental sciences are existing in the country so new Institutions/Centers/Departments devoted for the Environmental Sciences should be established at various locations of the country so that the country would be able to produce quality research in the field of environmental sciences and also to produce eminent and able environmentalists in the country who may create environmental awareness among the common masses and may also provide innovations for conserving our Mother Earth. Thus, our environment can be visualized in a holistic way and this will certainly make the Mother Earth more sustainable in future.
- The IT and ITES / BPO industries are to set up beyond the metros and focus should be given at other places including state capitals and district head quarters also.
- Govt. should promote in building India centric software and hardware industries as well as help in accelerating in driving for domestic market IT adoption and for enhancing software development business competitiveness in the country.
- Effective policy should be framed by the Union and State Governments to encourage the ICT educated youths to become entrepreneurs for setting S/w and H/w industries in the country.
- Focus should be given to energies the masses with the use of ICT with the help of internet connectivity and its convergence with mobile phones for the purpose of providing centralized services and benefits of e-governance
- The members of the section have unanimously recommended that the name of the section should be renamed as "Information And Communication Science & Technology (Including Computer And Library Sciences).

INFORMATION AND COMMUNICATION SCIENCE & TECHNOLOGY (INCLUDING COMPUTER SCIENCES)

- To harness ICT for inclusive development, It's use should be promoted more and more among the rural masses as well as women's communities.

MATERIAL SCIENCES

- Materials Science is of Interdisciplinary nature dealing with Education, Research and Development in the area of Applied Sciences. It deals with improvement in properties and applications of conventional materials as well as development of New materials with functional properties. This is directly or indirectly linked to the Industrial as well as economic growth of the country. Taking experience from all developed countries as well as Upcoming Developed

countries, efforts should be made to boost Materials Science education and research in the Universities and higher education system. Currently this is not included as subject in the UGC-NET examination since this is either taught as part of Physics or Chemistry main subject. Therefore, this should be introduced as independent Master course program, of course with emphasis on regional industrial and societal needs. Both traditional as well as high end Materials and Technologies for current health care, energy and programs strategic nature be given equal weightage while funding the projects.

- Efforts be made to rope in Industries so that the fruits of applied research are ripened by the Industries and the products reach the common man as well as help in elevating economy of the country.

MATHEMATICAL SCIENCE (INCLUDING STATISTICS)

- All participants of the section of Mathematical Sciences express their thanks to the Vice chancellor and other dignitaries of Jammu University, Jammu for hosting and providing good hospitality during 101st Indian Science Congress.
- All participants express their satisfaction and happiness on the deliberations and discussions held in various sectional programs.
- They also express thanks and gratitude to the local secretary Prof. J.P.Singh Joorel, Prof. Rahul Gupta (Chairperson, Dept. of Statistics), Prof. Dalip Singh (Chairperson, Dept. of Mathematics), Dr. Parmil Kumar (Asst. Profesor, Dept. of Statistics) other faculty.

MEDICAL SCIENCES (INCLUDING PHYSIOLOGY)

- More local volunteers/support are needed for running academic/scientific activities in Conference.
- A 24×7 active helpline is must for such a grand meeting and a docket number or such response numbers should be provided for reference till solving the query/problem in satisfactory manner.
- Transport/accomadation facility information should be handled in a more co-ordinated manner.

NEW BIOLOGY (INCLUDING BIOCHEMISTRY, BIOPHYSICS & MOLECULAR BIOLOGY AND BIOTECHNOLOGY)

- New Biology Section was well organized. Talks were of high scientific standard. Attendance in each and every session was quite good.
- There was not much formal discussion since most speakers left immediately after his/her talk or the particular session was over. However in some informal discussion it was suggested that it would be better if one or two sessions (mini symposium) could be arranged on specific important area -
- Biology
- Nanomedicine Cancer
- Proteomics & Genomics etc.

PHYSICAL SCIENCES

- The Physics research scenario was discussed and it emerged that research on grassroot technologies like solar energy, water harvesting, pollution control, energy production, etc. is being pursued at premier research institutions

in the country. It is important that universities of the country can also bring in change in this aspect and they need to be encouraged in this direction. Thus, the forthcoming Physical Science Section of the 102nd session of the Science Congress can address these issues possibly under the title Physics Research for Sustainable Development. Any of the topics mentioned above may be addressed in detail as a mini-symposium.

