EVERYMAN'S SCIENCE

Vol. XLIX No. 5 (Dec '14 – Jan '15)

COVER PHOTOGRAPHS

Past General Presidents of ISCA

1. Dr. T. N. Khoshoo	**(1986)**
2. Prof. (Mrs.) Archana Sharma	**(1987)**
3. Prof. C. N. R. Rao	**(1988)**
4. Dr. A. P. Mitra	**(1989)**
5. Prof. Yash Pal	**(1990)**
6. Prof. D. K. Sinha	**(1991)**

Printed and published by Dr. Ashok Kumar Saxena on behalf of Indian Science Congress Association and printed at Seva Mudran, 43, Kailash Bose Street, Kolkata-700 006 and published at Indian Science Congress Association, 14, Dr. Biresh Guha Street, Kolkata-700 017, with Dr. Ashok Kumar Saxena as Editor.

Annual Subscription : **(6 issues)**

Institutional ₹ 200/- ; Individual ₹ 50/-

Price : ₹ 10/- per issue

CONTENTS

ISCA PRESIDENTIAL ADDRESS (1986 TO 1991)

President	Title of Presidential Address*
Dr. T. N. Khoshoo 73rd Indian Science Congress 1986, Delhi	Role of Science and Technology in Environmental Management
Prof. (Mrs.) Archana Sharma 74th Indian Science Congress 1987, Bangalore	Resources and Human Well Being–Inputs from Science and Technology
Prof. C. N. R. Rao 75th Indian Science Congress 1988, Pune	Frontiers in Science and Technology
Dr. A. P. Mitra 76th Indian Science Congress 1989, Madurai	Science and Technology in India : Technology Mission
Prof. Yash Pal 77th Indian Science Congress 1990, Cochin	Science in Society
Prof. D. K. Sinha 78th Indian Science Congress 1991, Indore	Coping with Natural Disasters : An Integrated Approach

*Available in the Book "The Shaping of Indian Science" Published by University Press (India) Pvt. Ltd., 3-5-819 Hyderguda, Hyderabad 500 029.

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

NANOTECHNOLOGY IN CANCER TREATMENT

Technology is one of the key words in people's lives. In the near future, a subdivision of technology which is nanotechnology will have an important role. Bio-products, tools, devices, materials are influenced from consequences of research and developments on nanotechnology.

Nanotechnology refers to the interactions of cellular and molecular components and engineered materials—typically clusters of atoms, molecules and molecular fragments—at the most elemental level of biology. Such nanoscale objects—typically, though not exclusively, with dimensions smaller than 100 nanometers—can be useful by themselves or as part of larger devices containing multiple nanoscale objects. Nanotechnology is being applied to almost every field imaginable including biosciences, electronics, magnetics, optics, information technology, and materials development, all of which have an impact on biomedicine.

With nanotechnology; more useful devices, better drugs for diseases, more appropriate materials for construction will be developed.

Nanotechnology will also affect medicine and other life sciences. The numbers of research in cancer treatment with nano technologically modified drugs are increasing day to day and have had some good results on this issue. Nanotechnological improvements can be used for cancer patients; because nanotechnology can be used for better cancer diagnosis, more efficient drug delivery to tumor cells, and molecular targeted cancer therapy.

First of all, nanotechnology can be used for better cancer diagnosis. One of the main usage fields of optical nanoparticles is to allow better cancer detection. To start with, classical methods that are used in diagnosis have limitations. Classified methods such as X-rays, tomography or mammography require using mutagenic agents on cells that cause cancer, too. Using harmful substances and X-rays in cancer diagnosis are also related to the causes of cancer. To eliminate these concerns, optical nanoparticles in diagnosis is a possible technique that can be used. This technique works with special dyes to interact with tumor cells and optical nanoparticles can be detected. Preparing a nanoparticulate drug system, which has ability to be photo excited to produce singlet oxygen for detection and therapy is better than classical systems. Such interaction shows that, the detection of cancer with optical nanoparticles is new and developing subject, but it has considerable benefits for diagnosis.

Secondly, nanotechnology can be used for more efficient drug delivery system to tumors. One of the significant missions of passive liposomal drug delivery is to cancer cells. Liposome molecules are easily diffused into the cells; since their structures and cell membrane structure can interact very well while drug uptake process. The EPR (Enhanced Permeation and Retention) effect is the concept that liposomes remain in the bloodstream for a long time and are collected passively from tumor cells. Via the EPR effect, concomitant in toxicity problems of therapy are relatively solved as lower and repeated dose of liposomal drugs.

Aside from liposomal drug delivery systems, micelles drug delivery to cancer cells with nanotechnology is being developed. Micelle is described as aggregate form of molecules that generates colloidal shape. The functionalized micelles systems can be used for targeted drug delivery to cancer cells. One of the methods in micelles systems is micelles with small organic molecules as targeting ligands. Micelles are functionalized with glycosylphosphatidy-linositol that binds folic acid in high levels to inhibit cell proliferation activity. Folic acid acts as a carcinogenic agent that affects breast, lung and ovarian cells.

Thirdly, nanotechnology can be used for better cancer imaging. One of the main usages of cancer imaging is tomography with contrast agents. Contrast agents have been known to do better diagnosis and imaging. Computer Tomography (CT) is a widespread diagnostic imaging method which measures, in its imaging process, the radio density of matter. Therefore CT has important effect on health.

Finally, nanotechnology also can be used for better therapy. For example, Photothermal Therapy (PTT) is one of them. Photothermal therapy is using heat to control specific tumor. Tradition PTT uses radiation, along with dyes capable of absorbing radiation at the site of the tumor. Temperature is increased to nearly 40°C by using hyperthermia in the chosen tumor to stimulate lipid transitions and also to cause mutation of RNA and DNA. Therefore tradition PTT used past time. Now photodynamic therapy is using more. Photodynamic Therapy (PDT) is a different method that uses a photosensitizer and a particular type of a light. A specific wavelength of light effect on a photosensitizer and it produce a form of oxygen which kills nearby cells.

Nanotechnology prefers us to better medicine opportunities. It can be used for better diagnosis, efficient drug delivery, better imaging and therapy of cancer. Classical methods are not enough to cure all diseases, especially cancer treatment issue. With nanotechnology, it will possible to cure all diseases, may be it will cure in the beginning because of nanotechnology. After under-standing the importance of the nanotechnology, condition of life will be greater. Thus, nanotechnology has to be improved for the next generation.

The use of nanotechnology for diagnosis and treatment of cancer is largely still in the development phase. However, there are already several nanocarrier-based drugs in the market and many more nano-based therapeutics in clinical trials.

Dr. (Mrs.) Vijay Laxmi Saxena
Department of Zoology
D. G. (P. G.) College, Kanpur

"Creativity is contagious. Pass it on."
—Albert Einstein

RECOGNITION OF WOMEN IN SCIENCE IN INDIA : A REVIEW

Neepa Banerjee, Sandipan Chatterjee, Shankarashis Mukherjee*

There have been many path-breaking developments in science and technology throughout the world in the last century. Like in different walks of social life, women have played significant role in the scientific domain and their significant contribution have got International recognition with conferring of Nobel Prize and other awards. Indian women are not much lagging behind and their level of recognition is also increasing. In this context an attempt has been made to assess the status of recognition of women in science in India through tracing the database of Bhatnagar Awardees, Fellows of three principal science academies, and General Presidents of Indian Science Congress. It has been found that Indian women have been recognized in scientific arena for their significant contribution and the level of recognition is increasing. But, still in science and technology domain there are far less women and the visibility needs to improve significantly.

INTRODUCTION

India is home for about 17% of the World population[1], and the population is quite young with average age of people being lowest in the world. 48% of the population is females[2]. This huge women population is characterized by problems of illiteracy, early marriage, complications arising out at the time of child birth etc[3]. Although these inhibitions persists in many a way even in the recent century, efforts of women are being recognized significantly for the progress of nation in different spheres. World history of the Twentieth century is replete with instances of women making significant contribution in all walks of public life, including the field of science and technology. To recognize their contributions efforts have also been made. An attempt has been made, in this context, to assess the status of recognition of women in science in India through tracing the database of Bhatnagar Awardees, Fellows of three principal science academies, and General Presidents of Indian Science Congress.

* Human Performance Analytics and Facilitation Unit, Department of Physiology, University Colleges of Science and Technology, University of Calcutta, Rasbehari Shiksha Prangan 92 Acharya Prafulla Chandra Road, Kolkata 700 009, West Bengal, Email: msasish@yahoo.co.in

FINDINGS

Recognition of Women in Science: International scenario

Women's efforts in the field of science, like other walks of social life, started receiving major international recognition with the beginning of twentieth century, with Nobel Prize also being awarded to women. In the field of science, globally, from Madam Curie to

Ada Yonath, in recent times, there has been significant recognition being accorded to women with conferring of Nobel Prize. The Nobel Prize, initiated in the year 1895 by the will of Alfred Nobel, and also the Prize in Economic Sciences, has been awarded to women 45 times between 1901 and 2013. Only Marie Curie received the honor twice, in 1903 in Physics and in 1911 in Chemistry, i.e., 44 women in total have been awarded the Nobel Prize till date. Of these, Nobel Prize has been awarded 16 times to women in science disciplines, 13 times in literature, 15 times Nobel Peace Prize and once the Prize in Economic Sciences has been awarded to a woman (Table 1).

Table 1
Exhaustive list of women Nobel Laureates in Science

Year	Name of the laureate	Category
1903	Marie Curie-Sklodowska	Physics
1911	Marie Curie-Sklodowska	Chemistry
1935	Irène Joliot-Curie	Chemistry
1947	Gerty Theresa Cori, née Radnitz	Physiology or Medicine
1963	Maria Goeppert Mayer	Physics
1964	Dorothy Crowfoot Hodgkin	Chemistry
1977	Rosalyn Yalow	Physiology or Medicine
1983	Barbara McClintock	Physiology or Medicine
1986	Rita Levi-Montalcini	Physiology or Medicine
1988	Gertrude B. Elion	Physiology or Medicine
1995	Christiane Nüsslein-Volhard	Physiology or Medicine
2004	Linda B. Buck	Physiology or Medicine
2008	Françoise Barré-Sinoussi	Physiology or Medicine
2009	Carol W. Greider	Physiology or Medicine
2009	Elizabeth H. Blackburn	Physiology or Medicine
2009	Ada E. Yonath	Chemistry

Not only Nobel laureates, women of India and Indian origin like Kalpana Chawla and Sunita Williams have become household names because of their international recognition through significant achievements. Although women excel in all walks of life, including science and all sectors of economy, female representation in science and technology workforce is lower than their male counterparts all over the world, even in the developed countries. With rapid scientific development, gender divide is also increasing in various forms, which results in the exclusion of women from science and technology field. This will continue unless efforts are made to empower women, the so called weaker section of the society, to actively participate in nation's development through scientific inventions. Not only empowerment, efforts should also focus on recognizing the achievement and contributions of women scientist in science cultivation for creating scientific temper.

Recognition with Bhatnagar Award :

Bhatnagar award, named after its founder Director, late Dr (Sir) Shanti Swarup Bhatnagar (1894-1955) for Science and Technology, is given by CSIR since 1957 in applied or fundamental science, in the disciplines of Biological, Chemical, Earth, Atmosphere, Ocean and Planetary, Engineering, Mathematical, Medical, and Physical Sciences. 15 women out of over 450 total awardees have so far received the prize since its inception for notable and outstanding research work. The following is the exhaustive list of 15 Women recipients of Bhatnagar Award since its inception. (Table 2)

It is worth noting that out of 9 recipients of S S Bhatnagar Award in 2010, 3 were women.

Professor Asima Chatterjee (1917-2006), the first woman Bhatnagar Awardee, got the award in Chemical Sciences in 1961[4] and in recent

Table 2 : Exhaustive list of women Bhatnagar Awardees

Name of the Awardees	Year of receiving the award	Disciplines
Asima Chatterjee (1917- 2006)	1961	Chemical Sciences
Archana Sharma (1932 - 2008)	1975	Biological Sciences
Indira Nath (born in 1938)	1983	Medical Sciences
Raman Parimala (born in 1948)	1987	Mathematical Sciences
Manju Ray (born in 1947)	1989	Biological Sciences
Sudipta Sengupta (born in 1946)	1991	Earth Sciences
Shashi Wadhwa (born in 1948)	1991	Medical Sciences
Vijayalakshmi Ravindranath (born in 1953)	1996	Medical Sciences
Sujatha Ramdorai (born in 1962)	2004	Mathematical Sciences
Rama Govindarajan (born in 1962)	2007	Engineering Sciences
Charusita Chakravarty (born in 1964)	2009	Chemical Sciences
Mitali Mukerji	2010	Medical Sciences
Sanghamitra Bandyopadhyay (born in 1968)	2010	Engineering Sciences
Shubha Tole (born in 1967)	2010	Biological Sciences
Yamuna Krishnan (born in 1974)	2013	Chemical Sciences

past in 2013 Yamuna Krishnan got the prestigious award also in Chemical Sciences. Professor Asima Chatterjee, a noted Chemist, has made valuable research contributions in the field of production of natural products, especially, alkaloids, ploy phenolics, terpenoids etc derived from Indian medicinal plants.

Dr. Krishnan received the award in Chemical Sciences for her work with the structure and dynamics of nucleic acids[5].

Women Fellows of Science Academies :

The participation of women in the principal science academies was negligible for a long period of time. But today many women scientists have been honoured with Fellowship of science academies in the country.

The National Academy of Sciences, India was founded in the year 1930 as the first science academy of the country, under the initiative of great scientist and patriot Prof. Meghnad Saha, then Professor of Physics at University of Allahabad. The Academy started in 1930 with 57 ordinary Members and 19 Fellows. Prof. Meghnad Saha was the founder President of this science academy. Presently, it has about 1571 Members and 1579 Fellows including 29 Honorary Fellows and 88 Foreign Fellows from various disciplines of Science and Technology from all over India and abroad. The Academy has many women fellows; Archana Bhattacharyya, Manju Banerjee, Geetha Bali, V Ravindranath are to a name a few.

The Indian Academy of Sciences was founded and registered as a society by Nobel Laureate Professor C. V. Raman (1888-1970) in 1934 with the aim of promoting the progress and upholding the cause of science, in both pure and applied branches. The formal inauguration took place on July 31, 1934 with 65 Founding Fellows. Some of the renowned women fellows of this academy are Sashi Wadha, Shubha Tole, V Ravindranath, Amita Das, Tanusri Saha, Manju Bansal. It is important to mention here that the Council of Indian Academy of Sciences constituted a committee on 'Women in Science', presently

chaired by Prof. Rohini M Godbole, to look into the issues of women scientists. Such initiatives for recognising the work of women scientists are highly appreciable.

Indian National Science Academy, a premier science Academy in the country, plays crucial role in promoting, recognizing and rewarding excellence in scientific domain. It was established as the National Institute of India on January 7, 1935 at Calcutta and then got shifted to Delhi in 1951. Aparna Dutta Gupta, Ashima Anand, Joyoti Basu, Raman Parimala, Chanda Jayant Jog (newly elected Fellow 2013) are some of the women fellows in this renowned science academy.

Women in Indian Science Congress :

Indian Science Congress began its journey a century ago in 1914 at the initiative of Sir Asutosh Mookerjee, the then Vice Chancellor of the University of Calcutta[6]. In the century old history of Indian Science Congress, 4 women have so far been elected as General Presidents. Professor (Mrs.) Asima Chatterjee, distinguish scientist, was the first woman president of ISCA who conducted the 62nd session in Delhi in 1975. Professor (Mrs.) Archana Sharma, Professor of Genetics, University of Calcutta, conducted the 74th session in Bangalore in 1987. Dr. (Mrs.) Manju Sharma conducted the 86th session in Chennai in 1999, and in recent past Prof. Geetha Bali, former Vice Chancellor, Karnataka State Women's University, Bijapur, who hold the 99th session in Bhubaneswar in 2012, adorned the chair of the General President of Indian Science Congress. Interestingly, in the 99th session, the focal theme was Science and Technology for Inclusive Innovation - Role of Women. This is reflecting that achievement and contribution of women is increasingly getting recognized. Formally "Women's Science Congress", was started in 2012 in the 99th session of Indian Science Congress. It is an effort to motivate women scientists and enhance their participation in science and create a sustained platform to demonstrate women's contribution to science in India[7] and also to create the much needed awareness and confidence amongst the public and policy makers that women have the potential too to harness the power of Science and Technology for shaping the future of India.

DISCUSSION

The findings reveal that there have definitely been some efforts to recognize the contribution of Indian women in the scientific field where they have left indelible mark and helped the nation move forward. Although women are universally underrepresented in science and technology and India, viewed as a potential powerhouse of innovations, is no exception, women excel in many a way in scientific arena. Besides the mentioned major recognitions, the level of recognition of women scientists is increasing in scientific domains in many different ways also. Indian women scientists have received the prestigious civilian Padma awards from Government of India. In recent past, Manju Sharma, past Secretary, DBT, Government of India received Padmabhusan in 2007, Vijayalakshmi Ravindranath, founder Director NBRC, Gurgaon received Padmashree in 2010. Professor Asima Chatterjee, besides being a Bhatnagar awardee, received many honors and awards including Nagarjuna Prize and Gold Medal; Watumull Fellowship,; Bhuban Mohini Gold Medal; Sir C.V. Raman Award; Sir Asutosh Mookerjee Gold Medal and most importantly Padma Bhushan. She was also nominated Rajya Sabha Member during 1982-92. In this context, it is important to mention that presently women scientists account for 15% of the Research and Development

professionals in India. There has also been an increase from 13 to 31% in women receiving extra mural research funding.

India, the second most populous country with a population of more than 1.21 billion has about 0.58 billion female citizens, who are relatively young in terms of the mean age of the population. It could be viewed as a huge untapped talent pool. If properly harnessed, with recognition and facilitating participation through motivation and encouragement, it may be expected that the society would meaningfully gain[8]. As in some selected areas, intellectual competence supersedes physical strength, there is immense scope and urgent need to channelize the diverse manpower for the development of country. To improve the participation of women, constituting almost half of the human resource, in science and technology it is important to empower them with their fundamental rights and transform them to preferred workers. Women's participation in science and technology refers to the extent that women have been able to utilize the tool in capturing the opportunities ranging from research to highly skilled employment.

CONCLUSION

In the light of the discussion, it may be mentioned that women have been recognized in India for their contribution in scientific arena, and the level of recognition is increasing in the twenty first century. It is expected that women will bring more honor to the country, as there is increased attempt to facilitate their scientific endeavor. Although the mentioned examples of recognition are inspiring, there are some real ground level problems hindering the progress of Indian women in participating in science and nation development process necessitating a look into the issue.