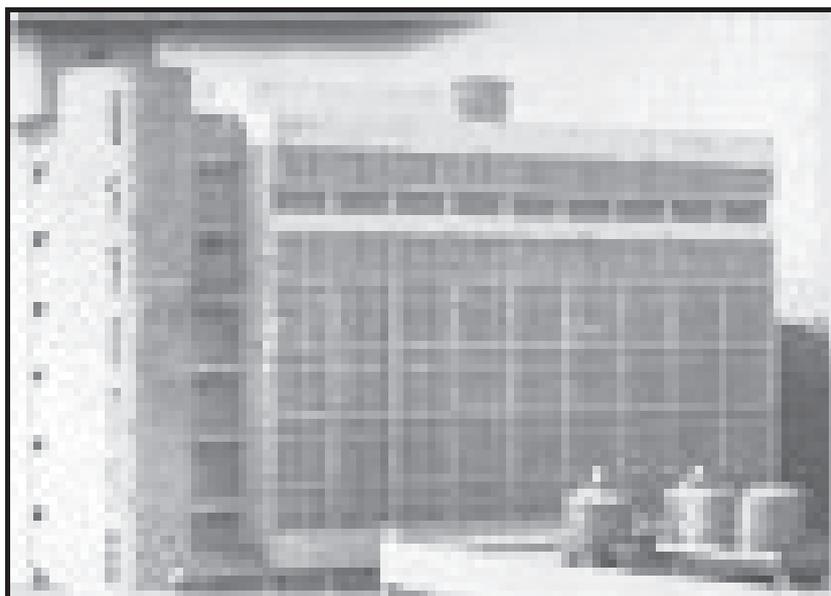
- The fact that only few posters (03) were shortlisted for Best Poster Award did not go well with the participants. Their contention is that all their efforts in preparation of the poster, attending the Science Congress after travelling long distances, etc. were in vain if their posters are not considered seriously. Collective opinion was that the Science Congress should consider all the posters for the award and then select the best two. This would encourage young researchers to actively participate in the Science Congress.
- There was also disappointment that Travel grant and Local Hospitality was limited to only few invited speakers (2+3). Many invited speakers suggested that this number should be increased to at least 12 members, if not all. This will help the Sectional President in inviting motivated, dedicated and active researchers/ speakers who can share their knowledge and experience with the youngsters and motivate them to carry

out quality research work. In fact this is the need of the hour, for our country.

PLANT SCIENCES

- Renaming of the Plant Sciences Section to Botany.
- Equitable distribution of Research Grants/Funds sanctioned by the Government to all branches/subjects and not restricts the Lion's share to selected fields.
- Best poster should be selected out of the posters displayed during the session and NOT out of those send to the ISCA office.
- Need of change of NET Syllabus for the recruitment of Lecturer/Researchers in Botany. The syllabus should be in Botany and not Life Sciences.
- Fundamental and Basic Sciences should be given due weight age .
- Setting up of Gardens for cultivation of Medicinal Plants. Collection of these from the wild should be discouraged.
- The Weightage of impact factor/citation index be given up. Since the funds are wasted on getting research work published in Journals of the impact factor.
- Encourage researches to publish in Indian Journals. These Journals could be rated by the National Academy of The Sciences.
- Co-supervisor/Advisors should be appointed for Ph.D. and other dissertations from India and abroad to make them more meaningful.

KNOW THY INSTITUTIONS



NATIONAL INSTITUTE OF PATHOLOGY, NEW DELHI

To make National Institute of Pathology a premier research Institute by carrying out research in molecular pathology, genetics, immunodiagnostics, vaccine development, environmental bio-monitoring and applied fields for better health care, efforts are being made to bring new technologies to the Institute, viz.: proteomics, nanotechnology, stem cell, tissue microarray, image analysis, etc. It is envisaged to establish Institute as a resource center for Modern Pathology and Biotechnology both nationally and internationally. In looking to the future and taking into account the past output from National Institute of Pathology, new high priority areas for research have been identified, viz.: metabolic syndromes (diabetes, CAD,

obesity), chronic diseases biology (fibrosis liver/ lung/ pancreas), idiopathic skin diseases (psoriasis, vitiligo) and bioinformatics along with continuation of working in existing thrust areas of tumor biology, infectious diseases, adult stem cell biology and environmental toxicology. It is envisaged that National Institute of Pathology should emerge as a Center of Excellence for Research, Training and Reference for Medical and Biomedical Sciences catering to health problems of national importance. Efforts are underway to establish a biobank for the pathologically characterized surgical material. Telepathology is being established in an effort to establish network with pathologists at different medical colleges and health centers.