REFERENCES

1. A. Nayak, V. Patel, B. Koria, I. Kotecha, A. Trivedi, M. P. Singh, *NJIRM*, **4**, 86-89, 2013.
2. V. Srinivasan, R. George, *IIM Bangalore Research Paper* No. 427, 2013.
3. G. Bali, *Proceedings of Women's Science Congress*, 16-20, 2013.
4. S. C. Pakrashi, *Current Science*, **92**, 1310, 2007.
5. S. Modi, S. Halder, C. Nizak and Y. Krishnan, *Nanoscale*, **6**, 1144-1152, 2014.
6. D. P. Sengupta, *Current Science*, **78**, 1566-1573, 2000.
7. N. Banerjee, S. Chatterjee, S. Mukherjee, *Proceedings of Women's Science Congress*, 100th Indian Science Congress, 92, 2013.
8. M. Tembhre, *Proceedings of Women's Science Congress*, 61-62, 2013.

LIGNOCELLULOSE PLANT BIOMASS ; AN EMERGING ALTERNATIVE FUEL RESOURCE

N.Arumugam and P.U.Mahalingam

The most abundantly available raw material in the globe is plants and its biomass (plant dry matters). It's composed of carbohydrate and aromatic polymers. Utilization of these carbohydrate (cellulose and hemicellulose) and aromatic (lignin) polymers are a potential resource for the production of second generation biofuels. Besides, there are many difficulties in production of biofuel from lignocellulose waste biomass. This literature summarizes the advantages and challenges involved in the utilization of lignocellulose biomass as an alternative sustainable energy with no green house effects.

INTRODUCTION

The worldwide energy demand is continuously rising due to the increase of population. According to the forecasts of International Energy Agency, it is expected to rise by approximately 50% until 2030. Due to increased usage and requirement of alternative fuel, search for novel easily available energy resource has become a matter of concern. Based on available reports, second generation biofuel play a vital role in meeting the needs by utilizing the plant biomass. The conversion technologies are biochemical and thermochemical conversions, which includes pretreatment of substrates, cellulose hydroloysis, substrate cleaning, fermentation, biofuel recovery and residual solids processing. In almost all plants biomass comprises of 10-25% lignin, 20-30% hemicelluloses and 40-50% cellulose (Fig. 1), complete removal of lignin is essential to utilize all available cellulose material for biofuel production. This pretreatment is carried out by dilute acids and Ammonia pretreatment[1]. Cellulose is made up of sugars which can be hydrolyzed with acid[2], cellulase enzymatic process[3], fermentation with microbes[4]. Biofuel is recovered by the distillation process[5]. Lignin co-products like vanillin, phenols and high octane hydrocarbon fuels are extracted last[6]. Even though the production cost of biofuel from plant biomass is expensive compared with conventional fuel production because of the optimization and upscaling process is difficult, but more advantage of these technology is effective utilization of plant biomass and reduction in emission of green house gases ultimately reducing global warming. To implement the efficient 2nd generation biofuel from plant biomass it is essential to upgrade thermochemical and biochemical or enzymatic routes for biomass conversion. Besides, relevant agricultural practices for plant biomass production are also needed. In order to use alternative plant

* Department of Biology, Gandhigram Rural Institute – Deemed University, Gandhigram, Dindigul – 624 302 Email: aarumugham83@gmail.com

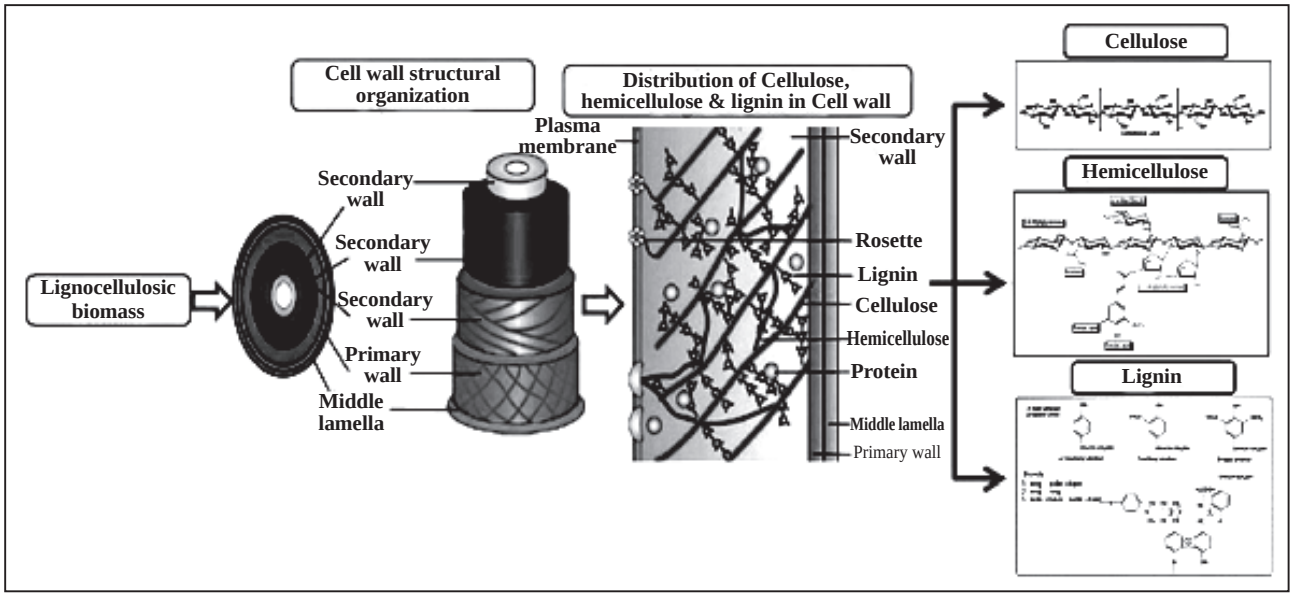


Fig 1. : Schematic representation of frame work of Lignocellulose; Hemicellulose and Lignin

biomass derived fuels, emission factor should be taken into consideration while designing engine for the machines and automobiles. Most of the promising systems of vehicles are internal combustion engines and fuel cells with electric engines which results in carbonyl emissions of formaldehyde, acetaldehyde, acrolein, acetone, propionaldehyde and butyraldehyde, which are higher in crude oil derived biofuels. This may be a better reason to consider biofuels from plant biomass[7].

PROPERTIES OF LIGNOCELLULOSIC BIOMASS

The most widely available waste in India is plant biomass, while small part of among overall waste biomass may be used for cattle fodder. After china, India is the largest producer of plant biomass waste in Asian continent. Lignocellulose biomass are promising feed stock which can act as a renewable energy resources in the functioning of modern industrial societies. Unknowingly much of the lignocelluloses biomass is disposed by burning and burying process in developing countries[8]. In recent years the importance of Lignocellulose plant biomass are exposed by researchers to utilize the same for the production of value added fine chemicals, fertilizer and energy etc., because of their natural properties. In general the composition of lignocelluloses highly depends on its source whether it is derived from the hardwood, softwood, or grasses (Table 1). Lignocellulose biomass is composed of combinations of Lignin, Hemicellulose and Cellulose. These combinations give overall strength to plants. Each carbohydrate has its own physical and chemical properties. Cellulose is a major and highly stable polymer made up of glucose attached with linear chains up to 12,000 residues of (1-4) –D-glucopyranose units[9]. In nature cellulose molecules are arranged in all plants in the form of bundles which aggregate together in the form of microfibrils order along with other carbohydrates of hemicellulose and Lignin[10]. The second majorly abundant heterogenous carbohydrate is hemicelluose which has 200 residues of glucose units with glucuronoxylan, glucomannan and trace amounts of other polysaccharides but in the form of branched nature and they do not

Table : Different plant biomass and their compositions

Biomass Material	Lignin %	Hemi cellulose%	Cellulose %
Banana waste	14	14.8	13.2
Bagasse	23.33	16.52	54.87
Costal permuda grass	6.7	35.7	25
Cotton seed hair	0	5-20	80-95
Corn cobs	15	35	45
Corn stover	19	26	38
Grasses	10-30	25-50	25-40
Hardwood	18-25	25-40	40-45
Leaves	0	80-85	15-20
Nut shells	30-40	25-30	25-30
Rice straw	18	24	32.1
Sugar cane bagasse	20	25	42
Sweet sorghum	21	27	45
Sponge gourd fibres	15.6	17.44	66.59
Wheat straw	15	50	30

share the beta 1-4 linkage. Both cellulose and hemicellulose are tightly bound with non covalent attraction on the surface of cellulose microfibril, Hemicelluose originally believed to be intermediate in the synthesis of Cellulose in the plants[11]. Final and more complex smallest fraction of heterogeneous polymer is Lignin; it has long chain of phenyl-propane units linked with ether bonds. Lignin acts like a glue which fills the gap between the cellulose and hemicelluose in plants. Hence, lignin will consider as a bi-products in plant biomass derived biofuel production[12].

PRODUCTION OF FUELS FROM CRUDE OIL

Petroleum is naturally found beneath earth, which is yellow to black liquid in nature. It has hydrocarbons of various Mwt and other liquid organic compounds. Native form of unprocessed yellow or black liquid is called crude oil. This crude oil is subjected to refining process at different boiling point as a result large no of consumer products like, Gasoline, Kerosene, Asphalt and various chemical agents etc. The elemental compositions of crude oil is Carbon 83-85%, Hydrogen 10-14 %, Nitrogen 0.1– 2.0%, Oxygen 0.05–1.5%, Sulphur 0.05–6.0%, different types of hydrocarbons in the range of Alkane 15-60%, Naphthenes 30–60 % and Aromatics 3 to 30%. Almost 84% of hydrocarbons present in petroleum is converted into energy rich fuels like petrol, diesel, jet fuel oils[13]. Lighter grade crude oil produce best yields of this products which is comparatively heavier grade oil due to less carbon and too much Hydrogen. Crude oil derived petroleum fuels resources got more important since 1950's. Presently consumption of crude oil derived fuel is around 84 million barrels so far (13.4×10^6 m^3) / day which in terms of remaining oil supply only for next 120 years, if current demand is static[13]. Hence, we are in the situation to find an alternative sustainable eco friendly renewable energy resource.

PRODUCTION OF BIOFUEL FROM LIGNOCELLULOSE PLANT BIOMASS AND BENEFITS

From biotechnological point of view a vast range of Lignocellulose biomass resources are available as potential candidates that are used to convert high value bioproducts like bio-ethanol/bio-fuels. Since last few years, considerable improvement from green biotechnology and green chemistry related to Lignocellulose biomass has emerged. The ever increasing costs of petroleum derived fuels and their greenhouse effects have caused core demand to find alternative less cost and environment friendly bio-fuels resources along with reducing global warming. A potential

method for the low cost production of bio-ethanol is to utilize the Lignocellulose or agro-industrial biomass because they contain carbohydrates that must be first converted into simple sugars (glucose) and then fermented into ethanol; given this reality nations around the world are investing in alternative sources of energy, including bio-ethanol. The conversion of Lignocellulose biomass into higher value added products like fine chemicals or bio-fuel production normally requires a multi-step processing that include (i) pre-treatment (mechanical, chemical, or biological etc) (ii) enzymatic hydrolysis (iii) fermentation process. In addition production of biofuel from biomass has following advantages : Long term security for energy, supply, free of green house gas emission and more focus on energy crop research.

CHALLENGES ASSOCIATED WITH BIOFUELS FROM PLANT BIOMASS

Even though plant biomass is available in huge mass in the environment, production of biofuel from Lignocellulose plant biomass has the following challenges :

1. Fermentation process of woody/plant biomass is cost effective.
2. Composition of feed stock may vary in each substrate, so the formulation of fermentation process needs to be optimized for bulk production.
3. Biomass transportation and storage of biomass without losing their efficiency.
4. Selection of suitable pretreatment process for the substrate.
5. Selection of catalyst and recovery of the same.
6. Extraction of cellulose or complete utilization of all available cellulose content from the substrate is difficult.
7. Removal of recalcitrant polymers like lignin needs more effort during the process.
8. Health of the plant and yield of biomass/ hectare area.
9. Selection of energy crops.
10. Consumption and cost of enzymes volume / kg of Biomass and difficulty of enzymes to act on the substrate to release the product in degradation of lignin and hydrolysis of cellulose and hemicellulose for utilization of cellulose content in the plant lignocellulose biomass.
11. Recovery of biofuel from fermented broth.
12. Removal of co-products and its influence/ interference in biofuel production.

CONCLUSION AND FUTURE OUTLOOK

The energy and environmental concern, which the modern world is experiencing, is forcing to re-evaluate the efficient utilization or finding alternative uses for natural, renewable resources, using clean technologies. In this regard, Lignocellulose biomass holds considerable potential to meet the current energy demand of the modern world. This is also essential in order to overcome the excessive dependence on petroleum for liquid fuels. Further advanced biotechnologies are crucial for discovery, characterization of new enzymes, and production in homologous or heterologous systems and ultimately lead to

low-cost conversion of Lignocellulose biomasses into bio-fuels and bio-chemicals. In the current scenario future trends are being directed to Lignocellulose biotechnology and genetic engineering for improved processes and products. To overcome the current energy problems it is envisaged that Lignocellulose biomass in addition of green biotechnology/ green chemistry will be the main focus of future research. The current research scenario in energy related area has to focus more to overcome the energy shortage in developing countries such as India.

REFERENCES

1. S. Jacobsen, C. Wyman, *J. Applied Biochemistry and Biotechnology*, **12** : 84–86, 2000.
2. LR Lynd *Annu Rev Energy and Environment*, **21**, 403–465, 1996.
3. K. Karhumaa, B. Wiedemann, B. Hahn-Hagerdal, E. Boles, MF. Gorwa-Grauslund, *J. Microb Cell Fact.*, **10**, 5-18, 2006.
4. Leland M Vane, *J Chem Technol Biotechnology* **80**, 603–629, 2005.
5. http://www.ott.doe.gov.biofuels/ http:www.ott.doe.gov
6. C. He, Y Ge, J. Tan, K. You, X. Han, J. Wang, Q. You, A. N. Shah, *J. Enviornmental Science*, **43**, 3657-3661, 2009.
7. M. Asgher, Z. Ahmad Iqbal, *J Industrial Crops and Products*, **44**, 488-495, 2013.
8. M. E. Himmel, S. Y. Ding, D. K. Johnson, W. S. Adney, M. R. Nimlos, J. W. Brady, *J biofuel production Science*, **315**, 804 – 807, 2007.
9. H. Iqbal, M. Asgher, *Protein & Peptide Letters*, **5**, 591-600, 2013.
10. D. Vercoe, K. Stack, A. Blackman & D. Richardson. In 59th Appita annual conference and exhibition : 2005 : Proceedings.
11. Crude oil is made into different fuels *Annual conference and proceeding* Eia.doe.gov. August 29, 2010.

HUMANS AND MAGNIFICENT GENTLE GOLIATHS OF THE FOREST IN CONFLICT

Mousumi Pal

The paper highlights the danger faced by Elephants, their reasons for endangerment and conflict with humans.

Ancient Indians had recognized the animals' right to co-exist with man and therefore they were loved, nurtured and even worshipped. To impress upon the commoners about their importance, the animals were given the status of gods and goddesses. They declared that 'Almighty' incarnates in different animal forms. The kings and the emperors opted different animals in their emblems. Many festivals were/are observed in honour of several animals. The rulers gave them prime position in art and architecture. Unfortunately, today we are neither adopting ancient Indians' compassionate attitude, nor any scientific approach towards preservation of these animals.[1]

It is well known that, various animals are now endangered. Endangered animals are those whose numbers are at a critically low level and whose habitats are drastically reduced or damaged that they are in imminent danger of extinction. In India, the Wildlife (Protection) Act, 1972, provides four schedules categorizing the fauna of India. Schedule 1 lists the rare and endangered species which are afforded legal protection. Conservation efforts have restored the status of some animals, like the tiger, rhinoceros, crocodiles etc. This study is woven around elephants. The majestic Asiatic Elephant (*Elephas maximus*), the Lord of the Jungle is under Schedule 1 of the India Wildlife Protection Act 1972 as amended. Recently, the government of India has accorded the Elephant as a National Heritage Animal. People worship Elephant as Lord Ganesha'. According to Gaja Jataka, Bodhisattva was an elephant in one of his incarnations. However, the Lord of the Jungle is in distress.[2]

In india there are around 25,600 to 32,750 Asian elephants left in the wild with an additional 15,000 in captivity[3]. Elephants are the largest living land animals and are highly intelligent. According to WWF reports, Asian elephants grow up to 21 feet long and stand up to 10 feet tall and weight up to 11,000 pounds. Generally elephants live in groups divided into clans and the clans are led by the female elephants. And for this reason, they are a materiarchal society.

Unlike the African elephant only the males of the Indian elephants have tusks, and a part of the genetic population called *MAKHANAS* do not have it at all. The tusk size denotes rank and position among the herd. A male elephants' most prized possession is the ivory tusk.

Elephant population in becoming a scourge of conflict with man. Inversely applicable, the

* Department of Zoology, Sovarani Memorial College, Jagatballavpur, Howrah, W.B.

reasons of endangerment and conflict tantamount of the same : loss of habitat and scarcity of food. Certain traits of elephants need attention. First, elephants do not have sweat glands and for this reason they need plenty of water and mud to submerge them. Secondly, elephants love to stay around water source and when this availability contracts, their movement across territory expands. Human intrusion into their habitat, out of extreme necessity, has extended movement of elephant between 150 and 600 kms.[4] An interesting case in point is that, in the Chandaka Dampara Sanctuary in Orissa, ten elephants explored a new water resource in Athgarh Forest Division around Mahanadi river.

HUMAN WILDLIFE CONFLICT

As human population expands, encroachment in wildlife territory becomes a reality by shrinking their habitat. This has resulted in conflict over living space and food, leading to a growing number of confrontations —commonly referred to as 'Human Wildlife Conflict' (HWC).

When wildlife lose their natural habitats and have reduced access to natural food sources, they eat agricultural crops and livestock. They can destroy property and can injure or kill people. In retaliation, humans too kill or capture animals. Many of the people affected by HWC are some of the most impoverished on earth. HWC is one of the main threats to many species of wildlife, including many endangered species. As habit gets fragmented, the length of 'edge' for the interface between humans and wildlife increases, while the animal population becomes compressed in insular refuges.

Incessant Conflict

Crop damage by elephants is the root cause of HWC. Asian elephants are attracted to food crops which are more palatable, nutritious and have lower secondary defenses than wild plants. An adult elephant in the wild will eat in the region of 100 to 200 kg of vegetation per day depending on the habitat and its size. The Buxar and Chilapata zones of the Dooars are suffering heavily from intrusions and the reason is their favourite 'chalta', a natural wild fruit which is a raw material for spicy pickles.[5]

To quote another instance, Bannerghatta National Park, located 23 kms from Bangalore city, have registered over 500 man-elephant conflict complaints during the monsoon and harvest season. The Park hosts more than 200 elephants and they raid private fields that grow ragi, paddy, sugarcane, mangotrees, jackfruit and coconuts[6]. When the food and living space of the elephants are appropriated by the greedy moneocrats, they raid crop fields and break down house to get at stored crops. Naveen Patnaik, the Chief Minister of Orissa, admitted in the State Assembly that elephants were mostly coming out of forests and entering human habitations in search of food and water.[7]

Generally the male elephants leave their natal home between 10 and 15 years of age and create their home range, often known as 'dispersal'. During thie period they raid agricultural fields and eat palatable bananas and coconuts. Unofficial reports say 200 elephants were killed during the last two years for encroaching into farmers' lands.[8]

Intrusion into Corridors

Migration of movement of elephants through corridor is needed as the large herbivore cannot be confined to one area they do so then so then the entire forest area will be lost. So naturally they shift places, and when they return the old habitat becomes covered with new vegetation for consumption.

A busy interstate highway of 2.5 kms connects Kerala and Karnataka. This corridor passes through the elephants' forestland which is threatening the largest population of Asian elephants. They migrate during wet season to a dry area for feeding. Unfortunately, the government has decided to cordon the corridor with infrastructural developments—like building complxes, housing, offices, toilets and dormitories for drivers, a fuel filling station.[9]

Elephant population has risen in Orissa from 1841 in 2002 to 1862 in 2007, but failure to restore elephant corridors owing to development activities and non-implementation of vital schemes have caused an increase in pachyderm deaths. The rate of elephant deaths that was 32 per year on an average during 1990-2003 had increased to 56 on an average during 2003-2008, according to a recent Comptroller and Auditor General (CAG) report tabled in the Orissa State Assembly. As many as 280 pachyderms have died due to various reasons during the period 2002-2007[10]. Mining activities in the state, like iron one and managenesa, has also caused loss of corridor for elephants resulting in isolation of their population, inbreeding and rising man-animal conflict.[11]

Distress of the elephants rises due to reckless driving of trains through the elephant corridors in the deep forests to north Bengal. This train line was earlier a metre gauge converted to broad guage. This unthoughtful gauge conversion by the Indian Railways has resluted in increase number of deaths of the elephants. The original Broad Gauge line in North Bengal was running through New Jalpaiguri to New Alipurduar passing through non forested areas whereas the metre gauge line ran through some of the beautiful forests of north Bengal namely Mahananda Wildlife Sanctuary, forests of Kalimpong Division, Chapramari Wildlife Sanctuary, Diana forests, Jaldapara Wildlife Sanctury and Buxa Tiger Reserve. The decision of guage conversion was taken without even consulting forest authorities. Since at no point the distance between the Broad Gauge and Metre Gauge lines were more than 25 kms, it would have been wiser to make the existing Broad Guage line as double line rather than converting the Metre Gauge passing through an excellent wildlife habitat to Broad Gauge. Statistics show that between 1974 and 2002 during the existence of Metre Gauge 27 elephants were killed due to rail accidents.[12]

An extent of about 12 acres of green lands in Madhugatta at Bokkapuram, in Tamilnadu, an elephant corridor, which comes under the purview of Supreme Court's definition of forests, has been cleared, presumably for the purpose of constructing a resort. The area is rich in natural regeneration of rosewood and teak wood. A Press release issued by S. Jayachandran, Joint Secretary of Tamilnadu Green Movement (TNGM) stated that, of late, scale violation of all Forest Acts in the Nilgiris with the active support and connivance of forest officials in being withnessed.[13]

Loss of Habitat

A desperate battle between elephants and humans for the forests of India's remote northeast has reached alarming proportions, resulting in hundreds killed on both sides. M.C. Malakar, the Chief Wildlife Warden of Assam, said that, "The main reason for this conflict is the depletion of the elephant habitats due to deforestation and encroachment on forested areas by illegal settlers". The illegal settlers inhabit as much as 44,480 acres spread over 10 national parks and game sanctuaries. Satellite imagery shows that between 1006 and 2000 some 691,880 acres of thick forests in Assam were cleared by humans. The loss of habitat has forced elephants into villages raiding crops, knocking down houses and

killing people. In retaliation, villagers have killed elephants by electrocution, shooting them with poison-tipped arrows or spiking food with poisons. In one instance, 19 elephants were poisoned in Sonitpur district, 180 kms north of Guwahati.[14]

Belinda Wright, the founder of Wildlife Protection Society of India, had argued that, 'human-animal conflict, generally, is going to be the biggest challenge of the next 10 years". Elephants are becoming endangered in Keonjhar, in Orissa. Their population had dwindled from 112 in 2002 to 51 in 2007 and this largely due to unplanned mining activities.[15]

Recently human intervention in the Western Ghats has caused an annual deforestation rate of 1.16 percent despite 15 percent of their land area being protected as wild life sanctuaries. Due to timber logging and rampant poaching for ivory, the forests have become a fragment of a once pristine wildlife hahitat.[16] Although this form of environmental degradation is probably quite extensive, it is, paradoxically, a less serious problem with regard to finding solutions. The second process concerns the destruction of mountainous forest ecosystems by the resident populatin. The main process can be summarized as follows : as the human population expands in the mountains and plains and forests are depleted the water-retaining capacity of the natural vegetation is reduced and run-off is increased, both in quantity and speed. This fact, deforestation itself, and the use of inappropriate agricultural techniques on unsuitable land lead to different forms of soil erosion and loss of cultivable land. Expansion and encroachment on both sides are inevitable and a resultant conflict ensues.

An increase in the elephant population in the forests of Jalpaiguri district and correspondingly land becoming fallen to agriculture in the forest periphery has become a scourage for the forest department officials. As there is little or no scope to expand the forest areas, which is possibly the only solution to prevent them from venturing outside the forests, has added to the growing number of man-animal conflict incidents. A total of 68 elephants have died unnaturally in the past two years in the forests of Dooars. According to the official of an animal lovers' association, Mr. Victor Basu, food has become scarce for the elephants, as the herbivore population has increased in the forests in general. "Other animals like deer, rhino, bison consume a share of the vegetation, which forces the elephants to stray out of jungle ultimately leading to unnatural deaths".[17]

Assam and Maghalaya have a projected elephant population of 7000. As people have cleared, 2,80,000 hectare of woodland area between 1996 and 2000, the elephants are strained to wander away into human settlements for food, habitually standing crops. Problem lies not with elephant population, but with the enormous contraction of its territory.[18]

CURING OF IDENTITY

Emergency steps are mandatory to alleviate the sufferings of subsistence farmers and starved elephants. The report "*Review of Human-Elephant Conflict Mitigation Measures Practiced in Sough Asia*", complied by WWF, Nepal, the Centre for Conservation and Research, Sri Lanka (CCR) and the Nature Conservation Foundation, notes that a comprehensive strategy is needed to mitigate human-elephant conflict. Prithiviraj Fernando, Chairman of CCR, Sri Lanka, said that, "Most mitigation measures currently being used are just akin to bandaging the wounds and not treating the root cause.....Good land use planning that takes both people and elephant needs into account are the only long-term solution".[19]

Project elephant, a centrally sponsored scheme was launched in February 1992 to provide financial and technical support to major elephant bearing states in the country for protection of elephants, their habitats and corridors. The project was circumscribed to the following states : Andhra Pradesh, Arunachal Pradesh, Assam, Jharkhand, Karnataka, Kerala, Meghalaya, Orissa, Tamil Nadu, Uttaranchal. Uttar Pradesh and West Bengal.[20]

Worried over increasing cases of man-elephant conflict, the Orissa government has chalked out an Rs. 53 crore integrated elephant management plan—setting squads to check poaching and chasing of elephants from human habitation areas, developing of pachyderm habitation areas and introduction of GIS monitoring system.[21]

CONCLUSION

To the animal lovers the conflict owes to loss of habitat due to human encroachments. The government is elated for a modest increase as elephant population in recent years; whereas the forest officials believe that, owing to lack of concrete plans or strategies the loss of human and elephant lives has been increasing.

Factors such as rapid industrialization, mining activities, tardy progress of elephant corridors, shortage of fodder for elephants in forests and lack of proper utilization of funds for wildlife management and conservation have added to the problem. A mandatory approach is needed to save the situation for both animals and humans.

REFERENCES

1. K. Kamat, *The Quarterly Jour. of the Mythic Society*, **85**, 1994.
2. Ramesh Bedi, *Lord of the Jungle*, NBT, New Delhi, 1969.
3. Anand & G. N. Pereira, *Wildlife Protection Society of India, Bulletin*, **8**, June 2008.
4. S. Chakraborty, *Ekhon Aranyak*, **32**, 11, 2012.
5. Sumanta Ray Chaudhuri, *DNA, India*, 21 June, 2007.
6. Bosky Khanna, *Daily News and Analysis*, 4 october, 2008.
7. *The Hindu*, 12 July, 2007.
8. *NDTV*, 16 November, 2006.
9. Hance Jeremy, *mongabay. com*, 5 April, 2009.
10. *The Hindu*, 16 February, 2009.
11. *Newindpress. com*, 26 June, 2007.
12. Shakti Banerjee, *Ekhon Aranyak*, **32**, 21-22, 2012.
13. B. Ravichandran, *Newindpress. com*, 29 December, 2007.
14. *Associated Press*, 20 September, 2006, Guwahati.
15. *The Statesman*, 27 September, 2007.
16. Dr. Anand & G. N. Pereia, "Wildlife Protection Society of India", *Bulletin*, 8 June, 2008.
17. *Statesman New Service*, 2 January, 2008.
18. *Meri News*, 13 November, 2008.
19. *WWF*, 17 November, 2008.
20. "*Project Elephant*", Press Release, Government of India, 20 June, 2008.
21. *Indopia*, 30 December, 2008.

A SNEAK PEEK INTO GROUND PENETRATING RADAR

Suresh Sahni, Mohit Singhal, Purushottam Kumar Garg, Reet Kamal Tiwari*

The possibility of detecting buried objects remotely has spellbound mankind over centuries. As yet, no single method has been found which could provide the ground and its contents clearly visible. Ground penetrating,-probing or surface-penetrating radar has been found to be an especially attractive option.

The last two decades have witnessed major advances and the range of applications is ever-increasing for Ground Penetrating Radar (GPR) methods and the complexity of signal recovery techniques, hardware designs and operating practices is increasing as the technology is maturing. Now we are in a much better position to understand that in which type of geographical settings GPR is effective. Not only do we understand the fine scale geological texture better than we ever did before, we also have attained a good understanding of the physical properties which can control the penetration and reflection of radio waves.

Instrumentation developments are also on the progressing note. Radar systems with higher power and high quality digital data recording capability have been developed. Furthermore, digital data processing capability and presentation is enhanced over the years which were thought to be an impossible task just a few years ago. The evolution of quantitative interpretation tools for GPR is just beginning. Though the technique is still not infallible and much is still to be explored, GPR is now a recognized weapon in the geophysical arsenal. In favourable geographical settings, GPR is unparallel in possession of detailed information.

INTRODUCTION

Radar (ellipsis for *Radio Detection And Ranging*) is an object-detection system that uses radio waves to determine an altitude, range, direction, or speed of objects. The radar antenna transmits pulses of radio waves that bounce off any object in their path. The object returns a tiny part of the wave's energy to an antenna that is usually located at the same site as the transmitter. The modern uses of radar are highly diverse, including air-defence systems, anti-missile systems, air traffic control, marine radars to locate landmarks and other ships, guided missile target locating systems, and ground-penetrating radar for geological observations.

GPR as the name suggests is a kind of radar system which is used for object-detection and its mapping in the subsurface by using radio waves which can penetrate the surface.

* Centre for Glaciology, Wadia Institute of Himalayan Geology, 33-G.M.S Road, Dehradun, Uttarakhand, Email: engg.sureshsahni@gmail.com

In other words, GPR is a high resolution system which is primarily designed to investigate the shallow subsurface objects using radio waves. GPR system has been developed substantially over the past thirty years[1].GPR uses the principle of scattering of electromagnetic waves to locate buried objects. In many respects GPR is the electromagnetic counterpart of sonar or geophones.

HISTORICAL BACKGROUND

The history of GPR is a relatively short one; the foundation for radar systems in general was laid by Christian Hülsmeyer when he obtained the worldwide first patent in radar technology on April 30, 1904. Six years later Gotthelf Leimbach and Heinrich Löwy applied for a patent to use radar technology to locate buried objects with radar technology. This system used surface antennas together with continuous-wave radar. In 1926, a pulse radar system was introduced and filed for a patent by Dr. Hülsenbeck. The particular invention improved the depth resolution and is still widely used today.

One of the first GPR survey was performed in Austria in 1930 by W. Stern when he measured the depth of a glacier. Thereafter GPR technology was not used any longer although some patents were filed in the field of "subsurface radar". Over the next three decades there was very little activity in the field, mainly due to lack of application identification[2].

This changed after the Second World War. Different scientific teams began to work on radar systems for viewing into the ground in the early 1970's. In the beginning, these radars were developed for military applications such as locating tunnels in the demilitarized zone between North and South Korea. Soon, thereafter public utility and construction companies were interested in such radars and systems were designed for applications such as measuring ice thickness, mapping bedrock structures in underground mines, and finding the location of hidden pipes and utilities. Some work was done on measuring the depth of shallow water; however, the study of glaciers, ice caps, salt, coal, and hard rock mines dominated this early work with GPR. During the same period Morey and others formed Geophysical Survey Systems Inc. (GSSI) which has been manufacturing and selling ground penetrating radars since that time (Morey, 1974). In addition, a better understanding of electrical properties of geologic materials at radio frequencies has developed during past decades. Work such as that by Olhoeft (1975) led to a much better understanding of the electrical properties such as relationship between electrical conductivity and dielectric polarization of naturally occurring geological materials. One major issue noted by the Geological Survey of Canada was the great difficulty in using existing equipment in remote areas because at that time equipment was very heavy, bulky and power hungry. In addition, digital data was needed to exploit the digital seismic processing advances rapidly evolving in the petroleum seismic field.

An interest in GPR waned to a degree during 1980's. The initial optimism for the technology gave way to the reality that many environments were not favourable for GPR. Considerable confusion often existed as to whether failures were equipment related or due to natural material responses. In addition, little money was available for technology development during this phase. A-Cubed Inc. was formed in 1981 in Canada and started development of ground penetrating radars. The low frequency digital GPR developments were reported.[4] This technology development led to the pulseEKKO series of GPR's. Many non-commercial developments occurred with

prototypes that embodied the ideas for portability, digital recording and the use of fibre optic cables. In 1988, Sensors & Software Inc. was spawned from A-Cubed Inc. and commenced commercialization of the pulseEKKO technology.

The real explosion in the advancement of GPR occurred during 1990's. Many groups worldwide became interested in the technology. Both the geophysical and electrical engineering community had started to pay much attention on research during this phase. Developments such as multi-fold data acquisition, digital data processing, and 2D numerical simulation occurred. Initial three dimensional numerical simulation was reported[3].

PRINCIPLE

The basic principles and theory of operation for GPR have evolved through the disciplines of electrical engineering and seismic exploration. The fundamental principle of operation of GPR is similar to that used to detect aircraft overhead[1]. In order to detect an aircraft the electromagnetic waves are radiated from a transmitting antenna which travel through a medium whose permittivity is known to us, these waves travel until they hit an aircraft that has different electrical properties from the surrounding medium, after which they are scattered from the aircraft and are detected by the receiving antenna. Antennas are like transducers that convert electric currents on the metallic antenna elements to transmit electromagnetic waves that propagate into a material and *vice-versa*. But the notable difference between GPR and radar used to detect an overhead aircraft is that in GPR the antennas are moved over the surface rather than rotating about a fixed point.

Electromagnetic waves travel at a particular velocity that is determined primarily by the permittivity of the object. The relationship between the velocity of the wave and material properties forms the fundamental basis for using GPR to investigate the subsurface. Also the velocity is different between materials with different electrical properties, and a signal passed through two materials with different electrical properties over the same distance will arrive at different times.

In GPR, the transmitted wave travels downward until it hit objects that have different permittivity, this wave is then scattered from those objects, and is detected by a receiving antenna and recorded on a digital storage device for later interpretation. The time taken by this reflected wave to be recorded on each trace is used to determine the depth of the buried object, if the velocity of the wave in the subsurface is known.GPR frequencies predominantly lie in the 1 MHz to 1000 MHz range but the depth of exploration generally depends upon the electrical conductivity of the material/site to be explored, for example, in sea water radio signals will only penetrate a few millimetres whereas in highly resistive granite formations signals can be transmitted through tens and even hundreds of metres of rock and still be detected[1, 4]. A simplified chart of exploration depth for common materials is presented in Figure 1[5].

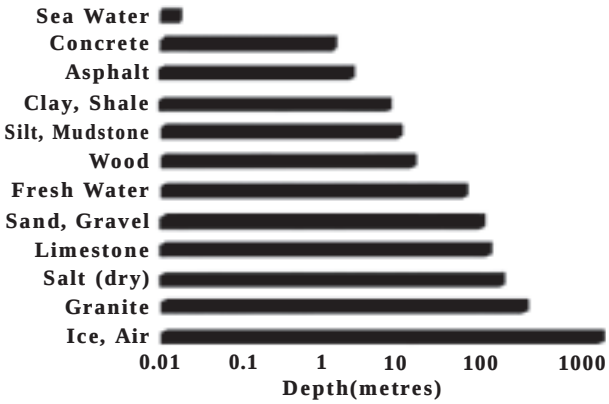


Fig 1: Chart indicating exploration depth for common materials

INSTRUMENTATION

Presently a number of different GPR systems are available in the market, though they all have slightly different configurations, however, they are all comprised of five main components (a) control unit, (b) transmitter, (c) receiver, (d) antennas, and (e) interface, data storage, and display module. The complete low frequency pulseEKKO PRO hand held Assembly is presented in Figure 2[5].

sending it to the storage device. In some systems the interface, data storage, display and control unit are all incorporated into one unit.