Scope of activities

Situated at New Delhi, the National Institute of Pathology (NIP) conducts research on various cancers of national importance (breast cancer, prostate cancer, urinary bladder cancer, hematopoietic lymphoid malignancies and neurological cancers), leishmaniasis, chlamydial infection, environmental toxicology and adult stem cell biology. The major thrust is on basic as well as translational research leading to development of vaccines for prevention and biomarkers for screening, diagnosis, prognosis and prediction of drug response/resistance for various diseases.

Thrust Areas :

The following are the thrust areas of NIP

- Tumor biology (breast cancer, genitourinary malignancies, lymphoma, cancers in north east region), infectious diseases (chlamydia, leishmania), stem cell biology and environmental toxicology.
- Genetic susceptibility for various familial and non familial tumors, predictive and prognostic biomarkers, molecular pathology, molecular functional pathways and drug targets.
- Investigation of the gene-environmental link responsible for very high incidence of several malignancies, especially those associated with tobacco and pesticide (oral, esophageal, gastric, lung and breast cancers) in north eastern states in India.
- Studies on chlamydia infection on genital tract and coronary artery disease, including study on role of chlamydial heat shock protein in pathogenesis of genital tract infection in women.
- Understanding the process of *in vitro* differentiation of *Leishmania donovani*.
- Studies on role of environmental toxicants especially heavy metal in cases of miscarriage.
- Studies on utility of a patented synthetic thermo-reversible hydrogel polymer as supportive matrix towards the development of 3-D composite skin for application in wound healing and other dermatological disorders.

New high priority areas have been identified, viz.: lifestyle diseases, metabolic syndromes, chronic diseases biology and telepathology.

Significant achievements of NIP are the following

- Demonstrated through studies on Indian Childhood Cirrhosis (ICC) that
 - * Factors like dietary copper toxicity, hepatitis A or B do not have any etiological role;
 - * The presence of stainable cu & cu binding proteins observed in the more severe stages could be a consequence of severe damage of hepatocytes;
 - * Trace element analysis of hepatic biopsies showed presence of Zn also, besides Cu suggesting manifestation of iatrogenic liver injury.
 - * The starting point of ICC seems to be at the stage of "Acute Hepatitis of Toxipathic or Trophopathic Nature" following widespread use of domestic remedies and the disappearance of such practices may explain the virtual extinction of this disease.
- Identification of high risk alleles- CYP17A2, VDR Poly A L allele and > 20CAG repeats in AR gene for breast

- cancer in young women and androgen receptor as independent predictive biomarker for response to neoadjuvant chemotherapy in locally advanced breast cancer patients.
- Establishment of cell line from primary breast cancer in young woman as an important tool to study molecular carcinogenesis and develop new therapeutic strategies.
 - Establishment of *in vitro* model of cultured autologous bladder cancer cells for *in vitro* cytotoxicity assay to select the drug and tailor the dose for individualization of treatment.
 - The wide spread use of tobacco and fermented betel quid in northeast region of India, the genotoxic chemicals in tobacco and betel quid contribute to the development and progression of oral, lung and esophageal cancer. Genome-wide analysis of chromosomal alterations and gene expression profile has shown a characteristic pattern of genomic imbalances associated with tumor initiation, metastasis and high-grade disease.
 - Betel quid chewing was identified as the single main risk factor for breast cancer in NE region.
 - Functional genomic studies of virulence related genes in *Leishmania*- First identification of centrin gene of *Leishmania*.
 - Genes associated with drug resistance in Kala-azar.
 - Developed diagnostics for Kala-azar (KA) and PKDL.
 - PKDL immunobiology
 - Development of indigenous diagnostic assays (serovar and species specific) for *Chlamydia trachomatis*
 - Identification of biomarkers for prognosis of women at risk of developing a sequelae to chlamydial infection.
 - Identification of proteins acting as potential candidates for vaccine development.
 - Biomarkers for a risk of developing coronary artery disease due to *C. pneumoniae* infection.
 - Conducted toxicological study on the health effects of the toxic gas leak from Union Carbide Methyl Isocyanate Plant in Bhopal which resulted in many unique patho-gnomonic and other major findings as described below-
 - * Detection of widespread conjunctival congestion, nasal and oral frothing and fluid exudation, pinkish discoloration of the bodies and lack of cyanosis.
 - * 'Cherry red discoloration' of blood and viscera accompanied by edema and haemorrhage. The lungs appeared to be the target organ, followed by brain and other organs to a variable degree. Microscopic examination showed extensive changes such as necrotising bronchiolitis and widespread damage of the lung parenchyma.
 - * Acute bronchiolitis, bronchopneumonia, pulmonary haemorrhages and edema, with outpouring of albuminous fluid into the alveoli, pneumonitis and alveolitis.
- The Histo-pathological changes in other organs were suggestive of extensive or

widespread cerebral edema or swelling, pericapillary ring haemorrhages, both in the

- * cortex as well as the white matter.
- * A group of autopsies on victims who died during the 8-12 week after the episode revealed less marked but essentially a similar picture of pulmonary changes. There was, however, no suggestion of any interstitial or parenchymal fibrosis at that stage. The progression of severe pulmonary edema to chronic fibrosis was confirmed experimentally, following a single exposure to MIC.
- * Established not only 'acute cyanide toxicity' but also 'delayed or recurrent cyanide toxicity' due to the thermal decomposition of products like HCN and/or 'recurrent cyanide toxicity' through N- & S-Carbamoylation.
- * There were elevated thiocyanate levels in the urine of exposed as against unexposed controls, especially after administration of NaTS injections to the survivors. In addition to 'clinical relief', the initial rise in the urinary NaSCN levels gradually declined.
- * Revealed the mechanisms of acute, delayed and recurrent cyanide toxicity, probably due to underlying disturbances of cyanide metabolism,

during the reversible phases by blockage of sulphane donors of rhodanese-like enzymes or due to trans-carbamoylation between more dynamic sulfhydryl (SH) and end-terminal amino groups.

- * Also demonstrated : That MIC crosses alveolar-capillary barrier and was observed bound to free endterminal alpha amino group of valine residues;
- * The binding of MIC to end-terminal amino groups of Hb and tissue proteins and tracked MIC in the blood of Bhopal victims (dead and living).

Undertook study on tank residue constituents (TRCs) to detect other possible 'cyanideyielding nitriles'. While no nitriles were detected, a total of 21 compounds were demonstrated, including 11 compounds reported previously by UCC and NCL, Pune. In addition, traces of HCN were also demonstrated even after a considerable lapse of time. Importantly many of these compounds could be traced in the autopsy tissues especially during the first few days.

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Conferences / Meetings / Symposia / Seminars

5th Annual International Conference on Advances in Biotechnology (BIOTCECH 2015), 13th to 15th March 2015, IIT, Kanpur, Uttar Pradesh

Biotechnology Topics :

- Microbial & Biochemical Technology
- Microorganism Technology
- Microbiology
- Bioremediation & Biodegradation
- Clinical and Cellular Immunology
- Petroleum & Environmental Biotechnology
- Biotechnology and its applications
- Biosensors, Bioelectronics & Biochips, Tissue chips
- Marine and Ocean Biotechnology
- Omics Technologies
- Medical Biotechnology and Biomedical Engineering
- Stem Cell Research & Tissue Science Engineering
- Environmental Biotechnology
- Industrial Biotechnology
- Food Processing & Technology
- Pharmaceutical Biotechnology
- Agricultural Biotechnology
- Nano science & Nanotechnology
- Regulatory and Economical Aspects in Biotechnology
- Neuroscience and Neuroengineering
- Biosecurity
- Disease Outbreak Assessment
- Bioenvironmental Engineering and Risk Assessment
- Applied Biotechnology
- Algae and photobiotechnology
- Bioeconomy
- Bio-based products: materials
- Biocatalysis and biotransformation
- Bioengineering at the μ -Scale
- Biomaterials engineering and nanomedicine
- Bio-nanoparticles
- Biopharmaceuticals production
- Bioprocess engineering, modelling, measurement & control
- Biorefineries
- Downstream processing and separation science
- Membrane technology
- Metabolic engineering
- Molecular, cellular and process biothermodynamics
- Renewables, biofuels and bioenergy
- Systems bio (techno) logy
- Synthetic biology
- Thermodynamics of chemical and pharmaceutical systems
- Tissue engineering