On the command of the control unit, the transmitter generates the electromagnetic pulse that is emitted through an antenna connected to it. The transmitter-antenna determines the centre frequency and bandwidth of the signal that is sent into the

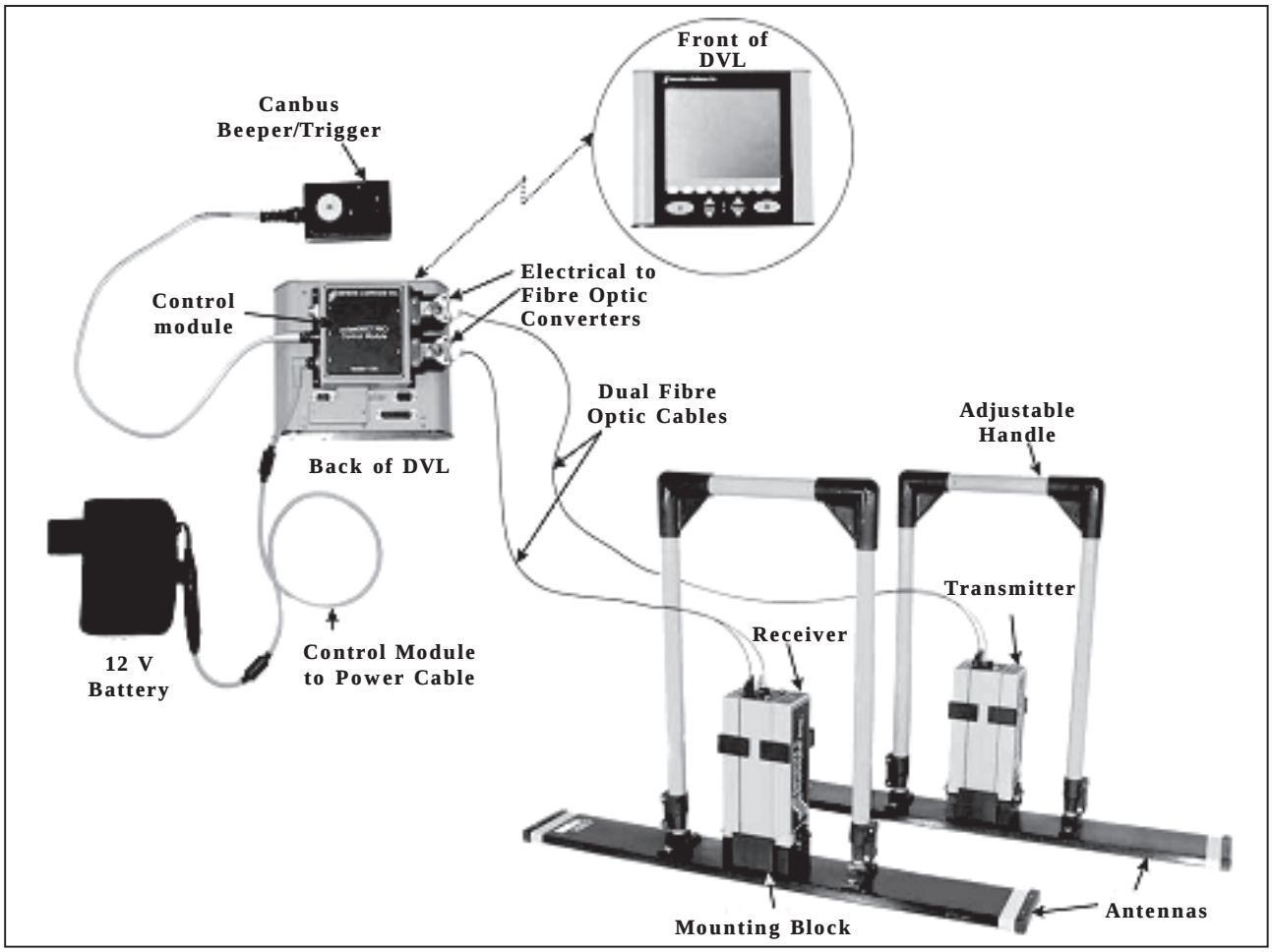


Fig. 2 : The complete low frequency pulse EKKO PRO hand held Assembly

The control unit receives the survey parameters from the interface and generates the timing signals for the transmitter and receiver. It also receives the data from the receiver and does the initial processing before

ground. Another antenna which is identical to that attached to the transmitter is attached to the receiver. This antenna intercepts reflected energy and sends it to the receiver where it is amplified, digitized and sent to the control unit[2].

GPR operation is mainly governed by its five system parameters, namely, (a) Antenna Frequency, (b) Time Window, (c) Sampling Interval, (d) Antenna Separation, and, (e) Antenna Step Size, which are interrelated to each other[5].

Depending on the objectives of the survey, antenna frequency must be selected to get optimum penetration and resolution. As frequency decreases, the depth of exploration generally increases but spatial resolution decreases. Therefore, the ideal survey will be one that uses the highest frequency that effectively penetrates to the target depth. This is not always easy to determine and often, field experimentation with several different frequencies is necessary.

The Time Window determines how long (and therefore how deep) the radar system will explore the subsurface. It is important that it is set to a value appropriate for the depth of the survey target. An entire survey could fail if the window is not sufficiently long enough to sample to the depth of the target. Conversely, too long a time window increases the data volume and decreases productivity.

The system samples the GPR signals returning to the receiver. The sampling interval is dependent on the frequency of the antennas being used. It is important not to choose a sampling interval that is too large for a particular frequency otherwise the data may be aliased. Choosing a sampling interval too small will increase the data volume unnecessarily and may slow down the data collection process.

If the antenna spacing is too small, receiver electronics may be overloaded by the transmit signal resulting in data clipping. The rule of thumb says that the minimum antenna separation should equal the antenna length.

Antenna Step Size specifies the distance the antenna pair will be moved each time to collect a new trace. To properly determine subsurface targets spatially, it is important that a proper Antenna Step Size must be selected. Too larger step size may result in missed subsurface targets whereas relatively smaller step size will result in large data volumes and slow survey productivity. A simplified table representing correlation between five system parameters is presented in Table 1[5].

APPLICATIONS

The applications of GPR are endless. So far GPR has been used for numerous purposes, some of them being, snow, glacier thickness

Table 1: Correlation amongst various system parameters of GPR

Center Frequency (MHz)	Antenna Length (m)	Depth (m)	Time Window (ns)	Sampling Interval (ns)	Minimum Antenna Separation (m)	Antenna Step Size (m)
12.5	8	50	1600	6.4	8	2
25	4	30	800	3.2	4	1
50	2	10	400	1.6	2	0.5
100	1	5	200	0.8	1	0.25
200	0.5	2	100	0.4	0.5	0.1
250	0.3	2	100	0.4	0.38	0.05
500	0.15	1	50	0.2	0.225	0.025
1000	0.08	0.5	25	0.1	0.15	0.01

measurements, archaeological investigations, geophysical investigations, forensic investigations, security applications, etc.

GPR is used to measure the ice thickness and bedrock topography of glaciers. The internal structure of glacial ice such as fractures, deformation and embedded debris in the glacial ice can also be detected. Though most of the GPR systems are used in close proximity to the ground, airborne systems have also been developed to map snow cover, glaciers, and even the snow lying under the forest cover.

To detect and detonate abandoned anti-personnel land mines and unexploded ordnance are major problem for many countries. Most of the detection is done with metal detectors, which respond to the large amount of metallic remains and hence have difficulty in detecting the minimum metal or plastic mines. GPR technology is being applied to this problem as a means of providing improved detection of low metal content mines.

Though we can say that the technology and applications of GPR had evolved to a much greater extent in such a short span of time, but still GPR is in an era where it is exploring and making way to being explored newer dimensions and applications[6].

ACKNOWLEDGMENTS

We gratefully acknowledge the Prof. Anil K. Gupta, Director, Wadia Institute of Himalayan Geology who continually and convincingly conveyed a spirit of adventure in regard to research. We would also like to give special thanks to Dr. D.P Dobhal, for his help and support. Finally, we would like to thank our colleagues and friends who have given us their valuable suggestions and support as and when needed.

REFERENCES

1. Jeffrey J. Daniels, *Ground penetrating radar fundamentals: Appendix to report to USEPA, Region 5*, 1–21, 2000.
2. Tracking Environmental Change Using Lake Sediments, 2001, 23-47, Kluwer Academic Publishers, Dordrecht.
3. A. P. Annan, *Subsurface Sensing Technologies and Applications*, **3,** 4, 253-270, 2002.
4. A.P. Annan, J.L Davis, *Proceedings of Exploration 97: Fourth Decennial International Conference on Mineral Exploration*, 512–522, 1997.
5. Sensors & Software Inc., *pulseEKKO PRO User's Guide.*
6. Ground Penetrating Radar, 2nd Edition, 2004, 3-4, Institution of Electrical Engineers, Cornwall.

PROMINENT TOOLS IN SYNTHETIC PATHWAYS OF GREEN TECHNOLOGY : MICROWAVE & ULTRASONIC IRRADIATION

A.P. Mishra, Brajendra S. Kusmariya and Rajendra K. Jain

Scientists must design safer and cleaner approaches to manufacture the products needed by mankind.

INTRODUCTION

The term "green chemistry" is defined as "the invention, design and application of chemical products and processes to reduce or to eliminate the use and generation of hazardous substances". Green Chemistry can diminish the need for other approaches to environmental protection. Ideally, the application of green chemistry principles and practice renders regulation, control, clean-up, and remediation unnecessary, and the resultant environmental benefit can be expressed in terms of economic impact.

Green Chemistry is an effort towards eliminating pollution by making chemical products that do not harm either our health or the environment and by using production processes that reduce or eliminate hazardous chemicals. Green Chemistry prevents pollution at it's source rather cleaning up the mess later.

It is high time that the chemists start thinking about chemical process in the same way i.e. instead of finding ways to dispose off the waste produced during the process, the later should be modified in a way that no waste is produced. Scientists must design safer and cleaner approaches to manufacture the products we need.

Green Chemistry with its 12 principles would like to see changes in the conventional ways that were used for decades to make synthetic organic chemical substances and the use of less toxic starting materials. Green Chemistry would like to increases the efficiency of synthetic methods, to use less toxic solvents, reduce the stages of the synthetic routes and minimize waste as far as practically possible. Prof Paul Anastas (father of Green Chemistry) and Prof John Warner have postulated 12 principles for practicing Green Chemistry[1].

1. Prevention : It is better to prevent waste than to treat or clean up waste after it has been created.
2. Atom Economy
3. Less Hazardous Chemical Syntheses
4. Designing Safer Chemicals
5. Safer Solvents and Auxiliaries
6. Design for Energy Efficiency
7. Use of Renewable Feedstock.

* Synthetic Bioinorganic Chemistry Laboratory, Department of Chemistry, Dr. H. S. Gour Central University, Sagar, 470003.
E-mail : apm19@ rediffmail.com

8. Reduce Derivatives.
9. Catalysis
10. Design for Degradation
11. Real-time Analysis for Pollution Prevention
12. Inherently Safer Chemistry for Accident Prevention

The use of microwave radiation has become a widespread and convenient method for heating food and beverage in modern society due to the energy efficient and volumetric heated observed with microwave radiation. The use of microwave or dielectric heating in chemistry has been limited, however, with most applications occurring in organic chemistry. The fast and volumetric heating of organic reactions has lead to extraordinary reaction rate enhancements.[2] In recent year microwave assisted organic reaction has emerged as new tool in organic synthesis. Important advantage of this technology include highly accelarated rate of the reaction, Reduction in reaction time with an improvement in the yield and quality of the product. Microwave chemistry is applicable in various industries such as the biotechnology, pharmaceuticals, petroleum; plastics, chemicals etc. and major applications have been developed in the field of analytical chemistry and chemical synthesis. Due to the successful development of commercial instrumentation, microwave dielectric heating is now being increasingly applied in chemical reactions.

In the coordination and organometallic chemistry, the microwave-assisted synthesis in not developed such sufficiently as for the preparation of inorganic compounds, composites and materials or in the organic synthesis, where microwave heating can be considered as a common preparative tool. However, during the last decade a considerable growth of related reports has been registered. The most number of reports corresponds to MW-reactions of the N-, N,O-, and N,S-containing ligands with sources of metal ions[3]. Microwave method has been proved to be a successful method in Synthesis of various intercalation compounds, Synthesis of ceramic products, Polymer Chemistry etc.[4]

Ultrasonic is the branch of acoustics, which consists of high frequency wave beyond the audible range of human ear. These are generally sound waves. Ultrasounds are mechanical waves with frequencies higher than 20 KHz. The propagation space of the ultrasound is named as ultrasonic field. Applications of ultrasonic irradiation are playing and increasing role in chemical processes, especially in cases where classical methods require drastic conditions or prolonged reaction times, Ultrasound irradiation enables many chemical reactions to proceed, even with some reactions which could not be carried out under conventional condition. The use of ultrasound in organic transformations is well known because it can enhance the reaction rate and can alter selectivity perfomance of the reaction. Ultrasonic irradiation has been increasingly used in organic synthesis in last three decades. Comparing with traditional methods, this method is more convenient and easily controlled. A large no. of organic reactions has been carried out in higher yield, shorter reaction time and milder condition under ultrasound irradiation.[5,6]

- A rapid and enviromentally benign method for the coupling of 2-naphthols is described using copper(II) acetylacetonate under microwave irradiation in dry media.[7]
- Studies have been carried out in comparative manner between

conventional and microwave synthesis of some transition metal complexes containing 2-amino-5-methylthiazole moiety.[8]

- Microwave method was used for induced synthesis and characterization of semiconducting 2-thiophencearbox-aldehyde metal complexes.[9]
- Microwave synthesis method was developed for the synthesis of a series of cyclometalated platinum complexes with long chain β-diketone ancillary ligands, with this the reaction time was greatly reduced from 32 h to several minutes.[10]
- Ultrasonic method was used for-Ultrasound mediated Green synthesis of Hexa-hydro Triazines.[11]
- Choline chloride.$ZnCl_2$: green, effective and reusable ionic liquid for synthesis of 7-amino-2, 4-dioxo-5-phenyl-2, 3, 5-tetrahydro-1*H*-pyrano [2, 3-d] pyrimidine-6-carbonitrile derivative.[12]

ADVANTAGES

Microwave is simple, convenient, fast, high yielding, efficient and environment friendly synthetic methodology.[13] Microwave synthesis is considered as a "green technology, principally since many organic reactions can be carried out in solvent-free conditions. Microwave radiation has proved to be a highly effective heating source in chemical reactions. Microwaves can accelerate the reaction rate, provide better yields and uniform and selective heating, achieve greater reproducibility of reactions and help in developing cleaner synthetic routes.

Practically in all reports, main attention of researchers is paid to extreme fastness of MW assisted reactions in comparison with classic protocols. The same reactions in the MW-field take place in 10-100 times more rapidly. Moreover, higher or comparable yields are frequently reported. Sometimes the MW-route leads to products, which it is impossible to get *via* traditional routes, for instance preparation of several metal cluster complexes.[14]

Sonochemistry is one of the green chemistry research area in which molecules undergo a reaction due to the application of powerful ultrasonic radiation. The ultrasound irradiation is a powerful technique for establishing unique chemical and physical conditions, such as a local increase in temperature of several thousands of Kelvins and pressure by several bars by which reaction proceeds.[15] This method has several advantages such as higher atom economy, energy efficiency, environmental friendly, waste and hazards minimization etc.[16]

DISADVANTAGES

Temperature measurement under microwave conditions, particularly for the reaction is dense and solvent-less medium is difficult. Heating in microwave cavities is based upon the ability of some liquid and solids to absorb and transform electromagnetic energy into heat. When a strongly conducting material is exposed to microwave irradiation, Microwaves are largely reflected from its surface. So the material is not effectively heated by microwaves, in response to the electric field of microwave radiation, electrons move freely on the surface of the material, and the flow of electrons can heat the material through a resistive heating mechanism. While, in the case of insulators microwaves can penetrate through the material without any absorption, losses or heat generation. They are transparent to microwave. Passage of microwave radiation which is electromagnetic

in nature can give rise to absorption of microwave energy and heat generation due to the so called dielectric heating mechanism.

Heat force control is difficult. Water evaporation occurs. Therefore, its applications have been limited to small-scale use in laboratories and have not been extended to the production level.[17]

In ultrasonic synthesis changes in the environment, such as temperature, pressure, humidity, air turbulence, and airborne particles affect ultrasonic response.

REMARKS

In 21st century the main objective is to develop environmental friendly and pollution free techniques; microwave and ultrasonic irradiation both fit into this profile. So many advantages and superiority over conventional methods make these techniques prominent tools of green technology.

REFERENCES

1. PT Anastas, JC. Warner Chemistry : Theory and Practice. Oxford University Press, New York, 1998.
2. V. K. Ahluwalia, *Alpha Science Int'l Ltd*., 280 pp., 2007.
3. J. A. Ahn, D. H. Chang, Y. J. Park, Y. R. Yon, A. Loupy, C. H. Jun, *Advanced Synthesis & Catalysis*, **348**, 1+2, 55-58, 2006.
4. AJ, Berteaud, JC. Badot, *J. Microwave Power*, 11, 351-320, 1976.
5. Anjali Jha, Shabana Yashmeen and D N Kumar, *Int. J Pharm Bio Sci* Oct; **4**, 4, (P) 197–204, 2013.
6. VV Dabholkar and FY Ansari, *Indian Journal of Chemistry*, 48B, 1759-1761, 2008.
7. H. M. Meshram, G.S. Reddy, *Indian Journal of Chemistry, Section B : Organic Chemistry Including Medicinal Chemistry*, 42B, **10**, 2615-2617, 2003 .
8. A. P. Mishra, Rajendra K. Jain, *Journal of Saudi Chemical Society*, DOI : 10.1016/ j.jscs.2011.09.013, 2011
9. A. P. Mishra, A. Tiwari, Rajendra K. Jain; *Adv. Mat. Lett.*, **3**, 3, 213-219, 2012.
10. K.J. Luo, L.I. Xu, X.Q. Wei, M.G. Xie, Q. Jiang. *Huaxure Yanjiu Yu Yingyong*, **19**, 9, 991-993, 2007.
11. Ashish K Singh, Sudhish K Shukla, Mumtaz A. Quraishi. *J. Mater, Environ. Sci.* **2,** 4, 403-406, 2011.
12. Dileep Kumar Yadav, M. A. Quraishi, *J. Mater. Environ. Sci.* **5,** Y, xxx-xxx, 2014.
13. G. Roussy and J.A. Pearce, Foundations and Industrial Applications of Microwave and Radio Frequency Fields, *John Wiley & Sons*. 1995, Chichester-New York-Brisbane-Toronto-Singapore.
14. Rafael Martinez-Palou, *J. Mex. Chem. Soc.*, **51,** 4, 252-264, 2007.
15. J.T. Li, W.Z. Yang, S.X. Wang, S.H. Li, T.S. Li, *Ultrason, Sonochem*. **9**, 237, 2002.
16. T.J. Mason, *Advances in Sonochemistry*; JAI Press 1990, London.
17. A. Loupy, Ed. Microwaves in Organic Synthesis; *Wiley-VCH Verlag Gmbh & Co*, 2002 Weinheim, pp 1-73.