Bioinformatics and Computational Biology Topics :

- DNA Computing
- Neural Computing
- Evolutionary Computing
- Immuno-Computing
- Swarm-Computing
- Cellular-Computing

- Gene Expression Array Analysis
- Structure Prediction and Folding
- Molecular Sequence Alignment and Analysis
- Metabolic Pathway Analysis
- RNA and Protein Folding and Structure Prediction
- Analysis and Visualization of Large Biological Data Sets
- Motif Detection
- Molecular Evolution and Phylogenetics
- Systems and Synthetic Biology
- Modelling, Simulation and Optimization of Biological Systems
- Robustness and Evolvability of Biological Networks
- Emergent Properties in Complex Biological Systems
- Ecoinformatics and Applications to Ecological Data Analysis
- Medical Imaging and Pattern Recognition
- Medical Image Analysis
- Biomedical Data Modelling and Mining
- Treatment Optimisation
- Biomedical Model Parameterisation
- Brain Computer Interface

Contact : Biotech Conference Secretariat, Global Science & Technology Forum (GSTF), 10 Anson Road, International Plaza, Singapore 079903, Email : secretariat@advbiotech.org, DID : +65 6327 0166, Fax : +65 6327 0162

19th World Congress of Clinical Nutrition being organised at Institute of Medical Sciences, Varanasi, Uttar Pradesh, 13th to 15th March 2015.

Theme : Eco-Friendly Agricultural, Food and Nutritional Approach For Sustainable Global

Sub Themes :

- Eco-Friendly Nutritional Approach for Global Health
- Agro-Nutritional Approach for Global Health
- Food and Nutritional Approach for Sustainable Global Health
- Micronutrients : Principles and Practices
- Principles of Clinical Nutrition for Global Health
- Indigenous nutritional practices for Global Health.
- Recent Advances in Food Technology for Global Health
- Food Security and Global Health
- Public-Private Partnership for enhancing Global Health
- Community Nutrition for Sustainable Development

Contact : Organizing Secretaries, Dr. Ratan. K. Srivastava Professor, Department of Community Medicine, Institute of Medical Sciences, Varanasi, U.P., Pin Code : 221005; Tel No. 00-91-542-670-3301; Mobile No. 00-91-9889665528, Fax No. 00-91-542-670-3301, Email : ratanpsm@gmail.com

International Conference on Renewable Energy and Sustainable Environment (RESE-2015), August 3-5, 2015, Pollachi, Tamil Nadu

Themes :

Wind

- Wind Energy Conversion System
- Optimization of Wind Energy Resources
- Off-Shore Wind Power
- Development in Small Wind Generators
- Grid Interactive Wind Power

Solar

- Advanced Solar PV Technologies
- Nano Technology for Solar PV
- Solar Thermal Power Generation
- Power Electronics Application in Solar Power Generation
- Hybrid Systems

Biogas/Bio Mass

- Bio Energy Conversion Technologies
- Bio Fuels in Transport

Energy and Environment

- Green/Smart Buildings
- Energy Economics
- Waste to Energy

- Biochar in Environment
- Environment and Green Energy

Sustainable Environment

- Environmental Pollution and Management
- Water/wastewater Quality Modelling
- Water/wastewater Treatment Technology
- Environmental Quality Monitoring
- Nanotechnology in Environmental Sustainability

Impact of Industrialization on the Environment

- Groundwater Contamination
- Mine Water Management
- Contaminant Transport and Fate Modelling
- Radioactive Material Disposal and its Impact on Environment
- Soil Reclamation/Restoration
- Social Impact

Contact : Dr. Ranga Palaniswamy, Conference Secretary--RESE 2015, Dr. Mahalingam College of Engineering & Technology, Pollachi, Coimbatore, TamilNadu, India-642003, E-mail : rese 2015@mcet.in, Contact No. : +91 99429 55574, +91 99423 47750, Web : www.mcet.in/conference

S & T ACROSS THE WORLD**NEW LIGHT TO ILLUMINATE THE WORLD**

The Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Physics for 2014 to Isamu Akasaki, Meijo University, Nagoya, Japan and Nagoya University, Japan, Hiroshi Amano, Nagoya University, Japan and Shuji Nakamura, University of California, Santa Barbara, CA, USA *“for the invention of efficient blue light-emitting diodes which has enabled bright and energy-saving white light sources”*

This year's Nobel Laureates are rewarded for having invented a new energy-efficient and environment-friendly light source—the blue Light-Emitting Diode (LED). In the spirit of Alfred Nobel the Prize rewards an invention of greatest benefit to mankind; using blue LEDs, white light can be created in a new way. With the advent of LED lamps we now have more long-lasting and more efficient alternatives to older light sources.

When Isamu Akasaki, Hiroshi Amano and Shuji Nakamura produced bright blue light beams from their semi-conductors in the early 1990s, they triggered a fundamental transformation of lighting technology. Red and green diodes had been around for a long time but without blue light, white lamps could not be created. Despite considerable efforts, both in the scientific community and in industry, the blue LED had remained a challenge for three decades.

They succeeded where everyone else had failed. Akasaki worked together with Amano at the University of Nagoya, while Nakamura was employed at Nichia Chemicals, a small company in Tokushima. Their inventions were

revolutionary. Incandescent light bulbs lit the 20th century; the 21st century will be lit by LED lamps.

White LED lamps emit a bright white light, are long-lasting and energy-efficient. They are constantly improved, getting more efficient with higher luminous flux (measured in lumen) per unit electrical input power (measured in watt). The most recent record is just over 300 lm/W, which can be compared to 16 for regular light bulbs and close to 70 for fluorescent lamps. As about one fourth of world electricity consumption is used for lighting purposes, the LEDs contribute to saving the Earth's resources. Materials consumption is also diminished as LEDs last up to 100,000 hours, compared to 1,000 for incandescent bulbs and 10,000 hours for fluorescent lights.

The LED lamp holds great promise for increasing the quality of life for over 1.5 billion people around the world who lack access to electricity grids: due to low power requirements it can be powered by cheap local solar power.

The invention of the efficient blue LED is just twenty years old, but it has already contributed to create white light in an entirely new manner to the benefit of us all.

SURPASSING THE LIMITATIONS OF THE LIGHT MICROSCOPE

The Royal Swedish Academy of Sciences has decided to award the Nobel Prize in Chemistry for 2014 to Eric Betzig, Jenelia Research Campus, Howard Hughes Medical Institute, Asbourn, VA, USA, Stefan W. Hell, Max Planck Institute for Biophysical Chemistry, Göttingen, and German Cancer Research Center, Heidelberg, Germany and William E. Moerner, Stanford University, Stanford, CA, USA, *“for the development of super-resolved fluorescence microscopy”*

For a long time optical microscopy was held back by a presumed limitation: that it would never obtain a better resolution than half the wavelength of light. Helped by fluorescent molecules the Nobel Laureates in Chemistry 2014 ingeniously circumvented this limitation. Their ground-breaking work has brought optical microscopy into the nanodimension.

In what has become known as nanoscopy, scientists visualize the pathways of individual molecules inside living cells. They can see how molecules create synapses between nerve cells in the brain; they can track proteins involved in Parkinson's, Alzheimer's and Huntington's diseases as they aggregate; they follow individual proteins in fertilized eggs as these divide into embryos.

It was all but obvious that scientists should ever be able to study living cells in the tiniest molecular detail. In 1873, the microscopist Ernst Abbe stipulated a physical limit for the maximum resolution of traditional optical microscopy: it could never become better than 0.2 micrometres. Eric Betzig, Stefan W. Hell and William E. Moerner are awarded the Nobel Prize in Chemistry 2014 for having by passed this limit. Due to their achievements the optical microscope can now peer into the nanoworld.

Two separate principles are rewarded. One enables the method stimulated emission depletion (STED) microscopy, developed by Stefan Hell in 2000. Two laser beams are utilized; one stimulates fluorescent molecules to glow, another cancels out all fluorescence except for that in a nanometre-sized volume. Scanning over the sample, nanometre for nanometre, yields an image with a resolution better than Abbe's stipulated limit.