THE SOLUTION OF POWER CRISIS THROUGH RENEWABLE SOURCES OF ENERGY

Md. Rashid Tanveer*, Deepak Mishra and Aradhana Kashyap

Crisis of power is one of the major problems in developing countries particularly in India. Day by day the gap between demand and production is increasing. Moreover, most of the power plants are fossil fuel based which will be phased out in future. Misuse and system loss in power sector are supposed to be the main issue regarding this crisis. It is possible to fulfill load demand by reducing transmission loss, by using compact fluorescent or LED lamps, transformation of holiday, proper load management and encouraging Independent Power Producers (IPP). Priority is given to control the misuse and mismanagement in power sector than to increase the generation of power. But proper utilization of renewable energy should be the up most choice for the solution of the power crisis. This is because it requires low cost and has lesser risk. Initiative should be taken to develop new technology and skilled manpower required for the power sector considering renewable energy sources. By incorporating Independent Power Producers (IPP), it is possible to increase the power generation and ensure its proper use in the country. This review article deals with the factors responsible for the power crisis in the country and its possible solution.

INTRODUCTION

India is one among the fastest developing countries which is facing the critical problem of power crisis. There is acute shortage of electricity. This crisis consists in a peculiarly interlocked group of shortages, not only of electrical generating capacity but also of every major fuel supply[1]. Behind these shortages lies a system of controls and interventions which not only have failed individually to achieve their intended purposes but have also worked at cross-purposes with one another. It is difficult to design a system that would succeed better than the current patchwork of interventions to wreak havoc in the field of power generation.

The ultimate source of power for both heating as well as for electricity is fuel. The four primary types of fuel currently in use are coal, oil, natural gas and uranium. Nuclear power plants provide less than 1% of the nation's total electricity at present although there is no shortage of uranium[2]. However, a number of nuclear power plants which were expected to be in operation by this time have been delayed, often by several years. Thus, although the delay in nuclear plants

* Department of Chemistry, St. Andrew's College, Gorakhpur -273001 (UP).
E-mail: rashidtanveer1@gmail.com

contributes to the power shortage, it is not in itself a part of the fuel shortage. It has contributed to the problem because electric utility officials, were counting on the increased nuclear capacity and consequently, did not pay sufficient attention to assure adequate supplies of coal, oil and gas to the thermal power plants[3,4]. Constraints in the availability of coal and natural gas, coupled with poor financial health of distribution companies, continue to remain major concerns for the growth prospects of the power sectors.

Total consumption of electricity in India is 698.8 billion kWh. This data consists of total electricity generated annually plus imports and minus exports. The discrepancy between the amount of electricity generated and/or imported and the amount consumed and/or exported is accounted for as loss in transmission and distribution. As of March 2013, the per capita total electricity consumption in India was 917.2 kWh. Electric energy consumption in agriculture is highest (18%) in India. The per capita electricity consumption is lower compared to many countries despite cheaper electricity tariff in India.

Recently India's Central Electricity Authority has anticipated, a base load energy deficit and peaking shortage to be 5.1% and 2% respectively. India also expects all regions to face energy shortage up to a maximum of 17.4% in north eastern region. Gujarat has the highest power surplus of any Indian state, with about 1.8 GW more power available than its internal demand. The state was expecting more capacity to become available. Andhra Pradesh leads in the greatest power deficit with peak power being less by 3.2 GW against demand. Despite an ambitious rural electrification program, some 400 million Indians lose electricity access during blackouts. While 80% of Indian villages have at least an electricity line, just 52.5% of rural households have access to electricity. In urban areas, the access to electricity is more than 93%. The overall electrification rate in India is 64.5% while 35.5% of the population still lives without access to electricity.

ELECTRICITY PRODUCTION IN INDIA

So far as total production of electricity is concerned, the electricity sector in India had an installed capacity of 255.012 GW as of end November 2014 and generated around 703.1 BU for the period April - November 2014. India became the world's third largest producer of electricity with 4.8% global share in electricity generation surpassing Japan and Russia. Renewable Power plants constituted 28.43% of total installed capacity and Non-Renewable Power Plants constituted the remaining 71.57%. India generated around 967 TWh (967,150.32 GWh) of electricity (excluding electricity generated from renewable and captive power plants). The total annual generation of electricity from all types of sources is 1102.9 TWh.

In addition to hydropower, coal, oil, gas and nuclear power generation, it covers generation by geothermal, solar, wind and tide-wave energy, as well as that from combustible renewable and waste. Production includes the output of electricity plants that are designed to produce electricity only as well as that of combined heat and power plants.

The 21st century finds a huge number of electric power plants located across country. India has sufficient technology and expertise to generate electricity through the use of coal power[5,6] wind power[7], water power[8] and nuclear power[9]. However, coal based plants is the main source of fuel for the production of electricity in India.

MAJOR ELECTRICITY GENERATOR PLANTS

India has a number of power plants. The production of electricity by different sources is given in Fig 1. These power plants are situated across the country. The entire country is dependent on these power stations for its energy requirement. The important power plants in India are given below;

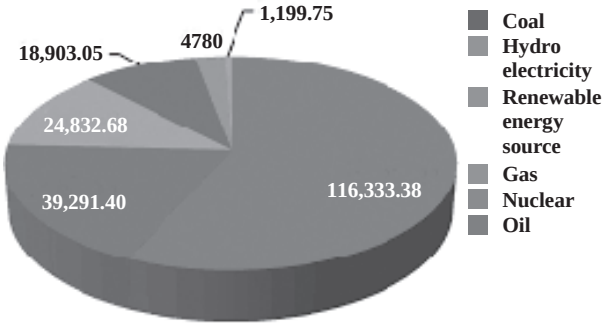


Fig 1. The production of electricity by different sources.

(a) Thermal power plants : The installed capacity of natural gas based power plants is 21,727 MW. These base load power plants are operating at overall PLF of 25% only due to severe shortage of Natural gas in the country. These power plants include Suratgarh state thermal power station, Paras thermal power station, Chhabra State thermal power plant, Rajiv Gandhi Thermal Power Project (RGTPP), Panipat thermal power Station and Nashik thermal power station, NTPC (singrauli, Korba etc.)

(b) Nuclear power plants : India has 4.8 GW of installed electricity generation capacity using nuclear fuels. India's nuclear plants generated 32455 million units or 3.75% of total electricity produced in India. The nuclear power plants include Kaiga Atomic power station, kakrapar atomic power station, Madras atomic power station and Narora atomic power station. Few more proposed are at Jaitpur, Kudankulam, Mithi virdi, Kovvada, Haripur and Kumharia.

(c) Hydroelectric power plants : The present installed capacity is approximately 40,661.41 MW which is 16.36% of total electricity generation in India. These power plants are located at Bhakra dam, Srisailam dam, Uri Hydroelectric dam, Madikheda dam and Bansagar dam.

(d) Wind power plants : India has the fifth largest installed wind power capacity in the world. Wind power accounted for 6% of India's total installed power capacity, and 1.6% of the country's power output. The installed capacity of wind power in India was 15.9 GW. The state of Gujarat is estimated to have the maximum gross wind power potential in India, with a potential of 10.6 GW. Important wind power plants are Muppandal Wind Farm, Vankusawade Wind Park, Arasinagundi (ARA) Wind Farm, Madhya Pradesh Wind Farm and Kanjikode Wind Farm. A wind farm is soon to be set up in West Bengal. This is supposed to generate 50 MW of electric energy.

ENERGY CRISIS IN INDIA

(a) India is slow to set up new power capacity principally because it is short of fossil fuels. Coal is mined hesitantly and natural gas, the other feedstock for power plants, is just beginning to flow in from new offshore finds.

(b) The immediate response to a power sector in distress-thermal plants are idling a quarter of their capacity is to give it a bigger slice of the pie. The sustainable response will need the pie to grow overall.

(c) India's basic energy shortage is compounded by the policy of selling electricity to consumers at politically correct prices.

REASONS BEHIND ENERGY CRISIS

There are several reasons behind the energy crisis or shortage of electrical energy in India. Some of the very crucial factors are being discussed here :

(a) Sharp increase in demand : Being a fast developing country the number of industries and other sectors power demand is being increased. The number of companies is multiplying each year and the power demand is increasing very fast. This is the most serious matter to match production of electricity with the demand.

(b) Poor utilization of electrical equipment : Apart from insufficient power supply the power which is being supplied is not utilized properly. Around 30-40% power is wasted due to low power factor. If we can save that 30% of power, we have to produce less electricity as that wastage can serve the purpose.

(c) High transmission loss : In India, the efficiency of electrical equipments used in power transmission and distribution like transformers and other equipments is very poor as compared to developed countries, so there is a chance to save power.

(d) Power theft : The biggest reason for power shortage is the theft of its resources. Due to importance of power, it is considered as one among the crucial resource but this is stolen by some people and this has to be stopped.

(e) Delay in commissioning of power project : Due to non-availability of funds power projects are delayed in India and sometimes some political problems are also faced. This delays the project and hence increases the supply versus demand ratio.

(f) Shortage of coal : Coal is not available at power generating locations like thermal power plants, on time and this causes delay in the power generation.

(g) Faculty planning and plant outages : The planning in Indian power industry is of 20 years behind the time. It should be upgraded like that in developed countries.

THE GRID FAILURE

The blackout may have been caused by a mix of coal shortages and other problems on the grid. The power deficit was worsened by a weak monsoon that lowered hydroelectric generation and kept temperatures high, feeding the appetite for electricity. Farmers using energy in intensive water pumps for irrigation to save their recently sown crops may also have pushed up the demand. If the monsoon does not pick up, the grids are expected to come under more stress. Hydro-power accounts for about 20% of installed power capacity but reservoirs have only 24% of water, they can hold.

STEPS TO MINIMISE POWER CRISIS

We can minimize the power shortage by switching off the electrical gadgets when they are not in use. To overcome the energy crisis following steps are required:

(a) Saving energy : Energy saved is the energy produced. So we all should take care of this and should save as much power as we can.

(b) Use of efficient equipments : Always consider power saving of the device while buying a new electrical equipment.

(c) Pay for what one use : If one is using electricity one must pay its cost. The fact is that from the fund earned from selling electricity is utilized in setting up new power.

(d) Checking of power factor : Mostly due to motors and other similar loads our power factor is not unity. It increases the current and hence wastage. Power may be saved by increasing power factor near unity.

SOLUTION OF POWER CRISIS THROUGH RENEWABLE ENERGY SOURCES

The demand for electric power increases each second and there is an alarming and mounting power crisis throughout the globe. The efforts are being made to solve the existing crisis. There are several counter measures being planned such as generating power through diesel generators, solar, wind and other green initiatives. However, they may incur huge costs and consume more time for actual implementation. In India renewable energy sector is said to be still in its infancy although Indian electricity sector is very active in renewable energy utilization, especially wind energy. India had an installed capacity of about 31.15 GW of non-conventional renewable technologies-based electricity, about 13.32% of its total. The percentage of production of electricity by different sources is given in Fig 2. The major renewable energy sources are as following :

(a) Solar energy : Solar energy is the ultimate solution to power crisis[10-12]. India has an ideal location for solar energy utilization. In a recent study conducted by Renewable Energy Research Centre, it is found that average solar radiation varies between 4 to 6.5 kWh per day and maximum amount of radiation are available in the month of March to April and minimum in December to January. Moreover, in the rural areas where there is no electricity connection, photovoltaic technology can be a blessing. Under Solar Mission, a central government initiative, India plans to generate 1 GW of power.

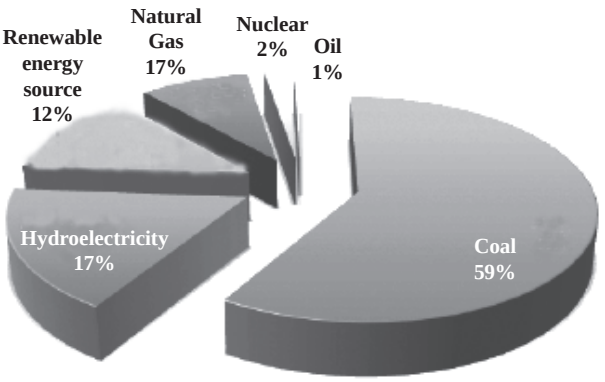


Fig 2. The percent of electricity produced by different sources.

It is needed that newly built apartment buildings use solar panels along with the grid connection to get support during the load shedding period. But solar photovoltaic is lagging behind due to some hurdles. Although it can give service up to 20-25 years with proper maintenance, its installation cost is very high. Further, conventional batteries are very costly and have life span of around two to five years. These batteries are suitable for small scale power generation. The electricity generated by solar cells is therefore about five times to the conventional electricity. Unless the technology allows us to develop efficient storage devices which are cost effective too, solar photovoltaic is going to remain confined in limited domain. This is the reason that grid interactive solar energy is getting popular in European countries as it does not require a battery to store generated energy. Solar plates tap the solar power and provide it to grid where it gets stored.

In the area where solar intensity is very high, solar thermal power plant can be installed. It is already well accepted in the country. Solar dryers, water heaters have directly contributed in conservation of electricity.

(b) Nuclear Power : In India, a total of 20 nuclear power plants are operational. Our history in nuclear power traces back to 1969 when Tarapur Atomic Power Station was setup. Foreseeing the ever growing power needs of the future generation and depleting natural resources, India has planned another 20 plants, while four are under construction.

Working of nuclear power plant is complex and each stage of energy production is closely monitored. A fission process of controlled nuclear reaction takes place where heavy nucleus splits into two or more lighter nuclei producing huge amount of power. Nuclear Power Plant works according to the international safety standards set by AERB (Atomic Energy Regulatory Board).

Nuclear Power Plants in India are spread across the country in zones which are non-earthquake prone. Most of the plants belong to the 3rd generation of plants, which have highly safety and security standards. It is notable that the operational plants like Kaiga Nuclear Power Plant, Madras Nuclear Power Plant, etc are standing example of optimal technological utilization. In addition, the planned and under construction nuclear power plants like Jaitpur Nuclear Power Project and Kudankulam Nuclear Power Plant are set to multiply nuclear energy generation potential of India.

(c) Hydroelectric Power : Hydroelectric and coal-fired power plants produce electricity in a similar way. In both cases a power source is used to turn a turbine, which then turns a metal shaft in an electric generator, this produces electricity. A coal-fired power plant uses steam to turn the turbine blades; whereas a hydroelectric plant uses falling water to turn the turbine.

I. Turbine Blades

The dams are built on large rivers that have a large drop in elevation. The dam stores lot of water behind it in the reservoir. Near the bottom of the dam wall there is water intake. Gravity causes it to fall through the penstock inside the dam. At the end of the penstock there is a turbine propeller. A hydraulic turbine converts the energy of flowing water into mechanical energy. A hydroelectric generator converts this mechanical energy into electricity. In a large generator, electromagnets are made by circulating direct current through loops of wire wound around stacks of magnetic steel laminations. These field poles are mounted on the perimeter of the rotor. The rotor is attached to the turbine shaft, and rotates at a fixed speed. When the rotor turns, it causes the field poles (the electromagnets) to move past the conductors mounted in the stator. This, in turn, causes electricity to flow. Power lines are connected to the generator that carries electricity to consumers. The water continues past the propeller through the tailrace into the river past the dam.

II. Pumped storage : Reusing water for peak electricity demand

Demand for electricity is not constant and it goes up and down during the day, and overnight. Hydroelectric plants are more efficient at providing for peak power demands during short periods than are fossil-fuel and nuclear power plants, and one way of doing that is by using "pumped storage", which reuses the same water more than once.

Pumped storage is a method of keeping water in reserve, for peak period power demands by pumping water that has already flown through the turbines back up a storage pool above the power plant at a time when

the demand for energy is low, such as during the middle of the night. The water is then allowed to flow back through the turbine generators at times when demand is high and a heavy load is placed on the system.

The reservoir acts much as a battery, storing power in the form of water when demand is low and producing maximum power during daily and seasonal peak periods. An advantage of pumped storage is that hydroelectric generating units are able to start up quickly and make rapid adjustments in output. They operate efficiently when used for one hour or several hours. Because pumped storage reservoirs are relatively small, construction costs are generally low compared with conventional hydropower facilities.

(d) Ocean wave energy

Ocean wave energy is generated directly from the waves of the oceans[13-15]. It is another special type of renewable energy which helps to decrease the harmful emissions of green house gases associated with the generation of power. India has the oceans surrounding the country. It can be potentially a significant source of electricity for our country. Though the main purpose of ocean wave energy is electricity generation, it can also be used for pumping of water, water desalination etc. The oscillation water column method is technically feasible and becoming economically attractive in this purpose. This type of wave energy harnessing device is being commissioned by several countries.

(e) Tidal energy

Tidal power or tidal energy is a form of hydropower that converts the energy of tides into electrical power[16,17]. As tides are more predictable than wind and sunlight, tidal energy can easily be generated from the changing sea levels. The coastal area has a tidal rise fall of several meters.

(f) Biodiesel

Biodiesel is chemically trans esterified lipid. It is mono-alkyl ester and said to be hydrogenated alkane renewable diesel. This term refers to a vegetable oil- or animal fat based diesel fuel consisting of long-chain alkyl (methyl, ethyl, or propyl) esters. Biodiesel is typically made by chemically reacting lipids e.g., vegetable oil, animal fat or tallow with an alcohol producing fatty acid esters.

Biodiesel is meant to be used in standard diesel engines and is thus distinct from the vegetable and waste oils used to fuel converted diesel engines. Biodiesel can be used alone, or blended with petrodiesel in any proportions. Biodiesel can also be used as a low carbon alternative to heating oil.

In recent years fossil fuel depletion and global warming issues are the point of concern around the world. To reduce carbon emissions and decreasing reserves of fossil fuels, biofuel can be an attractive source of energy. In comparison to fossil fuels, biofuel can reduce the emission of CO_2. Next generation biofuels can be a great solution to the global warming and the crying need of fossil fuels. The biodiesel can be used in the diesel generator to produce electricity. This will be cost efficient and also environmental friendly.