Eric Betzig and William Moerner, working separately, laid the foundation for the second method, single-molecule microscopy. The

method relies upon the possibility to turn the fluorescence of individual molecules on and off. Scientists image the same area multiple times, letting just a few interspersed molecules glow each time. Superimposing these images yields a dense super-image resolved at the nanolevel. In 2006 Eric Betzig utilized this method for the first time.

Today, nanoscopy is used world-wide and new knowledge of greatest benefit to mankind is produced on a daily basis.

THE BRAIN'S NAVIGATIONAL PLACE AND GRID CELL SYSTEM

The Nobel Assembly at Karolinska Institute has today decided to award Nobel Prize in Physiology or Medicine 2014 with one half to John O'Keefe, presently Director at the Centre in Neural Circuits and Behaviour at University College London and the other half jointly to May-Britt Moser and Edvard I. Moser now based in scientific institutes in the Norwegian town of Trondheim, "for their discoveries of cells that constitute a positioning system in the brain".

How do we know where we are? How can we find the way from one place to another? And how can we store this information in such a way that we can immediately find the way the next time we trace the same path? This year's Nobel Laureates have discovered a positioning system, an "inner GPS" in the brain that makes it possible to orient ourselves in space, demonstrating a cellular basis for higher cognitive function.

IN 1971, John O'Keefe discovered the first component of this positioning system. He found that a type of nerve cell in an area of the brain called the hippocampus that was always activated when a rat was at a certain place in a room. Other nerve cells were activated when the rat was at other places. O'Keefe concluded

that these “place cells” formed a map of the room.

More than three decades later, in 2005, May-Britt and Edvard Moser discovered another key component of the brain's positioning system. They identified another type of nerve cell, which they called “grid cells”, that generate a coordinate system and allow for precise positioning and pathfinding. Their subsequent research showed how place and grid cells make it possible to determine position and to navigate.

The discoveries of John O'Keefe, May-Britt and Edvard Moser have solved a problem that has occupied philosophers and scientists for centuries—how does the brain create a map of the space surrounding us and how can we navigate our way through a complex environment?

How do we experience our environment ?

The sense of place and the ability to navigate are fundamental to our existence. The sense of place gives a perception of position in the environment. During navigation, it is interlinked with a sense of distance that is based on motion and knowledge of previous positions.

Questions about place and navigation have engaged philosophers and scientists for a long time. More than 200 years ago, the German philosopher Immanuel Kant argued that some mental abilities exist as a prior knowledge, independent of experience. He considered the concept of space as an inbuilt principle of the mind, one through which the world is and must be perceived. With the advent of behavioural psychology in the mid-20th century, these questions could be addressed experimentally. When Edward Tolman examined rats moving through labyrinths, he

found that they could learn how to navigate, and proposed that a “cognitive map” formed in the brain allowed them to find their way. But questions still lingered—how would such a map be represented in the brain ?

John O'Keefe was fascinated by the problem of how the brain controls behaviour and decided, in the late 1960's to attack this question with neurophysiological methods. When recording signals from individual nerve cells in a part of the brain called the hippocampus, in rats moving freely in a room, O'Keefe discovered that certain nerve cells were activated when the animal assumed a particular place in the environment. He could demonstrate that these “place cells” were not merely registering visual input but were building up an inner map of the environment. O'Keefe concluded that the hippocampus generates numerous maps, represented by the collective activity of place cells that are activated in different environments. Therefore, the memory of an environment can be stored as a specific combination of place cell activities in the hippocampus.

May-Britt and Edvard Moser were mapping the connections to the hippocampus in rats moving in a room when they discovered an astonishing pattern of activity in a nearby part of the brain called the entorhinal cortex. Here, certain cells were activated when the rat passed multiple locations arranged in a hexagonal grid. Each of these cells was activated in a unique spatial pattern and collectively these “grid cells” constitute a coordinate system that allows for spatial navigation. Together with other cells of the entorhinal cortex that recognize the direction of the head and the border of the room, they form circuits with the place cells in the hippocampus. This circuitry constitutes a

comprehensive positioning system, an inner GPS, in the brain.