(g) Geothermal energy

The thermal energy which is generated and stored inside the earth surface is called geothermal energy. It is very much cost effective and environment friendly[18]. With this technology, the steam and hot water produced inside the earth surface is used to generate electricity. Geothermal energy is generated about 4000 miles below the surface, in earth core. This energy is produced due to slow decay of radioactive particles in rocks. As a

result high temperature is produced inside the earth. About 10715 MW of geothermal energy is generated in 24 countries worldwide. The demand of electricity in urban as well as in the rural areas are increasing, but our production of electricity is not increasing. The rural demand for electricity can be covered by the production of electricity through geothermal energy. The electricity demand of urban can be met by this saved electricity which is supposed to be provided in the rural areas. Geothermal energy can balance the electricity consumption.

(h) Wind energy

The wind sector is progressing fast. There are many hilly and coastal areas in India which have huge potential for wind energy generation. Wind energy is a technique which converts the air flow into mechanical energy which is eventually converted into electricity without generating pollutants.

CONCLUSION

Power crisis can be solved by the use of renewable energy sources. Such sources are bio-diesel, biogas, solar energy, micro hydro, wind energy, ocean wave energy, ocean tidal power, geothermal energy etc. Some renewable energy resources like small hydro, micro hydro, wind, solar thermal, bio-mass based stand-alone power generation units have succeeded in India to some extent, whereas there is no serious study for tapping the potential of geothermal energy. Potential of wave and tidal energy remains untapped just without any satisfactory reason. Solar energy can also be a great source for solving power crisis in the country. But due to some technical limitations and cost solar photovoltaics has failed to gain necessary popularity.

ACKNOWLEDGEMENT

The authors are grateful to the Principal, St. Andrew's College, Gorakhpur, for providing laboratory facilities. Financial assistance provided by University Grants Commission, New Delhi in the form of minor project – F. No. 8 - 3(38) / 2011(MRP / NRCB) is also thankfully acknowledged.

REFERENCES

1. Subhes C. Bhattacharyya, *Journal of Cleaner Production*, **15**, 235-246, 2007.
2. Michael Dittmar, *Science of The Total Environment*, **461–462**,792-798, 2013.
3. Lihua Zhao, Yin Lin, *Procedia Engineering*, **26,** 2032-2037, 2011.
4. R.C. Bhangare, P.Y. Ajmal, S.K. Sahu, G.G. Pandit, V.D. Puranik, *International Journal of Coal Geology*, **86** , 349-356, 2011.
5. Marcos L.S. Oliveira, Fabiane Marostega, Silvio R. Taffarel, Binoy K. Saikia, Frans B. Waanders, Kátia DaBoit, Bimala P. Baruah, Luis F.O. Silva, *Science of The Total Environment*, **468–469**, 1128-1137, 2014.
6. Ananth P. Chikkatur, Ambuj D. Sagar, Nikit Abhyankar, N. Sreekumar, *Energy Policy*, **35,** 3744-3758, 2007.
7. C. Marimuthu, V. Kirubakaran, *Renewable and Sustainable Energy Reviews*, **23**, 80-90, 2013.
8. Priyamvada Zutshi, Preety M. Bhandari, *Energy Policy*, **22**, 75-80, 1994.
9. Jessica Jewell, *Energy Policy*, **39,** 1041-1055, 2011.
10. Matías Hanel, Rodrigo Escobar, *Renewable Energy*, **49,** 96-100, 2013.

11. Antonio Urbina, *Renewable Energy*, **68,** 264-269, 2014.

12. D. Azofra, E. Martínez, E. Jimenez, J. Blanco, J.C. Saenz-Díez, *Applied Energy*, **121**, 28-37, 2014.

13. T.R. Anoop, V. Sanil Kumar, P.R. Shanas, *Ocean Engineering*, **81**, 150-157, 2014.

14. S.C. Pryor, R.J. Barthelmie, *Reference Module in Earth Systems and Environmental Sciences, from Climate Vulnerability*, **3**, 65-81, 2013.

15. Raymond Alcorn, *Chapter 17 - Wave Energy Future Energy (Second Edition)*, 357-382, 2014.

16. C.D. Rakopoulos, D.C. Rakopoulos, E.G. Giakoumis, A.M. Dimaratos *Fuel*, **89**, 3814-3826, 2010.

17. R. Prakash, R.K. Singh, S. Murugan, *Energy*, **55**, 610-618, 2013.

18. S.I. Yang, T.C. Hsu, C.Y. Wu, K.H. Chen, Y.L. Hsu, Y.H. Li, *Energy*, **66,** 172-180, 2014.

FLAX : THE VEGETARIAN OMEGA-3 SOURCE

Mamta Kumari* and Shashi Jain**

Nutritionally important omega-3 fatty acids include α-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), all of which are polyunsaturated. Flax and fish contains highest amount of omega-3 fatty acids among vegetarian and non-vegetarian sources respectively. Nutrition Scientists have recommended an appropriate ratio of n-6 to n-3 fatty acids intake of 5 : 1 to 10 : 1. Taking sufficient omega-3 is important to maintaining good health, as well as reducing the risk of stroke and heart attack and has many other health benefits.

INTRODUCTION

Everyone wants to be sure what they are eating is a healthy diet. It has been demonstrated that vegetarian diets can meet the nutritional needs for people of all ages. "Appropriately planned vegetarian diets, including total vegetarian or vegan diets, are healthful, nutritionally adequate, and may provide health benefits in the prevention and treatment of certain diseases." [American Dietetic Association]

Now a days omega (ω) 3 is a matter of concern among the weight conscious people. However, due to radical changes in food processing, manufacturing and dietary shifts, vegetarians have been found to be more deficient in essential omega-3 fatty acids than their omnivorous neighbors. This may predispose vegetarians to a variety of health ailments.

* Polytechnic in Home Science, Junagadh Agricultural University (JAU), Keriya Road, Amreli, Gujarat-365601.
Email- mamta.kumari27@gmail.com

** Department of Food & Nutrition, College of Home Science, Maharana Pratap University of Agriculture & Technology (MPUAT), Udaipur, Rajasthan. 313001. Email- shashijain13@yahoo.co.in

So, it's necessary to know about its benefits for our better health.

WHAT IS OMEGA 3 ?

Omega 3 is poly-unsaturated fatty acids. These are the fatty acids that contain more than one double bond in their backbone. Nutritionally important ω 3 fatty acids include α-linolenic acid (ALA), eicosapentaenoic acid (EPA), and docosahexaenoic acid (DHA), all of which are polyunsaturated. The ultimate vegetarian diet should include a high quality source of omega-3 fatty acid, such as fresh flaxseed oil in order to avoid omega-3 fatty acid deficiency and to provide an optimal balance of omega-6 to omega-3 fatty acids in the diet.

MECHANISM AND STUDIES

The cells in our body are made up of fat. The type of fat that make up these cells is determined by the type of fat consumed. Saturated fat, which is solid at room temperature, will make the cell walls of our body hard and inflexible. While unsaturated fats will allow our cell walls to be fluid allowing nutrients to pass easily into the cell and wastes to be easily discharged. EFAs are

unsaturated fats that will allow our body cells to easily discharge wastes and absorb nutrient. In addition, it has been suggested by recent studies, that cells composed of omega-3 fatty acids, protect against breast cancer.

Although omega-3 fatty acids have been known as essential to normal growth and health since the 1930s, but the awareness of their health benefits has dramatically increased in the past few years. Studies show that a diet rich in omega 3 fatty acids may help lower triglycerides and increase HDL cholesterol (the good cholesterol). Omega 3 fatty acids may also act as an anticoagulant to prevent blood from clotting. Several other studies also suggest that these fatty acids may help to lower high blood pressure.[1]

Omega 3 fatty acids may protect against the accumulation in the body of a protein believed to be linked to Alzheimer's disease, according to the results of a new study. This study specifically investigated one particular kind of omega 3 fatty acids - Docosahexaenoic acid (DHA), and the results are encouraging.[2]

DEFICIENCY SYMPTOMS

The following symptoms indicate a need for high omega-3 foods : depression, Type 2-Diabetes, cardiovascular disease, dry, itchy skin, brittle hair and nails, inability to concentrate, fatigue, joint pains, etc.

HEALTH BENEFITS

Omega-3's are necessary for normal biological functions but it is also important for many other benefits[3]; some are as follows:

- They can help to increase your energy level.
- Might prevent certain types of cancer
- Improve your sleep
- Reduce inflammation
- Improve muscle recovery from trauma
- Help with arthritis.
- Provide lubrication to the skin, arteries, veins and intestinal tract.
- Help to prevent cardiovascular diseases.
- Help to improve concentration
- Benefit for diseases like: Alzheimer's, depression and many other cognitively impaired situations.
- Reduces high blood pressure and lowers cholesterol.
- Might improve the healing capability for various health problems.
- Can improve constipation.
- For proper brain function

RDI (RECOMMENDED DIETARY INTAKES) FOR OMEGA-3 FATTY ACIDS

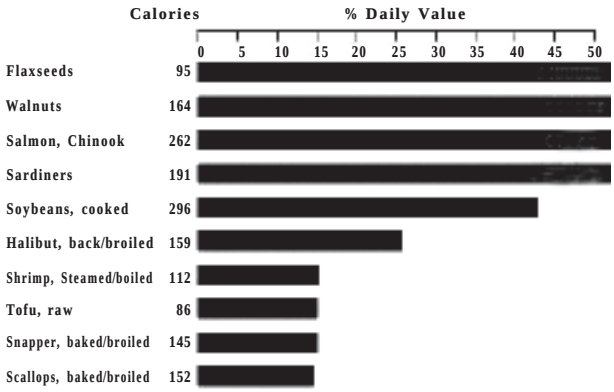
National Institute of Health (NIH) recommended that people consume at least 2% of their total daily calories as omega-3 fats. To meet this recommendation, a person consuming 2000 calories per day should consume at least 4 grams of omega-3 fatty acids. This can be easily met by adding just two foods to the diet, flaxseeds and wild-caught salmon. Two table spoon of flaxseed contain 3.5gm of omega-3fats. 4 Ounce of salmon contain-1.5 gm of omega-3 fats. (1 ounce = 28.35gm). According to the Food and Drug Administration (FDA), 2 servings of fish a week is recommended. Further a daily intake of 500mg omega-3 fats for infants,

750mg for 1-3 yrs children and 900mg for 4-8 yrs children are recommended. The suggested intake for boys and girls aged 9-13 yrs are 1200mg and 1000mg/day, respectively. The recommended intake of omega-3 for boys more than 13 yrs and adult males and girls more than 13 yrs and females are 1600mg and 1000mg/day, respectively.[4]

DIETARY SOURCES

Fish, plant, and nut oils are the primary dietary source of omega-3 fatty acids. Eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) are found in cold-water fish such as salmon, mackerel, halibut, sardines, tuna, and herring. ALA is found in flaxseeds, flaxseed oil, canola (rapeseed) oil, soybeans, soybean oil, pumpkin seeds, pumpkin seed oil, walnuts, and walnut oil. Other sources of omega-3 fatty acids include sea life such as krill and algae.[5]

World's Healthiest Food rich in Omega 3 Fatty Acids



OMEGA-3 : PLANT / ANIMAL

The omega-3 fatty acid derived from vegetable sources such as flax seed (rich in ALA) once ingested, are converted to the types of omega-3 fatty acids found in seafood. Thus, vegetarians need not to consume animal meats or fish oil supplements to obtain the health benefits of nutritionally required omega-3 fatty acids. The absolute best choice is unrefined, fresh, organic flax seed oil. Which contains more omega-3 fatty acid than any other source.[6]

Flax seeds come in two basic varieties: brown and yellow or golden. Most types have similar nutritional characteristics and equal amounts of short-chain omega-3 fatty acids. They are an excellent dietary supplement and contain several other essential nutrients such as vitamin B6, magnesium, and folate.

Omega 3 fish oil is more preferable because it contains greater levels of EPA and DHA, which are essential for the brain and body health.[6]

The Omega-3/Omega-6 Ratio

In the human body, LA and ALA compete for metabolism by the enzyme Ä6-desaturase. It has been suggested that this is important to health, as too high intake of LA would reduce the amount of Δ6-desaturase available for the metabolism of ALA, which may increase the risk of heart disease. Several sources of information suggest that human beings are evolved on a diet with a ratio of omega-6 to omega-3 essential fatty acids of approximately one. But due to technological advancements coupled with shifts in dietary patterns in the recent past have contributed to a shift in the ratio of these EFAs mainly due to either excessive amounts of omega-6 or due to deficiency of omega-3 fatty acids in the diets. Thus, Nutrition Scientists of leading health organizations have recommended an appropriate ratio of n-6 to n-3 fatty acids to 5:1 to 10:1. The following chart lists the omega-6 and omega-3 content of various vegetable oils and foods :

Oil	Omega-6 Content	Omega-3 Content
Safflower	75%	0%
Sunflower	65%	0%
Corn	54%	0%
Cotton seed	50%	0%
Seasame	42%	0%
Peanut	32%	0%
Soybean	51%	7%
Canola	20%	9%
Walnut	52%	10%
Flaxseed	14%	57%
Fish	0%	100%

CONCLUSION

Taking sufficient omega-3 is important to maintaining good health, as well as reducing the risk of stroke and heart attack. In addition, it has many other health benefits including weight loss. Omega-3 fats play an important part in the production of hormone-similar substances called prostaglandins; these substances help maintain normal body functions; some of these functions include blood pressure, nerve transmission, and allergic responses. Also, the functions of the kidneys and gastrointestinal tract, and the production of other hormones are also influenced by omega-3's too.

However, to receive the most benefit, consumers should make a conscious choice to remove extraneous sources of omega-6 fatty acids from the diet, such as refined foods, grocery-store oils and salad dressings high in omega-6 fatty acids. It would be prudent for vegetarians to use flaxseed oil, which has a very high percentage of omega-3 fatty acid as the basis for salad dressings and in baking, instead of sunflower, corn, safflower, and soy which have a poor ratio in comparison. Therefore, by regular exercising following the advice of personal physician, and taking dietary supplements quality of life can be improved.

REFERENCES

1. Cathy Wong, http://altmedicine.about.com/od/completeazindex/a/omega3.htm 2010.
2. MC. Morris, DA. Evans, JL. Bienias, CC. Tangney, DA. Bennett, RS. Wilson, N. Aggarwal, J. Schneider. *Arch Neurol.* **60,** 7 : 940-6 2003.
3. Joyce A. Nettleton. http://albatuna.com/Info/OmegaFacts.htm 2003.
4. Workshop on the essentiality and dietary reference intakes (DRIs) for omega-6 and omega-3 fatty acids. Sponsored by National Institute on Alcohol Abuse and Alcoholism-NIH.1999. Bethesda, Maryland, USA.
5. http://www.umm.edu/altmed/articles/omega-3-000316.htm
6. Gloria Tsang, http://www.healthcastle.com 2005.

ROLE OF VETERINARIAN IN LABORATORY ANIMAL RESEARCH AND MEDICINE

Manjurul Haque

Utilization of laboratory animal in medical research has great potential. When a new compound or certain new technique is developed, it is recommended to test its efficacy (weather beneficial or harmful) on laboratory animals before introducing in human being. The physiology and anatomy of these animals varies significantly and only a veterinarian can understand them properly. Besides, veterinarians also have responsibility to minimise the suffering of animals and conduction of experiment as per ethical guidelines.

INTRODUCTION

The science of laboratory animal medi-cine has extended a great scope for the growth of medicine, which is in consequent to flagrant outcomes of numerous infectious diseases, emerging needs for expertisation in food safety and continual development of new therapies. Undoubtedly, laboratory animal veterinarians have extended an unflinching support to play an important role in biomedical research involving animals with requisite welfare policies. The diverse nature of responsibilities of laboratory animal veterinarians includes prevention and treatment of diseases, relieve from pain and distress, research and support, development and formulation of appropriate animal husbandry programs, synthesis of policies on animal use protocols, designing and framing of experiments and finally operation of good laboratory animal facilities. Besides this, there are certain auxiliary which relies greatly on a shoulder of laboratory animal veterinarian, involves consultation and advice on compliance with laws and regulations specific to experimentation, training scientific and animal-care to paramedical staff, direction of usage and selection of suitable animal models for research.

WHY A VETERINARIAN IS REQUIRED?

Amazingly, it is has been often realized by numerous scientists and common people that why veterinarians become actively involved with animal experimentation, used for scientific purposes. To answer this unique query, here are the two important reasons. At the outset, usually in animal research, a sense of scientific inquisitivetiness always prevails around us, who consequently stimulates us to know the difference in physiological dynamism exists between the two domains i.e. human and animal (mammalian) medicine. To understand this concept, scientist and other common people have been encourage in taking help of veterinary professional. The veterinarian uses all of the primary disciplines of veterinary

* College of Veterinary Science, Mhow, NDVSU, Jabalpur, Madhya Pradesh.
Email: manjurul_h@ rediffmail.com

science and adds unique skills to supplement the event of experimental work with great authority.

In addition, the veterinarians were also taught about the usage of wide variety of unusual species, their handling and management, and possible outcome of the experiment, which resultantly felt others to realize the value and need of profession in laboratory animal medicine. Secondly, the desire to become a veterinarian usually stems from empathy for animals and it is that empathy that is critical for veterinarians that fulfils a role in the monitoring and care of animals used for scientific purposes, besides the veterinarian significantly and efficiently plays a key role in ensuring the respect adopted for the ethics and laws enacted by the legislative bodies. To illustrate this point, the given situation quintessentially elaborates the claim made by veterinary professional in previous realization. The adverse effects of stress on the immune system, for example, are well documented and it is the interface between the researchers and the veterinarians that promotes the reality that good animal welfare leads to good science.

The use of animals in laboratory experiments has always remained a controversial issue. Many people are opposed to vivisection, or medical experiments using living animals. To this consternation, primary concomitant controversy also exists in the usage of animal for research; however, there are many people who feel that animal experiments are necessary for the prolonging of human life. According to Pardes and his co-worker animal research has been responsible for increasing life expectancy in the United States from 52 years in the early 1900's to 72 years today[1]. On this basis, many doctors and scientists are in favour of maintaining animal experimentation.

A new study claims the number of animals used worldwide in laboratory experiments is close to 115 million. The annual figure is based on official statistics from 37 countries, but includes estimates for nations where data is unavailable and has therefore been contested by pro-experiment groups[2].

SIGNIFICANCE OF ANIMALS IN BIOMEDICAL RESEARCH

The mission of medicine is maintenance of health, elimination of suffering and prolongation of life[3]. These aims can be achieved by medicine based on experimental determination, because only then it becomes a real science. The nature of human mind has led the beginning of humanity on the earth to the cognition of his environment and himself. Being intellectually superior to other living creatures, man has got power over them. In his endless efforts to expand knowledge about living organisms, including his own, he started to use animals.

Man has used animals for cognitive purposes for all ages and is still doing it; however motivation has changed and is still changing. Cognition of functions of living organisms on the basis of observation, without any interference into the living body gave a lot of important information, yet, generally, this method was of little use for the development of science. Only the use of animals could give information about this what was earlier unknown and impossible. The long-lasting evolution of experimental studies of living functions of higher organisms resulted in achieving a perfect level in biomedical studies.

Undoubtedly, the greatest achievements in medicine in the 19th and 20th centuries were possible due to the use of animals. There is a strong relationship between rapid developments in experiments on animals and is evident from the progress of clinical medicine. Surprisingly, in the middle of 20th century, the man left the globe for the first time and reached another planet. This unusual event in the history was only possible due to space medicine developed from the basis of numerous biomedical experiments performed with ultimate usage of laboratory animals[3]. Despite such advances that have already been made, we are still reeling through the early stages of understanding of the complex working of human physiology. This makes the replacement of animal experiments a slow process. At the same time, our increasing knowledge is opening up whole new areas of medical research which in turn give rise to a need for further animal use. While it may be difficult to envisage total replacement, the proposition of work that can be done without animals is increasing all the time.

SCOPE FOR VETERINARIAN

The involvement of laboratory animals in medicine research has yielded numerous unique insights pertaining to pathogenetic mechanism and subsequent ability to link and develop new drug molecules. The recent advances in human genome research have further increased the usage of laboratory animals to get connections between diseases and molecular factors with introduction of molecular bio-imaging concept. This growing contribution in medical science has been highly appreciated and due regards has been paid to professional veterinarian whose active participation and thorough knowledge on actual physiological and anatomical peculiarities affiliated with different laboratory animals model has further propounded several valuable information. The animal model studies has continually enhanced our understanding on genetic, molecular cellular component of human diseases and promoted to direct animal to human translational application.

Many efforts are on to find suitable alternatives to animal experiments, to increase the usefulness of those that already exist, and to refine animal research models and methods. But, at present days biomedicine, with its experimentation on animals, reveals the laws of nature with which the clinician and his patient can use to improve the life quality and prolong the life span and eliminate sufferings. We all want to lead a healthy and enjoyable life. Most of us want the benefits of modern medical research-benefits that we would not have thought without the contribution of animal research.

REFERENCES

1. H. Pardes, A. West and H. A. Pincus, *N. Engl. J. Med*., **324,** 1640-1643, 1991.
2. J. Randerson, Scientific correspondence in *The Guardian* on 13th August, 2008.
3. W.W. Pawlik, *Folia Med Cracov*, **39,** 175-182, 1998.

CONTROVERSIES AND ETHICS OF ANIMAL USAGE : EMERGING ISSUES AND NEW CHALLENGES

P. V. S. Kishore

Animal usage plays a central role in biological science. Millions of animals are killed causing enormous degradation of biodiversity and massive ecological imbalance. Compassion and respect for life is achieved through focussed critical thinking. Use of the Information Communication Technology, development of Skill laboratories and Digital learning devices should be done to train students. Humane education where teaching objectives are met using non-animal alternatives is a valued need.

INTRODUCTION

Animal usage is a highly controversial issue unique to modern science though it has lead to many scientific breakthroughs. Scientists strongly favour animal usage in spite of repeated protests from animal rights activists. The academicians and researchers claim that scientific breakthroughs like the discovery of antibiotics, drugs and vaccines, the standardisation of toxicological and medical procedures and successful xenotransplantation of organs have saved many human lives. The animal rights activists on the other hand say that the scientists should use their decision making ability to avoid/minimise animal experimentation. The bleak result of deciding the morality of experimenting on animals on the basis of rights is probably why people always justify animal experiments on consequentialist grounds; by showing that the benefits to humanity justify the suffering of the animals involved. This can be demonstrated by comparing the moral consequences of doing or not doing an experiment. However, it can't be used to defend all forms of experimentation since there are some forms of suffering that are probably impossible to justify even if the benefits are exceptionally valuable to humanity.

Animal rights extremists pronounce that humans can decide whether to give consent or not which the animals cannot and hence tests are conducted on them. They often portray those who experiment on animals as being so cruel as to have forfeited any own moral standing. The use of animals in research should evolve out of a strong sense of ethical self-examination; a self analysis of one's own personal and scientific motives. The lack of it is common and generally involves the denial or avoidance of animal suffering, resulting in the dehumanization of researchers and the ethical degradation of their research subjects.

* Department of Veterinary Anatomy, Sri Venkateswara Veterinary University College of Veterinary Science, Korutla - 505 326 Karimnagar Dt. Telangana State.
E mail: pvskishore_1963 @yahoo.com

Moreover, it requires recognition of animal suffering and a satisfactory working through of that suffering in terms of one's ethical values. The possible benefits to humanity of performing the experiment are completely irrelevant to the morality of the case, because rights should never be violated.

Another major ethical controversy with animal usage is that it mostly involves pain, suffering and discomfort. Animals do in fact suffer, and do in fact feel pain. Rats have nervous systems similar to humans and feel the pain of shocks in a similar way. Pain is an intrinsic evil whether it is experienced by a child, an adult, or an animal. If it is wrong to inflict pain on a human being, it is just as wrong to inflict pain on an animal. "Speciesism" is as arbitrarily unjust as racism or sexism. Experimenters wherever possible will use anaesthetics but for some types of testing, using a pain reliever can mean an interaction with the drug being tested. The animals therefore experience the effects of that drug and if it involves pain it presents an unpleasant situation. In addition, irrational abuse, unnecessary replications and use of indiscriminate numbers are other areas of concern.

EMERGING ISSUES

Many issues keep emerging and the various bodies' concerned need to redress these periodically. The laws and regulatory practices of the various acts and committee's viz., Prevention of Cruelty to Animals (PCA) act, 1960; Wildlife protection act, 1972; Committee for the Purpose of Control and Supervision of Experiments on Animals (CPCSEA) guidelines 2010, UGC guidelines 2011 for discontinuation of dissection and experiments on live animals in a phased manner and Ministry for Environment and Forests (MoEF) guidelines 2012 should be strictly enforced. Ethical reviews and audit should be done periodically. Non scientific socially aware member's opinion in the Institutional Animal Ethics Committee (IAEC) should be strictly considered. The non-governmental organisations viz., Society for Prevention of Cruelty to Animals (SPCA), People for Ethical Treatment of Animals (PETA), People For Animals (PFA) etc. assist the government, R & D institutes and the general public in this regard.

UGC has issued the latest notification in 2014 on dissection and animal experimentation in undergraduate, postgraduate and research programmes with the objective to prevent the disruption of bio-diversity and maintain the ecological balance with the acquisition of appropriate alternative technology in place of animal experimentation and to develop competent skilled human resources. It projected that the enormous degradation of biodiversity and the massive ecological imbalances lead to natural calamities. It urged the universities to stop dissection of animals at undergraduate and postgraduate levels with immediate effect and use the alternative mechanisms available to provide hands-on-experience to the students. It urged that time has come to make profitable use of the Information Communication Technology (ICT) available around us.

It professed that higher educational institutions should make it their moral responsibility to do away with the use of animals for various academic purposes. No animal from any species should be dissected, either by teachers or students. The teachers shall demonstrate one or more aspects of anatomy to students with the help of digital alternatives, models and charts etc. The

laboratory exercises should make use of museum specimens, microscopic preparations, photographs, video clippings, models, charts, plastinated specimens etc. Many digital learning devices have modules for testing which can be used to evaluate the students at the examination. Skill laboratories should be developed by the institutions to train students on interactive plastic models.

However, it is mentioned that it shall be the responsibility of the institution to ensure that the animals permitted for dissection / experimentation in the instruction are procured from ethical sources and if live they should be transported without stress or strain and if dissected upon it should be done under appropriate anaesthesia. Ensuring a close observance of high ethical standards, it prohibited the use of animals for dissection and experimentation at both undergraduate and postgraduate levels except for research. Animals used in research should be procured from registered CPCSEA breeders after approval from their Institutional Animal Ethics Committee. They should never be removed from their natural habitat.

NEW CHALLENGES

A lot of challenges lie ahead in front of the scientists. Alternate modes for dissection and experimentation have to be explored. Digital and plastinated specimens, models and mannequins computer simulations, tissue cultures, *invitro* and *insilico* methods have to be developed. Development of alternatives to use of animals in education and research has to be done. Best experimental designs to reduce the number of animals, proper anaesthesia to reduce pain, and euthanasia if mandated have to be ensured in justifiable cases. Animal usage for cosmetics testing has to be banned as done in some countries which display the leaping bunny logo on the cosmetic products which have been produced without testing on animals. If animal testing is to continue, animal suffering should be minimised / avoided. The pros and cons of each experiment have to be discussed with a holistic approach. A scientific basis should prevail upon those who resort to experimentation preventing irrational abuse which may lead to allegations.

Use of Willed-Body programmes and other humane alternatives in Veterinary Education have to be implemented. Interactive lectures, simulation demonstrations, mannequins and supervised clinical practice on effective and economical non-animal training methods that are available to replace the use of live and healthy animals in the curricula are to be widely used. Numerous studies have shown that learning outcomes generated through non-animal teaching methods are as effective as those achieved through animal use. Many colleges in the advanced countries have done away with the use of live animals for education and yet their graduates are no way inferior to others who have used animals. Our animal usage policy should be improvised in tune with the changing policies in the world.

LEAPING BUNNY LOGO

CONCLUSION

Animal usage was and is and will be an ongoing process as it will help in furthering

medical science. It is a necessary evil; indispensible and inevitable. A focussed critical thinking in tune with the changing attitudes of the people is very much needed. All ethical dilemmas have to be cleared. It should be viewed in a broader perspective in the larger interest of a nation's progress. Transparency should exist which would help reduce any controversies.

REFERENCES

1. M. Balls, The Three Rs and the Humanity Criterion, 2009. FRAME, Nottingham, UK.
2. N. Jukes and M. Chiuia, From Guinea Pig to Computer Mouse, interNICHE, 2003. Leicester, England.
3. H. Pederson, Humane Education, 2002. Stiftelsen Forskning utan djurforsok, Stockholm, Sweden.
4. W.M.S. Russell and R. L. Burch, The Principles of Humane Experimental Technique, 1959. London, UK.

102ND INDIAN SCIENCE CONGRESS, MUMBAI

LIST OF ISCA AWARDEES FOR 2014-2015

1. *ASUTOSH MOOKERJEE MEMORIAL AWARD*

   No Award

2. *C. V. RAMAN BIRTH CENTENARY AWARD*

   No Award

3. *SRINIVASA RAMANUJAN BIRTH CENTENARY AWARD*

   No Award

4. *JAWAHARLAL NEHRU BIRTH CENTENARY AWARD*

   No Award

5. *S.N.BOSE BIRTH CENTENARY AWARD*

   No Award

6. *S.K.MITRA BIRTH CENTENARY AWARD*

   No Award

7. *BIRBAL SAHNI BIRTH CENTENARY AWARD*

   No Award

8. *S. S.BHATNAGAR MEMORIAL AWARD*

   No Award

9. *VIKRAM SARABHAI MEMORIAL AWARD*

   Dr. M. Y. S. Prasad
   Director, Satish Dhawan space centre, Sriharikota

10. *D. S. KOTHARI MEMORIAL AWARD*

    No Award

11. *M. K. SINGAL MEMORIAL AWARD*

    No Award

12. *JAWAHARLAL NEHRU PRIZE*

    No Award

13. *MILLENNIUM PLAQUES OF HONOUR*

    No Award

14. *EXCELLENCE IN SCIENCE AND TECHNOLOGY AWARD*

    No Award

15. *R.C.MEHROTRA MEMORIAL LIFE TIME ACHIEVEMENT AWARD*

    No Award

16. *B. C. GUHA MEMORIAL LECTURE*

    No Award

17. *G.P.CHATTERJEE MEMORIAL AWARD*

    No Award

18. *PROF.R.C. MEHROTRA COMMEMORATION LECTURE*

Dr. Manoj Kumar Misra
Birla Institute of Technology, Mesra, Ranchi

19. *PROF. SUSHIL KR. MUKHERJEE COMMEMORATION LECTURE*

No Award

20. *PROF. S.S.KATIYAR ENDOWMENT LECTURE*

No Award

21. *PROF.ARCHANA SHARMA MEMORIAL AWARD*

No Award

22. *DR.V.PURI MEMORIAL AWARD*

No Award

23. *PROF. G.K. MANNA MEMORIAL AWARD*

Dr. N. B. Ramachandran
University of Mysore, Mysore

24. *PROF. HIRALAL CHAKRAVARTY AWARD*

No Award

25. *PRAN VOHRA AWARD*

Dr. Swarup Kumar Parida
National Institute of Plant Genome Research (NIPGR), New Delhi.

26. *PROF. UMAKANT SINHA MEMORIAL AWARD*

Dr. Amit Kumar Mishra
Indian Institute of Technology, Jodhpur, Rajasthan

27. *DR. B. C. DEB MEMORIAL AWARD FOR SOIL/PHYSICAL CHEMISTRY*

No Award

28. *DR. B. C. DEB MEMORIAL AWARD FOR POPULARIZATION OF SCIENCE*

Dr. Ritesh Saha
Central Research Institute for Jute and Allied Fibres, Barrackpore, Kolkata

29. *PROF.R.C.SHAH MEMORIAL LECTURE*

No Award

30. *DR. (MRS.) GOURI GANGULY MEMORIAL AWARD*

Dr. Gnanavel Venkatesan
Indian Veterinary Research Institute Nainital, Uttarakhand

31. *PROF. (MRS) ANIMA SEN MEMORIAL LECTURE*

No Award

102ND INDIAN SCIENCE CONGRESS, MUMBAI

YOUNG SCIENTIST AWARDEES FOR 2014-2015

S.No.	Name of Section	Name of the Awardees
1.	***Agriculture and Forestry Sciences***	**Dibyendu Chatterjee** ICAR Research Centre, Nagaland.
2.	***Animal, Veterinary and Fishery Sciences***	**Bodhisattwa Banerjee** NEHU, Shillong.
3.	***Anthropological and Behavioural Sciences (including Archaeology, Psychology, Education and Military Sciences)***	**Monika Saini** University of Delhi, Delhi.
4.	***Chemical Sciences***	**Prabhat K. Singh** BARC, Mumbai.
5.	***Earth System Sciences***	**Ishya Devi** University of Jammu, Jammu.
6.	***Engineering Sciences***	**Debarghya Chakraborty** IIT, Kharagpur.
7.	***Environmental Sciences***	**Debanjana Sengupta** St.Xavier's College, Kolkata.
8.	***Information and Communication Science and Technology (including Computer Sciences)***	**Boopathy. D** Bharathiar University, Coimbatore.
9.	***Materials Science***	**Aditya Chauhan** IIT, Mandi, Himachal Pradesh.
10.	***Mathematical Sciences (including Statistics)***	**Namita** University of Delhi, Delhi.
11.	***Medical Sciences (including Physiology)***	**Medha Kapoor** DRDO, New Delhi.
12.	***New Biology (including Biochemistry, Biophysics & Molecular Biology and Biotechnology)***	**C.Sathish Kumar** Madras Diabetes Research Foundation, Chennai.
13.	***Physical Sciences***	**Swarniv Chandra** Jadavpur University, Kolkata.
14.	***Plant Sciences***	**Rajkumari Jashmi Devi** NEHU, Shillong.

102ND INDIAN SCIENCE CONGRESS, MUMBAI

BEST POSTER PRESENTATION AWARDEES FOR 2014-2015

S.No.	Section	Name of the Awardees
1.	*Agriculture and Forestry Sciences*	1. **G. C. Satisha** Indian Institute of Horticultural Research, Hessaraghatta, Bangalore. 2. **Jyoti Kaul** Directorate of Maize Research (DMR), New Delhi.
2.	*Animal, Veterinary and Fishery Sciences*	1. **B. Bibin Becha** College of Veterinary and Animal Sciences, Mannuthy, Thrissur, Kerala. 2. **Anubha Shukla** ETBL, Department of Zoology, University of Lucknow, Lucknow.
3.	*Anthropological and Behavioural Sciences (including Archaeology, Psychology, Education and Military Sciences*	1. **Shumayla** Department of Anthropology, University of Delhi, Delhi 2. **Indelah Khan** Department of Anthropology, University of Delhi, Delhi
4.	*Chemical Sciences*	1. **Saikat Kumar Seth** Mugberia Gangadhar Mahavidyalaya Bhupatinagar, Purba Medinipur, West Bengal. 2. **Priyanka Thakral** Dept. of Chemistry, University of Delhi, Delhi.
5.	*Earth System Sciences*	1. **S. S.Hangaragi** SRN Arts and MBS Commerce College, Bagalkot, Karnataka. 2. **Surjeet Singh** Dept. of Geology, University of Jammu, Jammu.
6.	*Engineering Sciences*	**No Award**
7.	*Environmental Sciences*	1. **Shraddha Dwivedi** ETBL, Dept. of Zoology, University of Lucknow, Lucknow. 2. **Tanmoy Basak** Dept. of Botany, Visva-Bharati, Santiniketan.

S.No.	Section	Name of the Awardees
8.	***Information and Communication Science & Technology (including Computer Sciences)***	1. **S. Kanchana** Research Dept. of Computer Science, NGM College, Pollachi, Coimbatore. 2. **Mamta Sharma** Central Scientific Instruments Org., Chandigarh.
9.	***Materials Sciences***	1. **Mrinmoy Garai** CSIR, CGCRI, Kolkata. 2. **Satyendra Singh** Dept. of Physics, Allahabad University, Allahabad/
10.	***Mathematical Sciences (including Statistics)***	1. **Garima Manocha** Dept. of Mathematics, Netaji Subhas Institute of Technology, New Delhi. 2. **D. K. K. Vamsi** Dept. of Mathematics & Computer Science, Sri Sathya Sai Institute of Higher Learning, Prasanthinilayam.
11.	***Medical Sciences (including Physiology)***	1. **Meenakshi Batra** P.D.U.I.P.H., New Delhi. 2. **Rupsa Ghosh** Dept. of Physiology, University of Calcutta, Kolkata.
12.	***New Biology (including Biochemistry, Biophysics & Molecular Biology and Botechnology)***	1. **Sudha S** Dept. of Biotechnology, Karpagam University, Coimbatore. 2. **Syed Mohammed Shoaib** Dept. of CS & IT, Maulana Azad National Urdu University, Hyderabad.
13.	***Physical Sciences***	1. **Suresh S** Dept. of Optoelectronics, University of Kerala , Thiruvananthapuram. 2. **Sudir Kumar** Dept. of Physics, University of Lucknow, Lucknow.
14.	***Plant Sciences***	1. **Amit Kumar Mishra** Dept. of Botany, Banaras Hindu University, Varanasi. 2. **Nandini Yadav** Dept. of Biochemistry, University of Lucknow, Lucknow.