Recent investigations with brain imaging techniques, as well as studies of patients undergoing neurosurgery, have provided evidence that place and grid cells exist also in humans. In patients with Alzheimer's disease, the hippocampus and entorhinal cortex are frequently affected at an early stage, and these individuals often lose their way and cannot recognize the environment. Knowledge about the brain's positioning system may, therefore, help us understand the mechanism underpinning the devastating spatial memory loss that affects people with this disease.

The discovery of the brain's positioning system represents a paradigm shift in our understanding of how ensembles of specialized cells work together to execute higher cognitive functions. It has opened new avenues for understanding other cognitive processes, such as memory, thinking and planning.

HUMAN SKIN CELLS REPROGRAMMED DIRECTLY INTO BRAIN CELLS

Scientists have described a way to convert human skin cells directly into a specific type of brain cell affected by Huntington's disease, an ultimately fatal neurodegenerative disorder. Unlike other techniques that turn one cell type into another, this new process does not pass through a stem cell phase, avoiding the production of multiple cell types, the study's authors report.

The researchers, at Washington University School of Medicine in St. Louis, demonstrated that these converted cells survived at least six months after injection into the brains of mice and behaved similarly to native cells in the brain.

"Not only did these transplanted cells survive in the mouse brain, they showed

functional properties similar to those of native cells," said senior author Andrew S. Yoo, PhD, assistant professor of development biology. "These cells are known to extend projections into certain brain regions. And we found the human transplanted cells also connected to these distant targets in the mouse brain. That's a landmark point about this paper."

The work appears Oct. 22, 2014 in the journal *Neuron*. The investigators produced a specific type of brain cell called medium spiny neurons, which are important for controlling movement. They are the primary cells affected in Huntington's disease, an inherited genetic disorder that causes involuntary muscle movements and cognitive decline usually beginning in middle-adulthood. Patients with the condition live about 20 years following the onset of symptoms, which steadily worsen over time.

The research involved adult human skin cells, rather than more commonly studied mouse cells or even human cells at an earlier stage of development. In regard to potential future therapies, the ability to convert adult human cells presents the possibility of using a patient's own skin cells, which are easily accessible and won't be rejected by the immune system.

To reprogram these cells, Yoo and his colleagues put the skin cells in an environment that closely mimics the environment of brain cells. They knew from past work that exposure to two small molecules of RNA, a close chemical cousin of DNA, could turn skin cells into a mix of different types of neurons.

In a skin cell, the DNA instructions for how to be a brain cell, or any other type of cell, is neatly packed away, unused. In past research published in *Nature*, Yoo and his colleagues showed that exposure to two micro RNAs

called miR-9 and miR-124 altered the machinery that governs packaging of DNA. Though the investigators still are unraveling the details of this complex process, these micro RNAs appear to be opening up the tightly packaged sections of DNA important for brain cells, allowing expression of genes governing developing and function of neurons.

Knowing exposure to these micro RNAs alone could change skin cells into a mix of neurons, the researchers then started to fine tune the chemical signals, exposing the cells to additional molecules called transcription factors that they knew were present in the part of the brain where medium spiny neurons are common.

“We think that the micro RNAs are really doing the heavy lifting,” said co-first author Matheus B. Victor, a graduate student in neuroscience. “They are priming the skin cells to become neurons. The transcription factors we add then guide the skin cells to become a specific subtype, in this case medium spiny neurons. We think we could produce different types of neurons by switching out different transcription factors.”

Yoo also explained that the microRNAs, but not the transcription factors, are important

components for the general reprogramming of human skin cells directly to neurons. His team, including co-first author Michlèle C. Richner, senior research technician, showed that when the skin cells were exposed to the transcription factors alone, without the microRNAs, the conversion neurons wasn't successful.

The researchers performed extensive tests to demonstrate that these newly converted brain cells did indeed look and behave like native medium spiny neurons. The converted cells expressed genes specific to native human medium spiny neurons and did not express genes for other types of neurons. When transplanted into the mouse brain, the converted cells showed morphological and functional properties to native neurons.

To study the cellular properties associated with the disease, the investigators now are taking skin cells from patients with Huntington's disease and reprogramming them into medium spiny neurons using the approach described in the new paper. They also plan to inject healthy reprogrammed human cells into mice with a model of Huntington's disease to see if this has any effect on the symptoms.

(Courtesy : <http://www.sciencedaily.com/releases/2014/10/141022123021.htm>)