102ND INDIAN SCIENCE CONGRESS, MUMBAI

INFOSYS FOUNDATION—ISCA TRAVEL AWARD 2014-2015

LIST OF AWARDEES

Name of Student	[Class/Std]	Name of School
Arushima Pankaj	**IX**	Presentation Convent Sr. Sec. School, Jammu
Aditya Atmakuri	**X**	Springdales School, New Delhi
Anubhav Kumar	**XI**	Seth Anand Ram Jaipuria School, Kanpur
Saakshi Singh	**XI**	Seth Anand Ram Jaipuria School, Kanpur
Aditi Das	**XI**	Springdales School, New Delhi
Yashraj Dhanuka	**XII**	Seth Anand Ram Jaipuria School, Kanpur
Shaikh Mohammed Fatwir	**IX**	Navy Children School, Kochi
Vaibhav Gosain	**X**	Springdales School, New Delhi
Anjali Bharadwaj	**X**	Springdales School, New Delhi

KNOW THY INSTITUTIONS

ENTEROVIRUS RESEARCH CENTRE, MUMBAI

Situated at Mumbai in Maharashtra the Enterovirus Reasearch Centre (ERC) conducts research on disease Enteroviruses, especially paralytic poliomylitis, acute flaccid paralysis, acute hemorrhagic conjunctivitis, encephalitis and acute gastroenteritis caused by enteric viruses such as Rotavirus, Norovirus and enterovirus.

Thrust Areas :

The following are the thrust areas of ERC

- Epidemiology of poliomyelitis leading to understanding of the virus transmission patterns for development of policies and strategies for disease control and eradication.
- Studies on poliomyelitis vaccines such as immunization schedules, vaccination campaigns, evaluation and improvements of vaccine delivery systems.
- Assistance to the Global Polio Eradication Program through laboratory support for disease diagnosis, understanding disease transmission by molecular epidemiology studies, evaluation of program progress, designing testing and validating newer assays, participating in introduction of newer vaccine formulations and contributions to national policy on polio eradicaion.

International Recognition :

- ERC is a part of the WHO network of 146 polio laboratories worldwide.
- ERC based on its contribution to the Polio Eradication Programme, is also a WHO recognise Laboratory for Polio (GSL) – the only laboratory, among the seven laboratories so recognize developed world.
- ERC is accredited by the WHO for poliovirus investigations.

Human Resource Development :

ERC conducts hands-on training workshops for WHO Polio Network Laboratories of Southeast Asia annually with a focus on laboratory bio-safety, cell culture, virus culture and newer molecular diagnostic assays. The Centre offers these subjects.

Recognition for Doctorate/Masters by a University :

ERC is recognized by the University of Mumbai for M.Sc., and Ph.D degrees in Microbiology.

Major Achievements :

Significant achievements of ERC are the following

- Introduction of Oral Polio Vaccine (OPV) in India.
- Generation of epidemiological data on Polio for Mumbai for over 50 years.
- Nucleotide sequencing of poliovirus RNA (Molecular epidemiology of wild poliovirus) has provided accurate information of virus transmission pathways and guided polio immunization activities in the 2001.
- Established enviromental sewage samples testing as a surveillance activity supplementing detect wild poliovirus circulation in slums in Mumbai.
- Provided unequivocal data confirming wild poliovirus exportation from India to China (1999) Bangladesh (2006), Nepal (2005 onwards) and Angola (2005 onwards). Also proved that the importation in Indonesia was from Nigeria via Saudi Arabia and not from India.
- Designing, development and evaluation of new testing algorithm for reducing time for reporting wild poliovirus detection in AFP cases resulted in reducing reporting time from 28 days to 14 days. The test algorithm has now been globally implemented.
- Evaluation of immunogenicity of monovalent, bi-valent and trivalent OPV for introduction of new polio vaccines for polio eradication. The trials, having a global significance, were conducted by the WHO in India with ERC as its laboratory partner.
- Serosurvey of poliovirus antibodies in Moradabad district UP that highlighted the risks of wild polio virus 3 and VDPV poliovirus 2 in UP and Bihar.
- Detection and analysis of vaccine derived polioviruses responsible an outbreak of polio 1 VDPV in Indonesia in 2005.
- Detection of VDPVs (poliovirus 1 and poliovirus 2, one case each) in India in 2009.
- Reported Coxsackievirus A24v as the etiological agent of an epidemic of AHC in Mumbai in 2007.
- Reported New Enterovirus 71 genotype (genotype D) from India.
- Identification of Coxsackievirus A6 and A16 as causative agents of hand, foot and mouth disease out breaks in Maharashtra, Tamil Nadu and Tripura in 2009-10.
- Development of an assay to identify mutations and attenuation sites in Sabin Oral poliovirus.

Contact :

Director
Enterovirus Research Centre
Haffkine Institute Campus
Acharya Donde Marg, Parel
Mumbai 400 012 Maharashtra, INDIA
Phone : 022-24134130,
Fax : 022-24156484
Email : erc@bom3.vsnl.net.in

Conferences / Meetings / Symposia / Seminars

6th International Conference on Stem Cells and Cancer (ICSCC-2015): Proliferation, Differentiation and Apoptosis, Pune, India from 2-5 October 2015.

Topics :

- Embryonic Stem Cells
- Induced Pluripotent Stem Cells
- Mesenchymal and Cardiac Stem Cells
- Hematopoietic and chord blood stem cells
- Neural stem cells
- Other stem cells
- Cancer stem cells
- Proliferation, differentiation and apoptosis of stem cells
- Proliferation, differentiation and apoptosis of cancer cells
- Clinical research and trials in stem cells and cancer
- Hematopoietic malignancies
- Myeloid leukemias
- Lymphoid leukemias
- Breast cancer
- Oral, head and neck cancer
- Cervical cancer
- Lung cancer
- Other cancers
- Cancer genomics and proteomics
- Cancer diagnostics and biomarkers
- Cancer therapeutics
- Immune systems in stem cells and cancer
- Nanotechnology applications in stem cells and cancer
- Ethical issues in stem cells and cancer research
- Molecular Biology of stem cells
- Molecular biology of cancer cells
- Molecular medicines for cancers
- Mathematical modeling and bioinformatics in stem cells and cancer
- Other topics related to stem cells and cancer

Contact : Prof. Dr. Sheo Mohan Singh, Director, ICSCCB, R.H. 2, Ujwal Regalia, Baner Road, Opposite Cosmos Regency, Pune – 411045, India Tel Office: +91-20-32398222 (10am-6pm, weekdays) Tel Mobile: +91-9545089202 Email : icscc2015@gmail.com Website : http://www.icscc.in

Third International Conference On Counselling, Psychotherapy And Wellness And The 4th Congress Of SithCp3 - ICCP2016, 5th to 7th January 2016, Bengaluru, Karnataka, India

Themes

- Culture, ethnicity and practice
- Diversity issues (gender, religion, class, caste, sexual orientation, special groups)
- Religion, spirituality, and transpersonal approaches
- Theories and techniques in counselling and psychotherapy
- Integrative and ecclectic practice in counselling and psychotherapy
- Research in counselling and psychotherapy
- Supervision in counselling and psychotherapy
- Integrating traditional and indigenous healing practices into counselling and psychotherapy
- Recent advances in counselling and psychotherapy

Contact : ICCP2016 Secretariat : Conference Secretariat, Department of Psychology, 7th Floor, Central Block, Christ University, Bangalore 560029, Email : tony.sam.george@christuniversity.in

S & T ACROSS THE WORLD

CLIMATE-CHANGE CLUES FROM TURTLES OF TROPICAL WYOMING

Tropical turtle fossils discovered in Wyoming by University of Florida scientists reveal that when Earth got warmer, prehistoric turtles headed north. But if today's turtles try the same technique to cope with warming habitats, they might run into trouble.

While the fossil turtle and its kin could move northward with higher temperatures, human pressures and habitat loss could prevent a modern-day migration, leading to the extinction of some modern species.

The newly discovered genus and species, Gomphochelys (pronounced gom-fo-keel-eez) nanus—provides a clue to how animals might respond to future climate change, said Jason Bourque, a paleontologist at the Florida Museum of Natural History at UF and the lead author of the study, which appears online in the *Journal of Vertebrate Paleontology*, 35 (1): e885441, 2015

The wayfaring turtle was among the species that researchers believe migrated 500-600 miles north 56 million years ago, during a temperature peak known as the Paleocene-Eocene Thermal Maximum. Lasting about 200,000 years, the temperature peak resulted in significant movement and diversification of plants and animals.

"We knew that some plants and lizards migrated north when the climate warmed, but this is the first evidence that turtles did the same," Bourque said. "If global warming continues on its current track, some turtles could once again migrate northward, while others would need to adapt to warmer temperatures or go extinct."

The new turtle is an ancestor of the endangered Central American river turtle and other warm-adapted turtles in Belize, Guatemala and southern Mexico. These modern turtles, however, could face significant roadblocks on a journey north, since much of the natural habitat of these species is in jeopardy, said co-author Jonathan Bloch, a Florida Museum curator of vertebrate paleontology.

"If you look at the waterways that turtles would have to use to get from one place to another, it might not be as easy as it once was," Bloch said. "Even if the natural response of turtles is to disperse northward, they have fewer places to go and fewer routes available."

To put the new turtle in evolutionary context, the researchers examined hundreds of specimens from museum collections around the country, including turtles collected during the 1800s housed at the Smithsonian Institution. Co-author Patricia Holroyd, a vertebrate paleontologist at the University of California, Berkeley, said the fossil history of the modern relatives of the new species shows they could be much more wide-ranging, if it were not for their restricted habitats.

The Central American river turtle is one of the most endangered turtles in the world, threatened by habitat loss and its exploitation as a human food source, Holroyd said. "This is an example of a turtle that could expand its range and probably would with additional warming, but — and that's a big but — that's only going to happen if there are still habitats for it," she said.

LONG-TERM NITROGEN FERTILIZER USE DISRUPTS PLANT-MICROBE MUTUALISMS

When exposed to nitrogen fertilizer over a period of years, nitrogen-fixing bacteria

rhizobia evolve to become less beneficial to legumes — the plants they normally serve, researchers report in a new study.

These findings, reported in the journal *Evolution, 2015* , may be of little interest to farmers, who generally grow only one type of plant and can always add more fertilizer to boost plant growth. But in natural areas adjacent to farmland, where fertilizer runoff occurs, or in areas where nitrogen oxides from the burning of fossil fuels settle, a change in the quality of soil rhizobia could have "far-reaching ecological and environmental consequences," the researchers wrote.

"The nitrogen that we apply to agricultural fields doesn't stay on those fields, and atmospheric nitrogen deposition doesn't stay by the power plant that generates it," said University of Illinois plant biology professor Katy Heath , who led the study with Jennifer Lau , of Michigan State University. "So this work is not just about a fertilized soybean field. Worldwide, the nitrogen cycle is off. We've changed it fundamentally."

Not that long ago, before the advent of industrial fertilizers and the widespread use of fossil fuels, soil nitrogen was a scarce commodity. Some plants, the legumes, found a way to procure the precious nitrogen they needed — from rhizobia.

"The rhizobia fix nitrogen — from atmospheric nitrogen that we're breathing in and out all the time — to plant-available forms," Heath said. "Plants can't just take it up from the atmosphere; they have to get it in the form of nitrate or ammonium."

In return, legumes shelter the rhizobia in their roots and supply them with carbon. This partnership benefits the bacteria and gives legumes an advantage in nitrogen-poor soils. Previous studies have shown that nitrogen fertilizers can affect the diversity of species that grow in natural areas, Heath said. In areas polluted with fertilizer runoff, for example, legumes decline while other plants become more common.

In the new analysis, Heath and her colleagues looked at six long-term ecological research fields at Michigan State University's Kellogg Biological Station. Two experimental plots were located in each of six different fields. One plot in each field had been fertilized with nitrogen for more than two decades; the other, a control plot, had never been fertilized.

The researchers isolated rhizobia from the nodules of legumes in fertilized and unfertilized plots. In a greenhouse experiment, they tested how these bacteria influenced legume growth and health. The researchers found that the plants grown with the nitrogen-exposed rhizobia produced 17 to 30 percent less biomass and significantly less chlorophyll than plants grown with rhizobia from the unfertilized plots.

A genetic analysis of the microbes revealed that the composition of the bacterial populations was similar between fertilized and unfertilized plots: The same families of rhizobia were present in each. But rhizobia from the fertilized plots had evolved in a way that made them less useful to the legumes, Heath said.

"This study tells us something about mutualisms and how they evolved," she said. "Mutualisms depend on this balance of trade between the partners, this special nitrogen-carbon economy in the soil, for example. And when the economy changes — say when nitrogen is no longer scarce — these mutualisms might go away."

NEW X-RAY MICROSCOPE FOR NANOSCALE IMAGING

Delivering the capability to image nanostructures and chemical reactions down to nanometer resolution requires a new class of x-ray microscope that can perform precision microscopy experiments using ultra-bright x-rays from the National Synchrotron Light Source II (NSLS-II) at Brookhaven National Laboratory. This groundbreaking instrument, designed to deliver a suite of unprecedented x-ray imaging capabilities for the Hard X-ray Nanoprobe (HXN) beamline, brings researchers one step closer to the ultimate goal of nanometer resolution at NSLS-II, a U.S. Department of Energy Office of Science User Facility.

The microscope manipulates novel nanofocusing optics called multilayer Laue lenses (MLL) — incredibly precise lenses grown one atomic layer at a time — which produce a tiny x-ray beam that is currently about 10 nanometers in size. Focusing an x-ray beam to that level means being able to see the structures on that length scale, whether they are proteins in a biological sample, or the inner workings of a fuel cell catalyst.

The team of scientists who built this microscope aren't stopping there; they are working toward making the focused x-ray beam spot even smaller in the future. The microscope they developed produces x-ray images by scanning a sample while collecting various x-ray signals emerging from the sample. Analysis of these signals helps researchers understand crucial information about the materials they are examining: density, elemental composition, chemical state, and the crystalline structure of the sample.

Getting a clear image at this scale requires extremely high stability of the microscope to minimize vibrations and to reduce possible thermal drifts, changes in the microscope due to heat. It requires over twenty piezo motors — very fine motors that produce motion when electric currents are fed into piezo crystals — controlled down to nanometer-scale precision, crammed into a tight space about the size of a coffee maker, to meet its functionalities.

"This instrument incorporates most recent developments in interferometric sensing, nanoscale motion, and position control. Recorded drifts of two nanometers per hour are unprecedented and set a new benchmark for x-ray microscopy systems," said Evgeny Nazaretski, a physicist at NSLS-II who spearheaded the development of the microscope.

After construction, the MLL module, a key component of the HXN x-ray microscope, was tested at the Diamond Light Source Beamline I-13L for extensive x-ray performance measurements. These measurements confirmed the stability and reliability of the new MLL system. Results are being published in the March issue of the Journal of Synchrotron Radiation.

"This instrument is a critical link connecting NSLS-II's bright x-rays to unprecedented nanoscale x-ray imaging capabilities, which we believe will lead to many groundbreaking scientific discoveries," stressed Yong Chu, the Group Leader of the Hard X-ray Nanoprobe Beamline at NSLS-II. The HXN beamline and the HXN x-ray microscope are currently being commissioned and will be available for user experiments later this year.

This work is published in the *Journal of Synchrotron Radiation*, 22(2), 336, 2015.

Source : ScienceDaily, 25 February 2015.

THE INDIAN SCIENCE CONGRESS ASSOCIATION

14, Dr. Biresh Guha Street, Kolkata–700 017

Nominations for " Asutosh Mookerjee Fellowships of ISCA " 2016-2017

ISCA has instituted 10 senior Fellowships in the name of **Asutosh Mookerjee Fellowship** in the Centenary year to utilize the services of the Life Members of the Association who are active in high quality research in their specialized disciplines but have superannuated from their service.

Objective : The objective is to utilize the expertise of ISCA Members after superannuated primarily for research work in some R&D Center/University/Colleges/Institute in India.

Eligibility :

(i) The fellowship is open to ISCA Life Members who have superannuated and are between the age of 65 to 70 years.

(ii) The applicant should possess a Ph.D. in Sciences/Engineering or MD in medicine.

(iii) The fellowship is meant for those who have a proven track record as evident from their Research Publications and recognition.

Number of Fellowships : The number of Fellowship to be selected each year shall be decided by the Executive Committee from the panel recommended by the Selection Committee, to be constituted by Executive Committee. Usually, the number of Scientists to be selected each year will be based on the availability of vacancies and funds available with the Association. The total number of Fellowships at a time should not be more than 10.The Fellowship will start from 1st April of every year.

Tenure : The term of **Asutosh Mookerjee Fellowship** will be tenable initially for a period of three years extendable for another two years after a review of the achievement of three years works.

Emoluments :

(a) The fellowship carries an honorarium of ₹30,000/- p.m. such that Rs. 30,000 + pension does not exceed the gross salary drawn at the time of retirement. The honorarium of ₹30,000 will be reduced wherever. The honorarium will be taxable at source.

(b) Contingency grant will be ₹ 1,00,000/- which includes the expenditure of chemicals glasswares, stationary, part time services of a scientific assistant/ secretary for typing and travel within country only.

Nominations : Nominations for the position shall be invited from the Life Members of the Association. The Nominations papers duly completed in all respect, signed, and routed through the Head of the Institute, where a scientist intends to work, should be sent to the General Secretary (Membership Affairs), so as to reach **latest by July 15, 2015.**

Announcement Report and Renewal of Scheme : Fellows will submit an Annual Report of his/ her research work at the end of each financial year along with statement of expenditure for renewal and release of grant for the next financial year.

Contact Details : General Secretary (Membership Affairs),The Indian Science Congress Association, 14, Dr. Biresh Guha Street, Kolkata – 700 017, Fax 033 22872551, Phone : 033 22874530, Email : iscacal@vsnl.net, website : www.sciencecongress.nic.in